

**VA MEDICAL CENTER, MANCHESTER, NH  
VA PROJECT 608-313**



Project Location:

VA Medical Center  
Manchester Division  
781 Smyth Road  
Manchester, NH 03104

Project Title: Mental Health Addition and Improvements,  
Buildings 1 and 18

Submission Type: 100% Construction Document Submission

Submission Date: June 29, 2012

VOLUME 1 OF 2

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**DEPARTMENT OF VETERANS AFFAIRS  
 VHA MASTER SPECIFICATIONS**

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1-HA-101	Mental Health Addition Asbestos Abatement Plan
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1-HA-103	Mental Health Addition Asbestos Abatement Plan
1-HA-104	Mental Health Addition Asbestos Abatement Plan
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CD101	Site Demolition Plan
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CI102	Erosion Prevention and Sediment Control Plan
CI103	Site Layout Plan
CI104	Site Layout Plan
CU101	Utility Relocation Plan
CS501	Site Improvement Details
CS502	Site Improvement Details
CS503	Site Improvement Details
CS504	Site Improvement Details
<b>LANDSCAPE</b>	
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SF101	Roof Framing Plan
SB301	Substructure Sections

SF301	Framing Sections
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EP601

Electrical Schedules

EP602

Electrical Schedules

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**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 Project 608-313, Mental Health Addition and Improvements, as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer.
- C. Offices of HDR Architecture, Inc., as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory, 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.
- E. All employees of general contractor and subcontractors shall comply with VA security management program, check out contractor badges daily, be identified by project and employer, and are restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by the VA Safety Manager.
  - 2. The site supervisor, or other designated competent person (in accordance with OSHA definition) shall have the 30-hour OSHA certified Construction Safety course.

3. Submit training records of all such employees for approval before the start of work.

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

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, roads, walks, grading, drainage, mechanical and electrical work, utility systems, necessary removal of existing items and construction and certain other items.
- B. ALTERNATE NO.1: Provide five (5) new domed skylights as specified in Section 07 71 00 in SW-106 Waiting, including but not necessarily limited to, skylights, curbs, blocking, supports, flashing, roof crickets, and interior gypsum wall board/metal framing "well."
- C. ALTERNATE NO. 2: \_\_Delete all walkways with the exception of walkways from Door CR-2 to Building 5 connection and the walkway from the drop-off area to the entrance of the new addition (see Civil Drawings)
- D. ALTERNATE NO. 3: Delete bays of the curved drop off polycarbonate sloped roof canopy (Section 08 63 00) east of the new addition, including, but not necessarily limited to, canopy, galvanized structural steel frame and footer/foundation. For all options, keep canopy overhang on south end as indicated on the drawings.
  - Option 1 - Delete one (1) bay extending from Column Line F to Column Line G.
  - Option 2 - Delete two (2) bays extending from Column Line E-1 to Column Line G.
  - Option 3 - Delete three (3) bays extending from Column Line D-1 to Column Line G.
  - Option 4 - Delete four (4) bays extending from Column Line C-4 to Column Line G.
  - Option 5 - Delete all bays of the entire drop-off and walkway canopies. The polycarbonate sloped canopy over the ramp shall remain in the base offer.
- E. ALTERNATE NO. 4: Delete the roof hatch and access ladder, including but not necessarily limited to, roof hatch, ladder, safety railing with gated access and roof cricket. The roof pavers shall remain in the Base Offer.
- F. ALTERNATE NO. 5: Delete the curved polycarbonate sloped roof canopy (Section 08 63 00) over the ramp, including, but not necessarily limited to, canopy, galvanized structural steel frame and footer/foundation (which are required for the canopy support).

- G. ALTERNATE NO. 6: The Primary Care area (Southwest corner of the addition) as designated on Drawing AS100ALT6 shall become shell space including but not necessarily limited to:
1. Typically delete all interior partitions, doors, frames, finishes, cabinet/casework, HVAC, Electrical, plumbing, signage, curtains and curtain tracks and wall protection.
  2. The following work shall be provided in the Base Offer this will NOT be part of this Deduct Alternate:
    - a. Concrete slab including all waste lines. Cap plumbing lines just above the floor.
    - b. Sprinklers
    - c. Complete, finished Curtain Wall
    - d. Fireproofing
    - e. Firestopping
  3. Construct the entire wall except omit the inner layer of gypsum board.
  4. Reference MEP documents for required HVAC, Electrical and plumbing.
  5. The partition as indicated separating the shell space from the rest of the building shall be completely finished on the non-shell side, including all electrical items. On the shell side delete gypsum board and provide R-13 foil faced batt insulation securely anchored from floor to roof deck above.
  6. Provide two (2) new doors and frames as indicated, fully finished on both sides. Include appropriate exit lights at these doors.
  7. In northwest corner of shell space provide fire rated partitions but delete all other non-rated construction.
- H. ALTERNATE NO. 7: The Primary Care area Southwest corner of the addition) as designated on Drawing No. AS100ALT7 shall become shell space including but not necessarily limited to:
1. Typically delete all interior partitions, doors, frames, finishes, cabinet/casework, HVAC, Electrical, plumbing, signage, curtains and curtain tracks and wall protection.
  2. The following work shall be provided in the Base Offer this will NOT be part of this Deduct Alternate:
    - a. Concrete slab including all waste lines. Cap plumbing lines just above the floor
    - b. Sprinklers
    - c. Complete, finished Curtain Wall

- d. Fireproofing
- e. Firestopping
- 3. Construct the entire exterior wall except omit the inner layer of gypsum board.
- 4. Reference MEP documents for required HVAC, Electrical and plumbing.
- 5. The partition as indicated separating the shell space from the rest of the building shall be completely finished on the non-shell side, including all electrical items. On the shell side delete gypsum board and provide R-13 foil faced batt insulation securely anchored from floor to roof deck above.
- 6. Provide two (2) doors and frames as indicated, fully finished on both sides. Include appropriate exit lights at these doors.
- 7. In northwest corner of shell space provide fire rated partitions but delete all other non-rated construction.

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

- A. AFTER AWARD OF CONTRACT, the specifications and drawings will be furnished electronically.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from the electronic files provided.

### **1.4 CONSTRUCTION SECURITY REQUIREMENTS**

- A. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees comply with the security requirements.
- B. Security Procedures:
  - 1. General Contractor's employees shall not enter the project site without an 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 1 week notice to the Contracting Officer so that VA coverage for the work can be scheduled. This notice is separate from any notices required for utility shutdown described later in this section. If appropriate coverage is not available for the date and time requested, work will have to be scheduled for an alternate date/time.
  - 3. No photography of VA premises is allowed without the COTR present. Photographs shall not ever be taken with patients in them.

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

C. Key Control:

1. If the project site is able to be secured, VA-provided lock cores shall be utilized. The Contractor is responsible for providing hardware and/or padlocks that will accept a BEST 6-pin lock core. The VA will provide keys for the lock. Keys shall not be duplicated by the Contractor.
2. The General Contractor shall provide full access to the project site to the COTR for the purpose of security inspections of every area of the project, including tool boxes and parked machines.
3. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Document Control:

1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
2. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

**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  
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. The Contractor shall be responsible for all Interim Life Safety during construction.
- C. 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 COTR, who will have it reviewed by the Facility Safety Manager. Submit in compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- D. 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 COTR that individuals have undergone contractor's safety briefing.
- D. 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.
- E. 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).
- F. Temporary Construction Partitions:
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  2. Install two-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous

areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- G. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- H. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR and facility Safety Manager.
- I. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COTR and facility Safety Manager.
- J. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- K. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COTR and facility Safety Specialist. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded and copies provided to the COTR.
- N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COTR and facility Safety Manager.
- O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COTR. Obtain permits from facility Safety Specialist or their designee before performing any hot work.

- P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COTR and facility Safety Manager.
- Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

#### **1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COTR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the COTR.



- E. Workmen are subject to rules of the Medical Center applicable to their conduct.
- 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 COTR 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.
  3. Provide unobstructed access to Medical Center areas required to remain in operation.
  4. 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. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR. All such actions shall be coordinated with the Utility Company involved:
1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- H. Phasing: To insure such executions, Contractor shall furnish the COTR 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 COTR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure

accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COTR, and Contractor, as follows:

For phasing reference the Drawings.

- I. The Medical Center will be occupied during performance of work.  
Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
- J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COTR.
- K. When a building, or portion of a building, 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 the Manchester Fire Department.
- L. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR.
  - 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 COTR. 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.

2. Contractor shall submit a request to interrupt any such services to COTR, in writing, 2 weeks 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 COTR. The COTR shall be notified of approximate dates of expected upcoming major interruptions 30 days in advance so that the Medical Center can begin making plans for maintaining operations during the utility interruption.
  5. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- M. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, 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.

- N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COTR.
- O. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of exit closures, heavy equipment operations, and work impacting traffic.

#### **1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.
  2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
  3. Shall note any discrepancies between drawings and existing conditions at site.
  4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COTR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COTR 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 COTR 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 the Infection Control Risk Assessment (ICRA) provided by the VAMC. Different ICRA's may be provided for different tasks. The medical center's Construction Safety group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if levels are unacceptable.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the Infection Control Risk Assessment (ICRA) provided by the VA Infection Control Coordinator.

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 may 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 COTR and VAMC Infection Control personnel may 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 COTR.
  2. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction. Coordinate with the COTR to ensure that blanking off ducts and diffusers will not adversely affect the HVAC system.
  3. Do not perform dust producing tasks within occupied areas without the approval of the COTR. 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 two-hour 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 COTR 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 reintroduced 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. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter 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.
- 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 area. 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 COTR 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.

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 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 COTR.
- 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.



**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.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing

construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

#### **1.11 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR 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 for executing the work to the lines and grades that may be established or indicated by the Contracting Officer or COTR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer or COTR 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 or COTR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

#### **(FAR 52.236-17)**

- B. Establish and plainly mark center lines for each building and/or addition to each existing building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, and parking lots, and are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COTR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.

- D. During progress of work, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COTR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the COTR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
1. Lines of each building and/or addition.
  2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
  3. Lines and elevations of sewers and of all outside distribution systems.
  4. Lines of elevations of all swales and interment areas.
  5. Lines and elevations of roads, streets and parking lots.
- E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward two hard copies and one electronic copy of these drawings upon completion of work to COTR.
- F. Surveying and layout work of this and other articles and specifications shall be performed by a registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

#### **1.13 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 insure compliance, as-built drawings shall be made available for the COTR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.
- 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 CTOR, 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 new 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 COTR. If the equipment is not installed and maintained in accordance with the following provisions, the COTR 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.
  - 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  - 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

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

- A. Use of existing freight elevator for handling building materials and Contractor's personnel will be permitted subject to following provisions:
  1. Contractor may use the freight elevator in Building No. 1 for daily use.
  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.

#### **1.17 TEMPORARY TOILETS**

Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water

connections; or, when approved by COTR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

#### **1.18 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 Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- 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. Steam is available at no cost to Contractor.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the Medical Center electrical distribution system.
- 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 COTR'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 COTR'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.

#### **1.19 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, feed water, 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.

## **1.20 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (two hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COTR 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 COTR and shall be considered concluded only when the COTR 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 COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

**1.21 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 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.

#### **1.22 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 COTR.
- 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. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of existing equipment, required to be relocated.
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

#### **1.23 HISTORIC PRESERVATION**

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 (COTR).
- 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 COTR, 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 COTR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

#### **1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date

constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

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

- D. The Complete Project Schedule shall contain work activities/events for each phase/portion of the project that includes pre-site work, site work, demolition, construction, and closeout.

#### **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.
  - 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 COTR 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 COTR. 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 COTR'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 COTR 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 COTR 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 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 COTR 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 COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion

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

- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) 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 RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Contracting Officer's Technical Representative (COTR) on behalf of the Contracting Officer.
- 1-6. The contractor shall number submittals consecutively. Contractor, in any subsequent correspondence regarding the submittal, shall refer to this submittal number.
- 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 in duplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in duplicate, except where a greater number is specified.
  - B. Submittals will receive consideration only when covered by the VA-provided submittal approval form and signed by the Contractor. The form must be completely filled out, including the list of items, 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. Any items received without project and contractor identification 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 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 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 COTR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to COTR 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 two full size hard copies and one electronic copy.
  2. 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.
  3. Submit drawings fully protected for shipment.
  4. 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 to

Thomas Ryan @ HDR Architecture, Inc.

(Architect-Engineer)

695 Atlantic Avenue

(A/E P.O. Address)

Boston, Massachusetts 02111

(City, State and Zip Code)

If submittals are transferred electronically they shall be transferred via HDR's ftp site, to the attention of Thomas Ryan.

- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COTR.

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SECTION 01 35 26

SAFETY REQUIREMENTS

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GOVERNMENTAL SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

- |                  |  |
|------------------|--|
| ASSE/SAFE A10.32 | (2004) Fall Protection   |
| ASSE/SAFE A10.34 | (2001; R 2005) Protection of the Public<br>on or Adjacent to Construction Sites              |
| ASSE/SAFE Z359.1 | (2007) Safety Requirements for Personal<br>Fall Arrest Systems, Subsystems and<br>Components |

ASME INTERNATIONAL (ASME)

- |             |                                     |
|-------------|-------------------------------------|
| ASME B30.22 | (2010) Articulating Boom Cranes     |
| ASME B30.3  | (2009) Tower Cranes                 |
| ASME B30.5  | (2007) Mobile and Locomotive Cranes |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- |          |  |
|----------|--|
| NFPA 10  | (2010) Standard for Portable<br>FireExtinguishers  |
| NFPA 241 | (2009) Standard for Safeguarding<br>Construction, Alteration, and Demolition<br>Operations SECTION 01 35 26 Page 5 |
| NFPA 306 | (2009) Standard for Control of Gas<br>Hazards on Vessels   |
| NFPA 51B | (2009; TIA 09-1) Standard for Fire<br>Prevention During Welding, Cutting, and<br>Other Hot Work                    |
| NFPA 70  | (2011; TIA 11-1; Errata 2011; TIA 11-2;<br>TIA 11-3; TIA 11-4) National Electrical<br>Code                         |
| NFPA 70E | (2012) Standard for Electrical Safety in<br>the Workplace  |

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010;  
Changes 4-6 2011) Safety and Health  
Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1919	Gear Certification
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.1400	Cranes & Derricks in Construction
29 CFR 1926.16	Rules of Construction
29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

- a. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- b. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- c. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).
- d. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - (1) Death, regardless of the time between the injury and death, or the length of the illness;
  - (2) Days away from work (any time lost after day of injury/illness onset);
  - (3) Restricted work;

f. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.) Any mishap meeting the criteria described above shall be documented in a memo to the Contracting Officer within five days.

Crane Reports

SD-07 Certificates (Submit one copy of each permit/certificate attached to each Daily Report).

Confined Space Entry Permit

Hot work permit

License Certificates

Contractor Safety Self-Evaluation Checklist

1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent addition of USACE EM 385-1-1, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.5 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.5.1 Personnel Qualifications

1.5.1.1 Site Safety and Health Officer (SSHO)

The SSHO must meet the requirements of EM 385-1-1 section 1 and ensure that the requirements of 29 CFR 1926.16 are met for the project. The SSHO or an equally-qualified Designated Representative/alternate shall be at the work site daily to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO's training, experience, and qualifications shall be as required by EM 385-1-1 paragraph 01.A.17, entitled SITE SAFETY AND HEALTH OFFICER (SSHO), and all associated sub-paragraphs.

1.5.1.2 Competent Person

A Competent Person shall be provided for all of the hazards identified in the Contractor's Safety and Health Program in accordance with the accepted Accident Prevention Plan, and shall be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Contracting Officer for acceptance in consultation with the Safety Office.

1.5.1.2.1 Contractor Quality Control (QC) Person:

The Contractor Quality Control Person can be the SSHO on this project.

1.5.1.2.2 Additional Site Safety and Health Officer (SSHO) Requirements

The Project Superintendent or other Contractor personnel may act on behalf of the SSHO for a period of no more than thirty (30) days annually,



provided that the individual meets the same competency level of the SSHOs, demonstrates the proficiency required, and is approved by the Contracting Officer in consultation with the VA Safety Manager.

#### 1.5.1.3 Competent Person for Confined Space Entry

Provide a "Competent Person" to supervise the entry into each confined space. That individual must meet the requirements and definition of Competent Person as contained in EM 385-1-1.

#### 1.5.1.4 Crane Operators

Meet the crane operators requirements in USACE EM 385-1-1, Section 16 and Appendix I. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification

#### 1.5.1.5 Crane Signal Persons

Submit documentation of signal person's qualifications. Documentation of these qualifications must be available by the contractor at the worksite in electronic or paper form. The documentation must specify each type of signaling (e.g. hand signals, radio signals, etc.) for which the signal person is qualified under the requirements of 29 CFR 1926.

Signal persons will be qualified by one of the following methods:

- a. Third party qualified evaluator. The signal person has documentation from a third party qualified evaluator showing that he or she meets the qualification requirements.
- b. Employer's qualified evaluator (not third party). The employer's qualified evaluator assesses the individual, determines the individual meets the qualification requirements and provides documentation of that determination. This assessment may only be used by the employer, and may not be relied on by other employers.

#### 1.5.2 Personnel Duties

##### 1.5.2.1 Site Safety and Health Officer (SSHO)

The SSHO shall:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.

- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.
- h. Maintain a list of hazardous chemicals on site and their material safety data sheets.

Failure to perform the above duties will result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

#### 1.5.3 Meetings

##### 1.5.3.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

##### 1.6.3.2 Safety Meetings

Conduct and document meetings as required by EM 385-1-1. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the Contractors' daily report.

#### 1.6 ACCIDENT PREVENTION PLAN (APP)

Use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements

in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan." Specific requirements for some of the APP elements are described below. The APP shall be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer, the Contractor Quality control Manager, and any designated CSP or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COTR, project superintendent, SSSH and quality control manager. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34,) and the environment.

Continuously review and amend the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered.

#### 1.6.1 EM 385-1-1 Contents

In addition to the requirements outlined in Appendix A of USACE EM 385-1-1, the following is required:

- a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. Specify the duties of each position.

- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.
- c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910 and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)
- d. Crane Critical Lift Plan.

Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.H. and the following:

- (1) For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400.
- e. Fall Protection and Prevention (FP&P) Program Documentation. The program documentation shall be site specific and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person for fall protection shall prepare and sign the program documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Revise the Fall Protection and Prevention Program documentation [every six months] for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Program documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Program documentation in the Accident Prevention Plan (APP).

The FP&P Plan shall include a Rescue and Evacuation Plan in accordance with USACE EM 385-1-1, Section 21.M. The plan shall include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and

Evacuation Plan in the Fall Protection and Prevention (FP&P) Plan, and as part of the Accident Prevention Plan (APP).

- f. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00 [DEMOLITION] [AND] [DECONSTRUCTION] and referenced sources. Include engineering survey as applicable.]]
- g. Excavation Plan. The safety and health aspects prepared in accordance with Section 31 00 00 EARTHWORK.]

#### 1.7 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, Section 1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

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

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

#### 1.8 DISPLAY OF SAFETY INFORMATION

Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.
- c. Interim Life Safety Measures
- d. Infection Control Risk Assessment

#### 1.9 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

#### 1.10 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment.  
Government has no responsibility to provide emergency medical treatment.

#### 1.11 NOTIFICATIONS and REPORTS

##### 1.11.1 Accident Notification

Notify the Contracting Officer as soon as practical, but no more than four hours after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

##### 1.11.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, property damage accidents resulting in at least \$20,000 in damages, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the report within 5 calendar days of the accident.
- b. Conduct an accident investigation for any weight handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

##### 1.11.3 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix I and as specified herein with Daily Reports of Inspections.

#### 1.12 HOT WORK

Submit and obtain a written permit prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, from the COTR or VA Safety Specialist. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit. When starting work in the facility, require personnel

to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED IMMEDIATELY.

#### 1.13 RADIATION SAFETY REQUIREMENTS

License Certificates for radiation materials and equipment shall be submitted to the COTR and VA Radiation Safety Officer (RSO) for all specialized and licensed material and equipment that could cause fatal harm to construction personnel or to the construction project.

Workers shall be protected from radiation exposure in accordance with 10 CFR 20. Standards for Protection Against Radiation Loss of radioactive material shall be reported immediately to the Contracting Officer.

Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays.

In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process. Transportation of Regulated Amounts of Radioactive Material will comply with 49 CFR, Subchapter C, Hazardous Material Regulations. Local Fire authorities and the site Radiation Safety officer (RSO) shall be notified of any Radioactive Material use.

Transmitter Requirements: The base policy concerning the use of transmitters such as radios, cell phones, etc., must be adhered to by all contractor personnel. They must also obey Emissions control (EMCON) restrictions.

#### 1.14 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer. Road, lane, or sidewalk closures must be in compliance with the Manual on Uniform Traffic Control Devices (MUTCD) Standards. These standards apply to all public streets, highways, bikeways, and private roads open to public traffic. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, air compressors, and explosive-actuated devices) shall be scheduled outside of the operating hours of the Primary Care Clinic and the Pharmacy. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work.

#### 1.15 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must:

- a. Secure outside equipment and materials and place materials that could be damaged in protected areas.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

#### 1.16 CONFINED SPACE ENTRY REQUIREMENTS

Contractors entering and working in confined spaces while performing general industry work are required to follow the requirements of OSHA 29 CFR 1926 and comply with the requirements in Section 34 of EM 385-1-1, OSHA 29 CFR 1910, and OSHA 29 CFR 1910.146.

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

##### 3.1 CONSTRUCTION AND OTHER WORK

Comply with USACE EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be carried/available on each person.

##### 3.1.1 Hazardous Material Use

Each hazardous material must receive approval from the VA Safety Manager or their designated representative prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

##### 3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the VA Safety Manager prior to excepted items of radioactive material and devices being brought on site.



### 3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

### 3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 14 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the COTR to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### 3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Ensure that each employee is familiar with and complies with these procedures and USACE EM 385-1-1, Section 12, Control of Hazardous Energy.

### 3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

#### 3.4.1 Training

Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with USACE EM 385-1-1, Section 21.B.

#### 3.4.2 Fall Protection Equipment and Systems

Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Paragraphs 21.N through 21.N.04. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required

when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

#### 3.4.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m 6 feet. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

#### 3.4.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

##### a. Low Sloped Roofs:

- (1) For work within 6 feet of an edge, on low-slope roofs, protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.
- (2) For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

#### 3.4.4 Horizontal Lifelines

Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

#### 3.4.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

#### 3.4.6 Rescue and Evacuation Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures

for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

### 3.5 SCAFFOLDING

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access scaffold platforms greater than 20 feet maximum in height by use of a scaffold stair system. Do not use vertical ladders commonly provided by scaffold system manufacturers for accessing scaffold platforms greater than 20 feet maximum in height. The use of an adequate gate is required. Ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Give special care to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Place work platforms on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

### 3.6 EQUIPMENT

#### 3.6.1 Material Handling Equipment

- a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
- c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

#### 3.6.2 Weight Handling Equipment

- a. Equip cranes and derricks as specified in EM 385-1-1, section 16.
- b. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

- c. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
- d. Under no circumstance shall a Contractor make a lift at or above 90 percent of the cranes rated capacity in any configuration.
- e. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 Section 11 and ASME B30.5 or ASME B30.22 as applicable.
- f. Do not crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane.
- g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers. All employees must keep clear of loads about to be lifted and of suspended loads.
- h. Use cribbing when performing lifts on outriggers.
- i. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- j. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
- k. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.
- l. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
- m. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

### 3.7 EXCAVATIONS

Excavation permits must be completed for all excavation work performed at the Medical Center. The permit must be submitted to the COTR for acceptance prior to start of the excavation activity. Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

#### 3.7.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department.

### 3.7.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.

### 3.7.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

## 3.8 ELECTRICAL

### 3.8.1 Portable Extension Cords

Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately removed from service all damaged extension cords. Portable extension cords shall meet the requirements of EM 385-1-1, NFPA 70E, and OSHA electrical standards.

## 3.9 WORK IN CONFINED SPACES

Comply with the requirements in Section 34 of USACE EM 385-1-1, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, OSHA Directive CPL 2.100 and OSHA 29 CFR 1926. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 34 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.



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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

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

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

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

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

DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management  
Facilities Quality Service (00CFM1A)  
811 Vermont Avenue, NW - Room 462  
Washington, DC 20420  
Telephone Numbers: (202) 461-8217 or (202) 461-8292  
Between 9:00 AM - 3:00 PM

**1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)**

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

- AA Aluminum Association Inc.  
<http://www.aluminum.org>

AABC	Associated Air Balance Council <a href="http://www.aabchg.com">http://www.aabchg.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 <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NLMA	Northeastern Lumber Manufacturers Association, Inc. <a href="http://www.nelma.org">http://www.nelma.org</a>
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>
NWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>

OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>
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  
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada  
<http://www.ulc.ca>

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:**

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by 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):
  - T27-06.....Sieve Analysis of Fine and Coarse Aggregates
  - T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
  - T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
  - T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
  - T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
  - A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A370-07.....Definitions for Mechanical Testing of Steel Products
  - A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
  - C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field
  - C33-03.....Concrete Aggregates
  - C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
  - C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars
  - C138-07.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete

C140-07.....Sampling and Testing Concrete Masonry Units and  
Related Units

C143/C143M-05.....Slump of Hydraulic Cement Concrete

C172-07.....Sampling Freshly Mixed Concrete

C173-07.....Air Content of freshly Mixed Concrete by the  
Volumetric Method

C780-07.....Pre-construction and Construction Evaluation of  
Mortars for Plain and Reinforced Unit Masonry

C1019-08.....Sampling and Testing Grout

C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete

C1077-06.....Laboratories Testing Concrete and Concrete  
Aggregates for Use in Construction and Criteria  
for Laboratory Evaluation

D698-07.....Laboratory Compaction Characteristics of Soil  
Using Standard Effort

D1188-07.....Bulk Specific Gravity and Density of Compacted  
Bituminous Mixtures Using Paraffin-Coated  
Specimens

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

D1557-07.....Laboratory Compaction Characteristics of Soil  
Using Modified Effort

D2166-06.....Unconfined Compressive Strength of Cohesive Soil

D2167-94(R2001).....Density and Unit Weight of Soil in Place by the  
Rubber Balloon Method

D2216-05.....Laboratory Determination of Water (Moisture)  
Content of Soil and Rock by Mass

D2922-05.....Density of soil and Soil-Aggregate in Place by  
Nuclear Methods (Shallow Depth)

D2974-07.....Moisture, Ash, and Organic Matter of Peat and  
Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and  
Inspection Bituminous Paving Materials

D3740-07.....Minimum Requirements for Agencies Engaged in the  
Testing and Inspecting Road and Paving Material

E94-04.....Radiographic Testing

E164-03.....Ultrasonic Contact Examination of Weldments

E329-07.....Agencies Engaged in Construction Inspection  
and/or Testing

E543-06.....Agencies Performing Non-Destructive Testing



E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive  
Material (SFRM) Applied to Structural Members

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor  
Levelness Numbers

D. American Welding Society (AWS):

D1.1-07.....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.; E 329, C 1077, D 3666, D3740, A 880, E 543) 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 EARTHWORK:**

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
  - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding

suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.

2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D1557 Method C.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Resident Engineer before the tests are conducted.
  - a. Building Slab Subgrade: At least one test of subgrade for every 185 m<sup>2</sup> (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m<sup>2</sup> (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
  - b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
  - c. Pavement Subgrade: One test for each 335 m<sup>2</sup> (400 square yards), but in no case fewer than two tests.
  - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
  - e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
  - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual

comparison of each subgrade with related tested subgrade when acceptable to Resident Engineer. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by Resident Engineer.

### **3.2 LANDSCAPING:**

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
  - 1. Test for organic material by using ASTM D2974.
  - 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to Resident Engineer.

### **3.3 ASPHALT CONCRETE PAVING:**

- A. Aggregate Base Course:
  - 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D
  - 2. Make a minimum of one field density test on each day's final compaction on each aggregate course in accordance with // ASTM D1556 //.
  - 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
- B. Asphalt Concrete:
  - 1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
  - 2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
  - 3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

### 3.4 SITE WORK CONCRETE:

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

### 3.5 CONCRETE:

#### A. Batch Plant Inspection and Materials Testing:

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

#### B. Field Inspection and Materials Testing:

1. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
2. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m<sup>3</sup> (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. // After good concrete quality control has been established and maintained as determined by Resident Engineer make three cylinders for each 80 m<sup>3</sup> (100 cubic yards) or less of each concrete type, and at least three cylinders

- from any one day's pour for each concrete type. // Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions.
3. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
  4. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m<sup>3</sup> (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m<sup>3</sup> (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
  5. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
  6. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
  7. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
  8. Verify that specified mixing has been accomplished.
  9. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
  10. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
  11. Observe conveying, placement, and consolidation of concrete for conformance to specifications.

12. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
  13. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
  14. Observe preparations for placement of concrete:
    - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    - b. Inspect preparation of construction, expansion, and isolation joints.
  15. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
  16. Observe concrete mixing:
    - a. Monitor and record amount of water added at project site.
    - b. Observe minimum and maximum mixing times.
  17. Measure concrete flatwork for levelness and flatness as follows:
    - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    - c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall  $F_F$  and  $F_L$  values for all slabs installed to date, within 72 hours after each slab installation.
  18. Other inspections:
    - a. Grouting under base plates.
    - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
  2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
  3. Furnish certified compression test reports (duplicate) to Resident Engineer. In test report, indicate the following information:

- a. Cylinder identification number and date cast.
- b. Specific location at which test samples were taken.
- c. Type of concrete, slump, and percent air.
- d. Compressive strength of concrete in MPa (psi).
- e. Weight of lightweight structural concrete in kg/m<sup>3</sup> (pounds per cubic feet).
- f. Weather conditions during placing.
- g. Temperature of concrete in each test cylinder when test cylinder was molded.
- h. Maximum and minimum ambient temperature during placing.
- i. Ambient temperature when concrete sample in test cylinder was taken.
- j. Date delivered to laboratory and date tested.

### **3.6 REINFORCEMENT:**

- A. Review mill test reports furnished by Contractor. //
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

### **3.7 MASONRY:**

- A. Mortar Tests:
  1. Laboratory compressive strength test:
    - a. Comply with ASTM C780.
    - b. Obtain samples during or immediately after discharge from batch mixer.
    - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
    - d. Test one sample at 7 days and 2 samples at 28 days.
  2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
  1. Laboratory compressive strength test:
    - a. Comply with ASTM C1019.
    - b. Test one sample at 7 days and 2 samples at 28 days.
    - c. Perform test for each 230 m<sup>2</sup> (2500 square feet) of masonry.
- C. Masonry Unit Tests:
  1. Laboratory Compressive Strength Test:
    - a. Comply with ASTM C140.

### 3.8 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
  - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
  - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
  - 3. Approve welder qualifications by certification or retesting.
  - 4. Approve procedure for control of distortion and shrinkage stresses.
  - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
  - 1. Weld Inspection:
    - a. Inspect welding equipment for capacity, maintenance and working condition.
    - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
    - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
    - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
    - e. Measure 25 percent of fillet welds.
    - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
      - 1) 20 percent of all shear plate fillet welds at random, final pass only.
      - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
      - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
      - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
      - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
    - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and



moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.

- h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
  - i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
  - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
  - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
  - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
  - d. Bolts installed by turn-of-nut tightening 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.

### **3.9 STEEL DECKING:**

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS

D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."

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

**3.10 SHEAR CONNECTOR STUDS:**

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

**3.11 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.

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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. Affect 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. City of Manchester Environmental Protection
- C. New Hampshire Department of Environmental Services
- D. Occupational Safety and Health Administration (OSHA):
  - 29 CFR 1910 Occupational Safety and Health Standards
  - 29 CFR 1926 Safety and Health Regulations for Construction
- E.U.S. National Archives and Records Administration (NARA):
  - 33 CFR 328.....Definitions

**1.4 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Technical Representative (COTR) 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 COTR 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, , soil and historical 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, 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 COTR. Do not fasten or attach ropes, cables, or guys to trees for

anchorage unless specifically authorized, or where special emergency use is permitted.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments and works of art before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
  - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
  - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
  - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown and on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the 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.
  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 Life Forms: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, and injury to any form . 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 New Hampshire 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 COTR. Noise-producing work may be required to be performed outside of normal working hours. 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 9:00 a.m. and 3:00 p.m unless otherwise permitted by local ordinance or the COTR. 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 A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the 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 COTR.

Cleaning shall include off 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**

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 73 29**  
**CUTTING AND PATCHING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

This section specifies the provisions for the rehabilitation and renovations of existing spaces and materials.

**1.2 RELATED WORK**

Provide and coordinate all necessary work and products meeting the requirements associated with all applicable specification sections and plans to produce a system complete, functional and ready for the purpose intended. No statements here in shall relieve the Contractor of responsibilities described elsewhere in the contract documents.

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 02 41 00, DEMOLITION: Removal and storage of products to be reinstalled.
- C. Individual Specification Sections:
  - 1. Cutting and patching incidental to work of the Section.
  - 2. Advance notification to other Sections of openings required in work of those Sections.
  - 3. Limitations on cutting structural members.
  - 4. Requirements and limitations for cutting and patching of work.

**1.3 SUBMITTALS**

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

- A. Submit written request in advance of cutting or alteration which affects:
  - 1. Structural integrity of any element of the Project.
  - 2. Integrity of weather-exposed or moisture-resistant element.
  - 3. Efficiency, maintenance or safety of any operational element.
  - 4. Visual qualities of sight-exposed elements.
  - 5. Work of Owner or separate contractor.
- B. Include in request:
  - 1. Identification of the Project.
  - 2. Location and description of affected work.
  - 3. Necessity for cutting or alteration.
  - 4. Description of proposed work and products to be used.
  - 5. Alternatives to cutting and patching.
  - 6. Effect on work of Owner or separate contractor.
  - 7. Written permission of affected separate contractor.
  - 8. Date and time work will be executed.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. New Materials: As specified in individual Sections.
- B. Match existing products and work for patching and extending work.
- C. Determine type and quality of existing products by inspection and any necessary testing and workmanship by use of existing as a standard. Presence of a product, finish or type of work, requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with existing quality.
- D. Use materials whose installed performance will equal or surpass that of existing materials.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. All surfaces within the contract limits are to be patched, refinished and painted with materials comparable to the existing surface unless otherwise noted or directed by the VA Project Engineer. Finished surfaces are to be indistinguishable from the surrounding area.
- B. All work is to be performed within approved tolerances, meet the requirements of the manufacturer and be neat, straight, plumb, level, smooth.
- C. Execute cutting, fitting and patching to complete work and to:
  - 1. Fit the several parts together, to integrate with other work.
  - 2. Uncover work to install ill-timed work.
  - 3. Remove and replace defective and non-conforming work.
  - 4. Remove samples of installed work for testing.
  - 5. Provide openings in elements for penetrations of mechanical and electrical work.
  - 6. Locate concrete slab cores between concrete ribs.

### **3.2 INSPECTION**

- A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- B. Verify that demolition is complete and areas are ready for installation of new work.
- C. After uncovering, inspect conditions affecting performance or work.
- D. Beginning of cutting or patching means acceptance of existing conditions.

### **3.3 PREPARATION**

- A. Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas which may be exposed by uncovering work.
- C. Cut, move or remove items as necessary for access to alterations and renovations work; replace and restore at completion.
- D. Remove unsuitable material not marked for salvage, such as rotted wood, rusted metals and deteriorated masonry and concrete; replace materials as specified for finished work.
- E. Remove debris and abandoned items from area and from concealed spaces.
- F. Prepare surfaces and remove surface finishes to provide for proper installation of new work and new finishes.
- G. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.
- H. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

### **3.4 INSTALLATION**

- A. Coordinate work of alterations and renovations to expedite completion and to accommodate Owner occupancy.
- B. Remove, cut and patch work in a manner to minimize damage and to provide means of restoring products and finishes to original and/or specified condition.

### **3.5 TRANSITIONS**

- A. Where new work abuts or aligns with existing, make a smooth and even transition. Patched work shall match existing adjacent work in texture and appearance.
- B. The elevation of existing finished floors varies from room to room. Where such variations occur grind the concrete topping and repair the floors to create a uniform level surface with the surrounding area.
- C. The plane of existing surfaces varies from room to room. Where such variations occur grind/finish the existing surfaces/partitions to create a uniform plumb surface with the surrounding surface. Where the partition separating rooms has been removed create a uniform level surface with the surrounding area. Where new partitions form a continuation of an existing surface the finish face of the partition shall align with and be indistinguishable from the existing surface.

- D. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation for Resident Engineer review.
- E. Where a new partition will form a continuation of an existing surface, the finish face of the new partition shall align with and be indistinguishable from the existing surface. Extend existing to remain partition and utility chase wall assemblies to underside of slab above ceiling line using materials to match existing.

### **3.6 ADJUSTMENTS**

- A. Make necessary modifications for compliance with applicable criteria. Accomplish all necessary field settings, adjustments and modifications to comply with the project intent. Demonstrate results compared to acceptable values.
- B. Where removal of surfaces/partitions results in adjacent spaces becoming one, rework floors, walls and ceilings to a smooth elevation/plane without breaks, steps or bulkheads.
- C. Where a change of elevation/plane of 1/4-inch or more occurs, submit recommendation for providing a smooth transition for Resident Engineer review.
- D. Trim existing doors as necessary to clear new floor finishes; refinish trimmed areas.

### **3.7 PERFORMANCE**

- A. Execute work by methods to avoid damage to other work and which will provide proper surfaces to receive patching and finishing.
- B. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- C. Restore work with new products in accordance with requirements of Contract Documents.
- D. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- E. At penetrations of fire-rated wall, ceiling or floor construction, completely seal voids with fire stopping material, full thickness of the construction element.
- F. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

### **3.8 REPAIR OF DAMAGED SURFACES**

- A. Damaged surfaces and items within the contract limits shall be patched, repaired, refinished, painted and/or replaced as necessary with materials comparable to the surrounding material and surface equal to



new conditions unless otherwise noted or directed by the VA Project Engineer. Finished surfaces shall be indistinguishable from the surrounding area.

- B. Patch or replace existing surfaces that are damaged, lifted, discolored or showing other imperfections.
- C. Repair substrate prior to patching finish.

### **3.9 FINISHES**

- A. Finish surfaces as specified in individual Sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

### **3.10 CLEANING**

- A. In addition to the cleaning requirements in other sections, cleaning shall include daily vacuuming, sweeping, dusting and washing of immediate and adjacent areas as needed.
- B. At the completion of new construction, all affected areas shall be cleaned, polished and hygienically sanitized including but not limited to floors, walls, partitions, ceilings (including above removable ceiling systems ceiling tiles), fixtures, lenses, windows, equipment, furniture (built-in or free standing), shelves counters, cabinets, doors, drawers.

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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. If hazardous waste is encountered or generated that is subject to NH DES Hazardous Waste regulations (Env-Wm 100-1100), promptly notify the GEMS Coordinator, via the COTR.
- 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, reused, or recycled.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage, reuse, and recycle.
- 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.

CONSTRUCTION WASTE MANAGEMENT

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 minimization of avoidable waste, such as that created by 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. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent, by weight.
- C. 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.
- D. 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.
- E. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties throughout the project.
- F. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

### **1.4 SUBMITTALS**

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

#### CONSTRUCTION WASTE MANAGEMENT

- B. Upon receiving the Notice to Proceed, prepare and submit to the COTR an inventory of the estimated job site waste to be generated, including the following information for each anticipated material/waste stream:
1. Brief description.
  2. Estimated total quantity of waste anticipated.
  3. Estimated quantity to be salvaged, reused, or recycled.
  4. Estimated quantity to be disposed of.
- C. Prior to the shipping date for any waste, submit the following to the GEMS Coordinator, via the COTR, for review and acceptance:
1. Prepared shipping documents.
  2. Documentation that the destination facility or site is approved to receive the waste.
- D. With each application for progress payment, submit a summary of construction and demolition debris waste streams for diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal. State the beginning and ending dates of the period covered. Include the following information for each waste stream:
1. Brief description.
  2. Quantity of waste generated for the period.
  3. Quantity of waste salvaged, reused, or recycled for the period.
  4. Quantity of waste disposed of for the period.
  5. Cumulative amount of waste generated for the project.
  6. Cumulative amount of waste salvaged, reused, or recycled for the project.
  7. Cumulative amount of waste disposed of for the project.
  8. Name of destination facility or site.
  9. Location of destination facility or site.
  10. Method of transportation.
  11. Costs associated with disposal, salvage, reuse, or recycling.
  12. Savings and/or proceeds associated with disposal, salvage, reuse, or recycling.
  13. Attach all applicable tracking data for the period, including receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, and invoices.

- E. Report all quantities of waste in pounds. For waste streams where reporting in pounds is not possible, report in a logical unit of measurement for the material and report the percent of waste salvaged, reused, or recycled.

**PART 2 - PRODUCTS**

NOT USED

**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 the respective recycling facility for processing.
- C. Cover all waste that is stored outdoors , including all dumpsters.
- D. Hazardous wastes and regulated materials shall be separated, stored, and disposed of according to local, state, federal regulations. All regulated and hazardous waste materials shall be communicated to the GEMS Coordinator, via the Resident Engineer, within 24 hours of waste generation/identification. Shipping documents for regulated and/or hazardous waste shall only be signed by the VA GEMS Coordinator or by a designated authorized personnel.

**3.2 DISPOSAL**

Contractor shall provide all demolition, removal and legal disposal of materials.

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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 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall

encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the 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.
- G. The Commissioning Agent, both the firm and individual designated as the Commissioning Agent, shall be certified by at least one of the following entities: the National Environmental Balancing Bureau (NEBB), the Associated Air Balance Council Commissioning Group (AABC), and the Building Commissioning Association (BCA). Certification(s) shall be valid and active. Proof of certification(s) shall be submitted to the Contracting Officer and the Resident Engineer three (3) calendar days after the Notice to Proceed.

## **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 07 08 00 FACILITY EXTERIOR CLOSURE COMMISSIONING.
- C. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
- D. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- E. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- F. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
- G. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.

### **1.4 SUMMARY**

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

### **1.5 DEFINITIONS**

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.

- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.
- G. System: A system is defined as the entire set of components, equipment, and subsystems 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 component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

- H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.
- I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.
- J. VA: Includes the Contracting Officer, Resident Engineer, or other authorized representative of the Department of Veterans Affairs.
- K. TAB: Testing, Adjusting, and Balancing.

#### **1.6 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:

1. Facility exterior closure (Division 7 and Division 8)
  - a. Roofs TPO,  
flashing and sheet metal, , roof specialties, and roof accessories)
  - b.
  - c. Curtain Wall Systems (Mullions, glazing, and sealing)
  - d. Exterior Doors ( glass leaf, emergency exit, and service)
  - e. Exterior Windows (Aluminum, glazing, )
  - g. Sealants (Caulking, mechanical seals, and wind and vapor barriers)
2. Fire Suppression (Division 21)
  - a. Fire Protection System (Fire pump, jockey pump, fire pump automatic transfer switch/controller, Wet-pipe fire suppression, Dry-pipe fire suppression, Pre-action fire suppression, dry system air compressors and motors, and clean agent fire suppression).
3. Plumbing (Division 22)
  - a. Domestic Hot Water systems
  - b. Chemical Waste System & Equipment (Waste storage tanks or sumps, controls and alarms, pumps and motors - if applicable).
4. HVAC (Division 23)
  - a. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
  - b. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).
  - c. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
  - d. Steam System (Boilers, controls, gages and instrumentation,
  - e. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).

- f. Radiology/Imaging Cooling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
  - g. HVAC Water Treatment Systems (Closed circuits - including shot feeders and final water analysis, open circuits - including water analysis, chemical/biocide tanks, injection piping, chemical/biocide pumps and motors, controls, water meter, and automatic blowdown).
5. Electrical (Division 26)
- a. Utility Service Switchgear
  - b. Automatic Transfer Switches (Test with associated generator).
  - c. Normal Power Distribution Systems (Grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - d. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  - e. Essential Equipment Power Distribution Systems
  - f. Lighting Controls (Control system hardware and software, scene settings, zone settings, occupancy sensor interface, and unoccupied cycle control).
6. Communications (Division 27)
- a. Facility Telecommunications and Data Distribution Systems.
  - b. Nurse Call / Code Blue Systems (Local stations, system hardware and software, reset functions, response time per activation, and notification signals).
  - c. Public Address and Mass Notification Systems (Amplifiers and head-end hardware, speaker volume, and background noise - i.e. hiss or similar interference).
7. Electronic Safety and Security (Division 28)
- a. Fire Detection and Alarm (Master panel and software, addressable units - i.e. pull stations, flow detectors, heat detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, and fire command center functions - stairwell communications, stairwell pressurization fan start, mechanical systems shutdowns).
8. Site Utility Systems (Division 31)

- a. sump or tank level controls, alternator, alarms, pumps and motors).
- b. Steam Condensate Pump Stations (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, and safeties).

#### **1.7 COMMISSIONING TEAM**

##### **A. Members Appointed by Contractor:**

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

##### **B. 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. Representatives of the facility user and operation and maintenance personnel.
- 3. Architect and engineering design professionals.

#### **1.8 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.

#### **1.9 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.

#### **1.10 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 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.

#### **1.11 COMMISSIONING DOCUMENTATION**

- A. Commissioning Agent's Certification(s): Commissioning Agent shall submit evidence of valid and current certification(s), as required in Section 1.1(G), to the Contracting Officer.
- B. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:

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

1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.
- D. 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.
- E. 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.
- F. 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.
1. The Contractor shall be liable for costs incurred by the VA for retesting; including costs for additional fees to the Commissioning Agent and/or the Architect/Engineer directly related to retesting of systems and/or equipment

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

1. Creating an Commissioning Issues Log Entry:

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

2. Documenting Issue Resolution:

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

f. Identify person(s) verifying the issue resolution.

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

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

I. 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.
- J. 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.

#### **1.12 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.

#### **1.13 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 10 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 10 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.

#### **1.14 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.

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

### **PART 3 - EXECUTION**

#### **3.1 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.

**3.2 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.

### **3.3 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.

### **3.4 TRENDING AND ALARMS**

- 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.
  - a. The following tables are guidelines for commissioning; follow these tables for commissioning applicable systems affected by work for this Project.



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

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Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational 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		
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		

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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 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	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Refrigerator Alarm	DI	COV	12 hours	3 days	C	N/A	10 min
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

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

Steam and Condensate Pumps Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
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

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

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
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		

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

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

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
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.

### 3.5 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 degrees C (54 degrees F), when the outside air temperature is above 12 degrees C (54 degrees F), temporarily change the lockout setpoint to be 2 degrees C (4 degrees 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.

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

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.
- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and

resolution shall be documented on the Systems Functional Test Procedure.

2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
  - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
  - b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
  - a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
  - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as

needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.

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

up to one week, upon which the VA will decide whether to accept the solution.

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

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

### **3.7 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.

### 3.8 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 Videotapes: Submit two copies within seven days of end of each training module.
  - a. Identification: On each copy, provide an applied label with the following information:
    - 1) Name of Project.
    - 2) Name and address of photographer
    - 3) Name of Contractor.
    - 4) Date videotape was recorded.
    - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
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. 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, and fire suppression systems.
  - b. Intrusion detection systems.
  - c. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
  - d. Refrigeration systems, including chillers, , distribution piping.
  - e. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - f. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - g. Lighting equipment and controls.
  - h. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - i. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

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

1. Basis of System Design, Operational Requirements, and Criteria:  
Include the following:
  - a. System, subsystem, and equipment descriptions.
  - b. Performance and design criteria if Contractor is delegated design responsibility.

- c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project Record Documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.

- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
  - 1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
  - 2. Instruction:
    - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.

- b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
    - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
    - 2) The VA will furnish an instructor to describe VA's operational philosophy.
    - 3) The VA will furnish the Contractor with names and positions of participants.
  - 3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
  - 4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral, or a written**, performance-based test.
  - 5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
- I. Demonstration and Training Recording:
- 1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
  - 2. Video Format: Provide high quality color DVD color on standard size DVD disks.
  - 3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
  - 4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point,

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indicating location, direction (by compass point), and elevation or  
story of construction.

----- END -----

**SECTION 01 99 99**

**PROJECT CLOSEOUT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF REQUIREMENTS**

- A. Definitions: Closeout is hereby defined to include general requirements near the end of contract duration, in preparation for final acceptance, final payment, normal termination of contract, occupancy and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in Sections of Division 02 through 34 as applicable.
- B. Time of closeout is directly related to "Substantial Completion", and therefore may be either a single time period for entire work or a series of time periods for individual parts of the work which have been noted as substantially complete at different dates, that time variation (if any) shall be applicable to other provisions of this section.

**1.2 PREREQUISITES TO SUBSTANTIAL COMPLETION**

- A. General: Two weeks prior to requesting inspection of "substantial completion" (for either entire work or portions thereof), complete the following and list exceptions ...
  - 1. List "substantially complete" areas for portion claimed with certifications and supporting documentation in accordance with the contract documents (properly installed and ready for operation), and itemize incomplete items (Contractor issued final "Punch List"), value of incomplete work, and reasons for being incomplete with supporting documentation.
  - 2. No GWB/SAT ceiling material shall be installed in the project area until "all" work above the ceiling line has been completed, tested, inspected, approved and accepted by specified agents and the VA Resident Engineer in advance with "all" associated test/inspection reports issued demonstrating compliance with the contract requirements.
  - 3. Complete start-up testing of systems, and instructions to Government's operating/maintenance personnel. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools, equipment, and similar elements.
- B. Inspection: Upon receipt of Contractor's request, the Contracting Officer will either proceed with inspection or advise Contractor that prerequisites are not fulfilled. Following initial inspection, the Contracting Officer will either approve "substantial completion", or issue a "Deficiency Report" itemizing work which must be performed and

repeat inspection when requested and assured that work has been substantially completed. Results of completed inspections ("Deficiency Report") will form the basis of the "Punch List" to be completed for final acceptance.

### **1.3 PREREQUISITES TO FINAL ACCEPTANCE**

- A. General: Prior to requesting final inspection for final acceptance and final payment, as required by General Provisions and Conditions, complete the following and list known exceptions (if any) ...
1. Submit final payment request with final releases and supporting documentation not previously submitted and accepted.
  2. Submit copy of Contractor final Punch List including resolution of Deficiency Reports resulting from earlier inspections stating that each item has been completed, resolved or otherwise delayed for acceptable circumstances with supporting documentation.
  3. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
  4. Submit record documents in the format specified.
  5. Submit final record information (eg, electrical panel schedule, equipment data sheets).
  6. Provide tools, spare parts, extra stocks of materials, and similar physical items.
  7. Make final change-over of locks and transmit keys to the Contracting Officer and advise Government personnel of change-over in security provisions.
  8. Complete final cleaning up requirements, including touch-up painting of marred surfaces.
  9. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Re-inspection: Upon receipt of Contractor's notice that all work has been completed, including resolution of Deficiency Reports resulting from earlier inspections, the Contracting Officer will re-inspect the work. Upon completion of re-inspection, the Contracting Officer will either proceed to final acceptance or issue a Punch List itemizing work not completed and obligations not fulfilled as required for final acceptance. If necessary, re-inspection will be repeated until work is accepted.

### **1.4 RECORD DOCUMENTS**

- A. General: As work progresses, prepare and maintain record documents as specified herein. Each record shall be certified by the General Contractor. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location



accessible to the Contracting Office for reference during normal working hours. Upon completion, turn record documents over to the Contracting Officer.

- B. Record Drawings: Maintain a white-print set (blue-line or black-line) of contract drawings (including amendment and change order drawings) and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related CO (change order) and/or RFI numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.
1. Four (4) weeks prior to the final inspection, the Contractor shall provide the VA Project Engineer with 8 complete sets (4 full size, 4 reduced size) of CAD quality drawings on vellum (reproducible, clean & legible).
  2. AutoCAD (verify required version) files in the format consistent with the VA's standards on PC CD disks with all the above information incorporated.
  3. Adobe Acrobat PDF files for each AutoCAD file on PC CD disks with all the above information incorporated.
  4. The draftsmanship and information shall be comparable in all ways to the original documents, and shall be dated and noted "As-Built".
- C. Record Specifications: Maintain one copy of specifications, including amendments, change orders and similar modifications issued in printed form during construction, and mark-up variations in actual work in comparison with text of specifications and modifications as issued. Give particular attention to substitutions, selection of options, and similar information on work where it is concealed or cannot otherwise be readily discerned at a late date by direct observation. Note related record drawing information and product data, where applicable.
- D. Record Product Data, Certifications and Laboratory Test Reports: Maintain one copy of each product data submittal, product certification, and laboratory test report and mark-up significant variations in actual

work in comparison with submitted information. Include both variations in product as delivered to site, and variations from manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the work which cannot otherwise be easily discerned at a later date by direct observation. Note related change orders and mark-up of record drawings and specifications.

- E. Record Samples and Salvaged Items: Immediately prior to date(s) of substantial completion, the Contacting Officer or designated representative will meet with Contractor on site, and will determine which (if any) of submitted samples and salvaged items maintained by Contractor during progress of the work are to be retained by the Government. Comply with the Resident Engineers instructions for packaging, identification marking, and delivery.
- F. Miscellaneous Record Submittals: Refer to other Sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to date(s) of substantial completion, complete miscellaneous records and place in good order, appropriately identified and bound, ready for continued use and reference. Turn over to the Contacting Officer prior to final acceptance.

#### **1.5 OPERATION AND MAINTENANCE MANUALS**

- A. General: Submit in accordance with Article, INSTRUCTION MANUALS, in Section 01 00 00, GENERAL REQUIREMENTS, 3 sets of operation and maintenance manuals (with parts/shop/service details) for each mechanical and electrical system (except as otherwise specified), for each piece of equipment, and for other systems and components specified in the technical Sections of the specification. Organize manuals into suitable volumes of manageable size, as approved by the Contacting Officer. Manuals shall have table of contents (TOC), and be assembled to conform to the TOC with tab sheets covering each subject. The instructions shall be legible and easy to read. Manuals shall be hard bound and sheets consistent in size; where oversize drawings are necessary they shall be folded. The organized document shall be labeled "Operation and Maintenance Manual" with the project name, building location, contact and project numbers appearing on the cover.
- B. Contents: Manuals shall include, but not be limited to, the following data ...
  - 1. Detailed description of each system and each of its components, including layout showing piping, valves, and controls and other

components, and including diagrams and illustrations where applicable.

2. Wiring and control diagrams with data to explain detailed operation and control of each component. Provide installed electrical panel schedules using the VA format.
3. Control sequence describing start-up, operation, and shut-down.
4. Procedure for starting.
5. Procedure for operating.
6. Shut-down instructions.
7. Installation instructions.
8. Maintenance and overhaul instructions.
9. Emergency instructions and safety precautions.
10. Corrected shop drawings.
11. Approved equipment data sheet using the VA format.
12. Approved certifications and laboratory test reports (where applicable).
13. Copies of warranties.
14. Test procedures.
15. Parts list, including source of supply, recommended spare parts, and service organization convenient to building site.
16. Name, address, and telephone number of each subcontractor who installed equipment and systems, and local representative for each type of equipment and each system.
17. Other pertinent data applicable to the operation and maintenance of particular systems or equipment and/or other data specified in technical Sections of the specification.

#### **1.6 APPROVED SUBMITTALS**

Provide Contracting Officer with one copy of each final approved submittal package with all review notations and remarks indicated prior to the time that system or equipment tests are performed, and two additional copies 2 weeks before either the start of operation by the Government or any instruction period specified (whichever comes first).

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Keys and Special Tools: Provide Project Engineer with all keys and special tools that might be necessary for access, maintenance, and operation of installed items.

### **PART 3 - EXECUTION**

### 3.1 INSTRUCTIONS TO GOVERNMENT PERSONNEL

- A. Each applicable trade shall provide qualified, factory-trained representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each system and piece of equipment. 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 of information.
- B. Instructional services of competent instructors shall be provided for a minimum of 4 hours of onsite training to designated Government employees covering the overall installation, operational methods, adjustments, care and periodic maintenance requirements for their systems.
- C. Each instructor shall be familiar with all parts of their respective system and shall be trained in operating theory as well as practical operation and maintenance practices. Factory trained instructors shall be employed wherever practical and available. 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.
- D. Utilize the maintenance manual for the system or equipment as a text for instruction. **Instruction shall include a full and extensive review of the maintenance and operation manual.** Failure to execute this task shall require additional training sessions when this information is made available.
- E. Unless otherwise required or approved, the instruction shall be given during the regular work week after the equipment has been accepted and turned over to the Government for regular operation. Where significant changes or modifications in equipment are made under the terms of the guarantee, additional instruction shall be provided as may be necessary to acquaint the operating personnel of the changes or modifications. When more than four man-days (32 hours) of instruction are specified in other Sections, approximately half of the time shall be classroom instruction and the other half at the site of the system or equipment.

- F. Upon completion, submit written acknowledgment with documentation to the Project Engineer demonstrating that the required instructions were successfully completed for each discipline.

### 3.2 FINAL CLEANING

- A. Cleaning shall include dusting, washing, HEPA vacuuming and other required sanitizing of all surfaces within immediate and adjacent affected areas. All affected areas shall be cleaned, polished and hygienically sanitized including but not limited to floors, walls, partitions, ceilings (including above removable ceiling systems ceiling tiles), fixtures, lenses, windows, equipment, furniture (built-in or free standing), shelves counters, cabinets, doors, drawers. Comply with manufacturer's instructions for cleaning operation. Close off access to areas as cleaning is completed. **Project phasing shall require cleaning to be performed in various phases.**
- B. The following minimum requirements shall be performed in addition to special cleaning requirements specified in other Sections:
1. Remove markings that are not required as permanent labels.
  2. Vacuum clean carpeted surfaces and similar soft surfaces.
  3. Clean transparent materials, including mirrors and glass, to a polished clear condition. Replace broken glass and damaged transparent materials.
  4. Clean exposed exterior and interior hard-surface finishes, to a dirt-free condition, free of dust, stains, films and similar noticeable substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
  5. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, and similar spaces.
  6. Wet mop concrete floors in non-occupied spaces.
  7. Strip, wash, wax and polish to a sanitary clean condition all floor surfaces within the construction boundary and outside the boundary throughout areas of construction traffic flow throughout the project.
  8. Clean HVAC systems within the construction area to the requirements specified.
  9. HEPA vacuum the inside/outside sections of the building baseboard perimeter heating fin tube components within the construction area to insure clean and healthy operation.
  10. Wet wipe surfaces of equipment clean. Remove excess lubrication and other substances.

11. Clean and polish plumbing fixtures to a sanitary condition free of stains.
  12. Clean light fixtures and lamps of debris and stains to function with full efficiency.
  13. Clean other items to a condition of sanitation acceptable for intended service use.
- C. Damaged surfaces and items within the contract limits shall be patched, repaired, refinished, painted and/or replaced as necessary with materials comparable to the surrounding material and surface equal to new conditions unless otherwise noted or directed by the VA Project Engineer. Finished surfaces shall be indistinguishable from the surrounding area.
- D. Protection Removal: Except as otherwise indicated or requested by the Contracting Officer, remove temporary protection devices and facilities which were installed during course of the work to protect previously completed work during remainder of construction period.

### **3.3 PARTIAL CHECKLIST PRIOR TO BENEFICIAL OCCUPANCY**

The Contractor is required to ensure that all the following list items are completed:

#### **1. Mechanical Systems -**

- Completion of Mechanical System Inspecting & Testing Checklist as specified in Section 23 05 11, REQUIREMENTS FOR MECHANICAL INSTALLATIONS.
- Verification of Air Conveyance System Cleanliness as specified in Section 23 31 00, HVAC DUCTS AND CASINGS.
- Equipment is operating correctly, air/water/steam flow balanced and thermostatic sensors control temperature as designed.
- All parameters met per specifications (actual measurements) with documentation.
- Equipment labeled, access doors tagged with belt and filter sizes designated.
- Balancing Report for all HVAC piping and duct systems.
- Mechanical/Plumbing System Valve Schedule sheets.
- As-built plans with pipe/ductwork diagrams.
- Equipment Data Records - Removed and/or Installed.

#### **2. Electrical Systems -**

- Completion of Electrical System Inspecting & Testing Checklist as specified in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

- Completion of NEC Compliance Checklist as specified in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - All parameters met per specifications (actual measurements) with documentation.
  - All panelboard labeled, circuits traced out, directories updated and panelboard schedule sheets completed (in typed format).
  - Each receptacle and switch identified as to circuit & panelboard number.
  - Master electrical one-liner updated.
  - As-built plans with wiring diagrams.
  - Equipment Data Sheets.
3. Facility Communication Systems -
- Computer networks, special system alarms to digitizers, fire alarms.
  - Code Blue, Code Green, Emergency Call, intercoms, et al, etc.
  - HVAC energy management system.
4. Warranty -
- Contractor shall provide name and telephone number of qualified service organization to perform emergency repairs on a 24-hour basis. Each trade shall provide a minimum 1 year (24 hour on call) labor/parts service for equipment troubleshooting and correction. Warranties' starting dates may not be the same for all systems so they must be explicitly stated with supporting documentation.

#### **3.4 CONTRACT COMPLETION**

- A. Notification: Contractor shall notify the Contracting Officer in writing with supporting documentation, when all work has been completed in accordance with the contract requirements.
- B. Acceptance: Final Inspection shall not be performed until Contractor issued final Punch List work is completed or otherwise resolved for acceptance with supporting documentation. All test and documentation for electrical and mechanical systems must be complete per contract requirements. Additional final Punch Lists may be developed in collaboration with Project A/E including Resident Engineer, Contracting Officer, Department Service (customer) and appropriate technical personnel from the Department of Veterans Affairs.
- C. Keys issued to the Contractor by the VA shall be returned to the VA Resident Engineer at the completion of beneficial occupancy. Project

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completion is not achieved until all assigned VA keys have been  
returned.

- - - E N D - - -

ATTACHMENTS FOLLOW

ATTACHMENT A:      Equipment Data Record ... 1 Page



**Equipment Data Record**

**Contractor Removed and/or Installed Equipment**

VA Project Name & Number:

General Contractor Name & Address:

Subcontractor Name & Address:

Manufacturer:

Vendor:

Project Device Name:

Mfg's Device Name:

Model #:

Serial #:

VA #:

Bar Code #:

Acquisition Date:

Acquisition Value:

Life Expectancy:

Warranty Expiration Date:

Equipment Location:

Facility Utilities Altered:

Filter Size/Type/Qty:

Belt Size/Type/Qty:

M & O Comments:



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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies demolition and removal of waste and items in the building and other structures shown. Construction and demolition waste includes products of demolition, excess or unusable construction materials, and packaging materials used for construction products.

- A. The Department of Veterans Affairs assumes no responsibility for the actual condition of items or structures to be demolished. Demolition includes, but is not limited to:
1. Portions of the existing building structures and components to the extent indicated on the drawings and as required to accommodate the new construction as outlined.
  2. Removal of any structures, utilities, finishes, fittings, or appurtenances that in any way hinder the execution of the new work or would be inconsistent with the new work as outlined.
  3. Removal of flooring to the sub-floor concrete slab to the extent indicated and to the extent required to accommodate the new construction.
  4. Removal of existing building unit masonry to the extent indicated.
  5. Removal of interior partitions and finishes to the extent indicated.
  6. Removal of doors and frames to the extent indicated.
  7. Removal of ceilings and support systems to the extent indicated.
  8. Removal of built-in equipment and casework to the extent indicated.
  9. Removal of existing windows and metal panels to the extent indicated.
  10. Removal of abandoned mounted, suspended equipment or miscellaneous appurtenances.
  11. Removal of all unnecessary items from the remaining partitions.
  12. Removal of Mechanical, Electrical, Plumbing, Fire Protection systems to the extent indicated.
  13. Removal and protection of existing fixtures and equipment identified as "salvaged" or "relocated".
  14. Removal of asbestos-containing materials to the extent indicated or necessary.
  15. Removal of debris from trash dumps shown.
- B. During the execution of work, deactivation, relocation, rerouting, removal of existing equipment and systems shall be performed by the Contractor as required by the job conditions to facilitate the installation of the new systems.

## 1.2 RELATED WORK

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- F. 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 INFECTION PREVENTION MEASURES.

## 1.3 SUBMITTALS

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

- A. Manufacturer's Literature and Data:
  - 1. HEPA Air Scrubbers - Make, Model, Output.
  - 2. HEPA Vacuums - Make, Model, Capacity.
  - 3. Other dust control apparatus.
- B. Submit a plan detailing project specific dust control and noise control measures, weather protection and safety precautions including weekly status reports.
  - 1. Submit required Interim Life Safety Measures (ILSM) evaluation, and issue recurring reports according to the specified schedule.
  - 2. Submit required Infection Control Risk Assessments (ICRA) plan, and issue recurring reports according to the specified schedule.
  - 3. Submit documentation demonstrating the required number of HEPA Air Scrubbers necessary to achieve the required amount of negative air pressure and air changes within the work area during all phases of work, location of each HEPA Air Scrubbers and location of back up HEPA Air Scrubber.
- C. Schedule: Submit schedule indicating proposed methods and sequence of operations for selective demolition work to the COTR for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required.
  - 1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of construction and Medical Center operations.

2. Coordinate demolition and removal work with the Medical Center's continuing occupation of portions of the building.
3. Provide detailed disposal and retention methods to be utilized.
- D. Submit required proof that an OSHA certified "Competent Person" (CP) (29 CFR 1926.20(b) (2)) shall maintain a presence at the work site whenever the general or subcontractors are present.
  1. Submit a project Safety Plan in accordance with OSHA 29 CFR 1926 Safety and Health Regulations for Construction signed by the "Competent Person" (CP).
  2. Submit OSHA certified Construction Safety course and other relevant competency training records of all employees for approval before the start of work.

#### **1.4 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. The VA will be continuously occupying areas of the building immediately adjacent to demolition areas. Conduct demolition work in a manner that will minimize need for disruption of the Medical Center's normal operations. Provide a minimum of 72 hours advance notice to the Project Engineer of demolition activities that will severely impact the Medical Center's normal operations. Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, utilities, and persons.
- C. 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.
- D. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- E. Provide temporary dustproof barrier partitions in existing structures where directed by the COTR. "ZipWall" (1-800-718-2255) and/or "SmartSeal" (1-407-466-9189) or equal dustproof barriers are required in occupied areas.
- F. Provide temporary fire rated security sound/dust proof access barrier as required to restrict the flow of unauthorized personnel. Barrier shall

be secured from floor to deck above ceiling. All barriers separating facility areas from construction areas shall be rated with self-closing, self-latching doors.

- G. 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.
- H. 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.
- I. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
  - 2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  - 3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- J. 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 COTR.
- K. 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 COTR's approval.
- L. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- M. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article INFECTION PREVENTION MEASURES.

## 1.5 UTILITY SERVICES

- A. Demolish and remove outside utility service lines shown to be removed. Remove existing utilities indicated or uncovered by work, and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COTR.
- B. Abandoned Lines: Unless otherwise stated, 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.
- C. Coordinate all mechanical (eg, HVAC), electrical, plumbing (MEP) utility service, fire protection sprinkler system shutdowns and space access three (3) weeks in advance with the Project Engineer. Due to facility scheduling and access difficulties, some shutdowns and the performance of certain work will need to be performed during prime-time by the Contractor.
- D. Continuous operation of existing systems is required during demolition, tie-ins, relocation, rerouting and removal work. Outages required for construction purposes shall be scheduled in a manner that shall afford the shortest possible duration. Shutdowns shall be scheduled with the facility for specified mutually agreeable periods. After each period, the interruption shall cease and the service restored to normal operation and the process repeated until the work is completed. Due to the Medical Center schedules and access difficulties, some shutdowns and the performance of certain work shall be performed during prime time by the contractor.
- E. Maintain and restore all utilities (including plumbing, medical gases, electric branch circuits and feeders) servicing undisturbed regions which pass through the renovated areas. Contractor shall utilize deep scan metal detectors prior to coring/drilling holes in existing structure, and ground detecting core/drill equipment during operation to avoid damaging active existing systems buried in the existing structures.
- F. Devices that are not scheduled for deactivation and are loop fed from devices being removed shall be fed from the extended existing system unless otherwise specified. Where existing components are removed from continuous lengths due to architectural modifications, the remaining

system shall be reconnected to the system as required by the job conditions. Re-hang unsupported existing to remain appurtenances as required by the job conditions with suitable supports in compliance with applicable requirements.

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

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Erect and maintain dustproof partitions as required to prevent spread of dust, fumes and smoke to other parts of the building. Upon completion, remove partitions and repair damaged surfaces to match adjacent surfaces.
- B. Do no work in affected areas until the various dust and protective barriers have been installed. Provide adequate dust control, to eliminate dust from migrating beyond work area. Dust shall be contained within dustproof areas, shall not be tracked outside the construction area and shall be vacuum cleaned at the end of each removal procedure. Dust protection shall consist of the following:
  - 1. Install and maintain one (1) hour fire-rated temporary construction partitions to provide smoke-tight separations between construction areas, the areas that are described in phasing requirements and adjoining areas that are occupied by Department of Veterans Affairs (VA) personnel to contain dirt debris and dust. Barriers shall be sealed and made presentable on Medical Center occupied side.
    - a. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. Refer to National Gypsum Association's Fire Resistance Design Manual GA-600 for fabrication details.
    - b. Where directed by the COTR, provide temporary dustproof barrier partitions with a hinged self-closing Class C 45 minute fire/smoke rated door and lockset in a metal frame, appropriate for the partition, to allow worker access. Seal doors with either gasket strips or sweeps. When local building codes require barrier partitions/doors to have a fire rating the design and construction materials shall provide the required fire rating.



- c. Non-flammable (fire retardant) reinforced polystyrene meeting local fire codes, 6-mil thick or greater plastic tarpaulin partitions surrounding work areas properly sealed at ceiling, floor, partitions, and adjacent construction may be used in selected areas where dust control is the only hazard if approved by the COTR, Safety Officer, Infection Control and Medical Center. "ZipWall" (800-718-2255), "Smart Seal" (407-466-9189) dust barriers or equal.
2. Install one (1) hour fire-rated temporary construction partitions 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. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction. 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.
4. HEPA (High Efficiency Particulate Accumulator) filtration is required where the exhaust air may reenter the breathing zone. Provide and operate the necessary quantity and size of HEPA air scrubbers during ALL phases of construction (not limited to demolition) to maintain air quality and provide continuous negative air pressure at all times within the work area. HEPA filtration shall be rated at an efficiency level of 99.97% retaining all particles including pollen, mold spores and dust 0.3 microns in size or larger. The HEPA filtration units shall be cleaned and serviced daily at a minimum. Provide both primary (high capacity ASHRAE 85%) and secondary filtration pre-filters to extend the useful life of the HEPA filter. Contractor shall verify that construction exhaust to exterior is not reintroduced into the Medical Center through intake vents, or building openings. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that particles are not reintroduced into the Medical Center. Demonstrate the operation of the negative pressure system to the VA Project Engineer to include, but not be limited to, the following:
  - a. Plastic barriers and sheeting move lightly in toward the work area.
  - b. Noticeable movement of air through (inward) the site's open entrance.
  - c. Positive motion of air across all areas in which work is to be performed.

- d. Modify the negative pressure system as necessary to achieve the above.
5. Adhesive Walk-off Mats/Carpets, minimum size 24 inches by 36 inches, shall be used at all interior transitions from the construction area to occupied medical center area. Mats shall be changed as often as required to maintain areas outside construction area clean at all times.
6. Vacuums shall utilize completely sealed HEPA filtration rated at an efficiency level of 99.97% retaining all particles including pollen, mold spores and dust 0.3 microns in size or larger bag, filter and motor components shall be completely sealed by rubber gaskets with no dust leakage.
7. Vacuum and wet mop all construction transition areas to the occupied Medical Center at the end of each workday. Clean surrounding areas frequently and maintain.
8. Daily clean inside the construction barrier. Use sweeping compound products daily to collect and control floor dust.
9. Vacuum ceiling tiles prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be closed immediately when unattended.
10. Take all measures and provide all material necessary for protecting existing equipment and property in affected and other areas against dust and debris; equipment, property, affected and other areas used in the Medical Center's operations shall not be hindered. For additional requirements refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 01 00 00, GENERAL REQUIREMENTS.
- C. Open windows shall NOT be permitted in rooms where demolition work is in progress, unless a HEPA filtered exhaust fan is provided at the window to ensure negative air pressure at all times within the area. NO dust shall be permitted to escape either under doors or thru barriers.
- D. Cover and protect furniture, equipment, fixtures to remain and be salvaged from soiling or damage when demolition work is performed in rooms or areas where such items have not been removed.
- E. Demolition and removal work shall be executed with due respect to the Medical Center and occupants. Affected work shall be carefully removed or altered by acceptable methods, in the least amount of time, with the least amount of noise and dust generated. The use of impact tools will not be permitted unless approved by the Project Engineer. Carry out demolition work to cause as little inconvenience to adjacent occupied spaces and building areas as possible.

- F. Proper precautions shall be taken so that adjacent occupied areas shall not be disturbed or contaminated during construction. The Project Engineer shall be consulted three (3) weeks in advance for approval of work schedules in occupied areas. Due to Medical Center scheduling and access difficulties some work will likely require prime-time performance by the Contractor. Work above ceilings in areas beyond the construction boundary shall be cleaned and closed with matching undamaged materials by the close of each day.
- G. All original building plumbing/steam pipes where originally insulated with asbestos. Work performed on these pipes shall be conducted in compliance with all applicable State and Federal requirements.
- H. The elevation of existing floors will vary from room-to-room where the partition separating two rooms has been removed. Modify the floor to create a uniform level surface with the surrounding area. Level all floors and make repairs as required to ensure a true and flush surface for installation of the finish flooring.
- I. The plane of existing finished plaster walls will vary from room-to-room where the partition separating two rooms has been removed. Grind the existing plaster and repair the floor to create a uniform level surface with the surrounding surface.
- J. Where a new partition will form a continuation of an existing surface, the finish face of the new partition shall align with and be indistinguishable from the existing surface.
- K. Extend existing to remain partition and utility chase wall assemblies to underside of slab above ceiling line using materials to match existing.

### **3.2 DEMOLITION**

- A. Contractor shall be responsible for dust controls especially plaster and masonry dust, including partition and ceiling removals. Such dust may contain organisms that are hazardous to health. All such removals shall take place in sealed rooms and enclosures. Maintain a negative air pressure inside all construction areas thru the use of HEPA air handling units operated continuously to control dust.
- B. Demolish in an orderly and careful manner as required to accommodate new work, including that required to remain.
- C. Perform demolition in accordance with applicable authorities having jurisdiction.
- D. Construction debris shall be covered when transported through the Medical Center with a dustproof cover. NO uncovered material will be permitted outside of dustproof areas.

- E. Remove from site, contaminated, vermin infested or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers and public.
- F. Remove demolished materials, tools and equipment from site upon completion of work and on a daily basis. Leave site in a condition acceptable to the COTR.
- G. Repair all demolition performed in excess of that required, at no cost to the Government.
- H. Items damaged due to Contractor's neglect shall be replaced or repaired to "like new" condition at the Contractor's expense in a timely manner. The Government shall make the determination of replace, repair or be compensated for loss.
- I. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
- J. On the floor below in areas where ceiling demolition is necessary remove entire plaster ceiling and replace with suspended acoustic tile ceiling to match facility standard. In rooms where SAT ceilings exist the tiles are to be re-installed (or replaced if damaged) on a daily basis. At the completion of construction work in each room, the affected areas shall be vacuumed clean above and below the ceiling line
- K. All demolition, relocation and temporary tie-ins shall be provided by the Contractor.
  - 1. 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 COTR.
  - 2. Reroute existing to remain MEP systems as required to accommodate new construction layout, and as necessary to maintain MEP connections for existing to remain components.
  - 3. Demolition of mechanical, electrical, plumbing (MEP) systems shall appropriately isolate each branch from riser, remove branch back to main riser and install isolation.
  - 4. Disconnect and remove feeder and branch circuit wires and conduit from the source to the panelboard that are being removed or relocated.
- L. Remove all debris, waste and the like in accordance with Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- M. 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 COTR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

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

### **3.3 CLEAN-UP**

On completion of work of this Section and after removal of all debris, leave site in clean condition satisfactory to COTR. Clean-up shall include disposal (off the Medical Center Property) 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**

**PART 1 - GENERAL**

**1.1 SUMMARY OF THE WORK**

**1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS**

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

**1.1.2 EXTENT OF WORK**

- A. 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;

**BUILDING 18:**

800 square feet of sub-surface waterproofing on exterior wall that is inaccessible therefore assumed ACM, contractor to verify.

411 square feet of mastic associated with floor tile

210 linear feet of pipe insulation

80 square feet of transite panels at heating unit

1 fire door

5 pipe fittings and gaskets

**BUILDING 1:**

2,410 square feet of waterproofing on exterior wall

20 linear feet of caulk on exterior door frame

420 linear feet of pipe insulation

100 linear feet of black pipe coating

360 square feet of transite panels at heating unit

**TRADITIONAL ASBESTOS ABATEMENT**

375 linear feet of transite window casing  
150 square feet of transite panels above windows  
750 square feet of residual old caulk on window frame  
120 square feet of mastic under floor tile  
280 square feet of floor tile and mastic  
360 square feet of waterproofing on interior wall behind heating unit

CANOPY:

3 ventilation unit components

**1.1.3 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 02 41 00, DEMOLITION.
- C. Division 09, FINISHES
- D. Division 22, PLUMBING.
- E. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING / Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- F. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING / Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION
- G. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- H. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING / Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING / Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING / Section 22 11 00, FACILITY WATER DISTRIBUTION / Section 22 13 00, FACILITY SANITARY SEWERAGE / Section 22 13 23, SANITARY WASTE INTERCEPTORS / Section 22 14 00, FACILITY STORM DRAINAGE / Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 23 11 23, FACILITY NATURAL-GAS PIPING.
- I. Section 23 21 13, HYDRONIC PIPING / Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.
- J. Section 23 31 00, HVAC DUCTS AND CASINGS / Section 23 37 00, AIR OUTLETS AND INLETS.

**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, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
- C. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

**1.1.5 CONTRACTORS USE OF PREMISES**

- A. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.



- B. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action.

## 1.2 VARIATIONS IN QUANTITY

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 ACM and those prices shall be used for additional work required under the contractor.

## 1.3 STOP ASBESTOS REMOVAL

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

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

- G. power failure or loss of wetting agent; or
- H. any visible emissions observed outside the regulated area.

#### 1.4 DEFINITIONS

##### 1.4.1 GENERAL

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

##### 1.4.2 GLOSSARY

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

**Aerosol** - Solid or liquid particulate suspended in air.

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

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

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

**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.

**Crawl space** - 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**

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

- A. Massachusetts Department of Environmental Protection

1. 310 CMR 7.00: Air Pollution Control Regulations
2. 310 CMR 19.061: Special Waste Disposal Requirements for Asbestos

#### **1.5.5 LOCAL REQUIREMENTS**

The local requirements are MassDEP 310 CMR 7.00.

#### **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.

## 1.6 PROJECT COORDINATION

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

### 1.6.1 PERSONNEL

- A. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
- B. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; social security number; qualifications; accreditation card with color picture; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.
- C. Minimum qualifications for Contractor and assigned personnel are:
  - 1. The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and state as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable states; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.
  - 2. The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.
  - 3. The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has developed at least one complete standard operating procedure for asbestos abatement; has trained abatement personnel for three (3) years; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.
  - 4. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating

procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

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

## **1.7 RESPIRATORY PROTECTION**

### **1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM**

The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.Subpart I;134. ANSI Standard Z88.2-1992 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c)(1)(i - ix) - Respiratory Protection Program.

### **1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR**

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

### **1.7.3 SELECTION AND USE OF RESPIRATORS**

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

### **1.7.4 MINIMUM RESPIRATORY PROTECTION**

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

### **1.7.5 MEDICAL WRITTEN OPINION**

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

#### **1.7.6 RESPIRATOR FIT TEST**

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

#### **1.7.7 RESPIRATOR FIT CHECK**

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

#### **1.7.8 MAINTENANCE AND CARE OF RESPIRATORS**

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

#### **1.7.9 SUPPLIED AIR SYSTEMS**

If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-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 facepiece and under the respirator straps.
  3. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
- C. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
- D. Shower and wash body completely with soap and water. Rinse thoroughly.
- E. Rinse shower room walls and floor to drain prior to exiting.
- F. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

### **1.8.5 REGULATED AREA REQUIREMENTS**

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

## **1.9 DECONTAMINATION FACILITIES**

### **1.9.1 DESCRIPTION**

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

### **1.9.2 GENERAL REQUIREMENTS**

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

### **1.9.3 TEMPORARY FACILITIES TO THE PDF AND W/EDF**

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

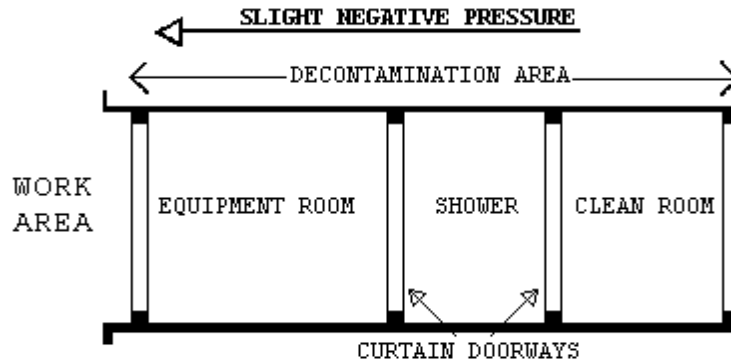
### **1.9.4 PERSONNEL DECONTAMINATION FACILITY (PDF)**

The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6 mil opaque fire retardant poly to provide an air tight

- room. Provide a minimum of 2 - 900 mm (3 foot) wide 6 mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male can enter or exit the PDF during her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6 mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
  3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6 mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3 layers of 6 mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6 mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6 mil opaque fire retardant poly.



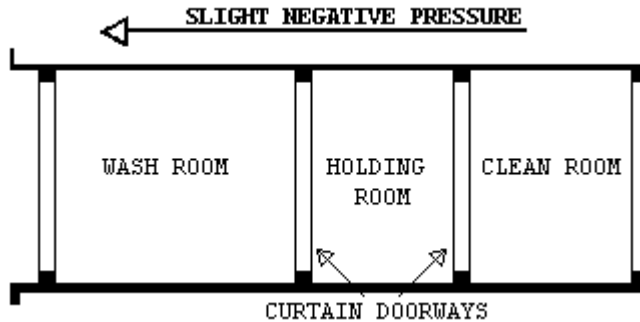
#### 1.9.5 WASTE/EQUIPMENT DECONTAMINATION FACILITY (W/EDF)

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

1. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
2. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6 mil fire retardant poly.
3. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6 mil fire retardant poly.
4. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 x 4 wood framing and 2 layers of 6 mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6 mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure

separation between the W/EDF clean room and the adjacent areas shall be provided.

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



#### 1.9.6 WASTE/EQUIPMENT DECONTAMINATION PROCEDURES

At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. These personnel will not be required to wear PPE. At no time shall personnel from the clean side be allowed to enter the Wash Room.

### PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

#### 2.1 MATERIALS AND EQUIPMENT

##### 2.1.1 GENERAL REQUIREMENTS

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

- A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
- B. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
- C. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.

- D. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
- E. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
- F. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
- G. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6 mil fire retardant poly.
- H. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
- I. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
- J. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
- K. Disposal bags - 2 layers of 6 mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
- L. The VA shall be provided an advance copy of the MSDS as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
- M. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
- N. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

## **2.2 MONITORING, INSPECTION AND TESTING**

### **2.2.1 GENERAL**

- A. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee

exposure to asbestos must not exceed 0.1 fiber per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples to satisfy OSHA requirements. Additional inspection and testing requirements are also indicated in other parts of this specification.

- B. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
- C. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

#### **2.2.2 SCOPE OF SERVICES OF THE VPIH/CIH CONSULTANT**

- A. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:

1. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
  2. Task 2: Perform continuous air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
  3. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
  4. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
  5. Task 5: Perform, in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
  6. Task 6: Issue certificate of decontamination for each regulated area and project report.
- B. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
- C. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

### **2.2.3 MONITORING, INSPECTION AND TESTING BY CONTRACTOR CPIH/CIH**

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



start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for air personal monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. 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. 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.
- D. Interiors of existing ductwork may require decontamination. This may be done during the pre-cleaning phase of operations before the ductwork is sealed off or during the final cleaning phase prior to re-engagement of the system. Appropriate equipment and control measures shall be utilized to prevent contamination of building spaces during this operation. Adequate cleaning of ductwork may sometimes be accomplished by drawing high volumes of air through the system using the HEPA filtered negative pressure ventilation units.

### **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  $\mu$ m or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5  $\mu$ m 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.
- B. No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.
- C. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
- D. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.
- E. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.

#### **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.

Fire resistant barriers must be drywall/gypsum board. Danger signs must be posted as per OSHA. Any alternate method must be submitted in advance for VA written approval prior to use.

#### **3.1.4.4 CRITICAL BARRIERS**

Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6 mil fire retardant poly and duct tape. Individually seal with 2 layers of 6 mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

#### **3.1.4.5 PRIMARY BARRIERS**

- A. Cover the regulated area with two layers of 6 mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12"). Seams must overlap at least 1800 mm (6') and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6 mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.
- B. If stairs and ramps are covered with 6 mil plastic, two layers must be used. Provide 19 mm (3/4") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

#### **3.1.4.6 SECONDARY BARRIERS**

A loose layer of 6 mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work and at a minimum once per work day.

#### **3.1.4.7 EXTENSION OF THE REGULATED AREA**

If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

#### **3.1.4.8 FIRESTOPPING**

- A. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
- B. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
- C. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination.

Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

#### **3.1.5 SANITARY FACILITIES**

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

#### **3.1.6 PERSONAL PROTECTIVE EQUIPMENT**

Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

#### **3.1.7 PRE-CLEANING**

The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.

Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities must don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor's work plan. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.

Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items should be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting will be disposed of prior to abatement if in the regulated area. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet will be disposed of as asbestos waste.

Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables,

sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

Control panels, gauges etc., in the regulated area may require VA access during abatement. These shall be designated and enclosures constructed with access flaps sealed with waterproof tape.

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. The following areas shown on drawings indicate locations of amosite ACM which will require local exhaust ventilation and collection as described below, in addition to wet removal. Provide specific description /locations/ drawings.
- B. Provide local exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 300 mm (12") flexible rigid non-collapsing duct shall be located no more than 600 mm (2') from any scraping/brushing activity. Primary filters must be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity must have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe attach a 1200 mm (4') square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2') below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.
- C. Amosite does not wet well with amended water. Submit full information/documentation on the wetting agent proposed prior to start

for review and approval by the 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.

The extent of soil contamination; soil composition; access and clearance to the impacted area; future use and access; potential for flooding; as well as other site specific factors will dictate the appropriate option(s) for ACS.

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.

The extent of soil contamination; soil composition; access and clearance to the crawlspace/pipe tunnel; future use and access; potential for flooding; as well as other site specific factors will dictate the appropriate option(s) for ACS.

Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulated the soil using shotcrete or other spray applied concrete materials. Considerations for which option to be used will be made by the VA representative. Factors which may affect which option to be used may include: access to the work area; height of the area (such as is there sufficient height to use concrete materials in the area, etc.)

### **3.3 LOCKDOWN ENCAPSULATION**

#### **3.3.1 GENERAL**

Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, the contractor shall encapsulate all surfaces with a bridging encapsulant.

#### **3.3.2 DELIVERY AND STORAGE**

Deliver materials to the job site in original, new and unopened containers bearing the manufacturer's name and label as well as the following information: name of material, manufacturer's stock number, date of manufacture, thinning instructions, application instructions and the MSDS for the material.

#### **3.3.3 WORKER PROTECTION**

Before beginning work with any material for which an MSDS has been submitted, provide workers with any required personal protective equipment. The required personal protective equipment shall be used whenever exposure to the material might occur. In addition to OSHA/specification requirements for respiratory protection, a paint pre-filter and an organic vapor cartridge, at a minimum, shall used in addition to the HEPA filter when an organic solvent based encapsulant is used. The CPHI/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: \_\_\_\_\_

TRADITIONAL ASBESTOS ABATEMENT

VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
Mental Health Addition/Improvements, Project 608-313

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**

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





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 and state 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.
3. The following local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:
  - a. New Hampshire Hazardous Waste Rules Chapter Env-HW

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 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 24 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**

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. Reclean 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 labels 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. Comply with land disposal restriction notification requirements as required by 40 CFR 268:

- a. 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 approved hazardous waste treatment, storage, or disposal facility off Government property.
  - b. 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.
  - c. 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 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

**1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:**

- A. Testing agency retained and reimbursed by the Contractor and approved by Resident Engineer.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

**1.4 TOLERANCES:**

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).

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D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

**1.5 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
  1. Reinforcing Steel.
  2. Cement.
- D. Manufacturer's Certificates:
  1. Abrasive aggregate.
  2. Lightweight aggregate for structural concrete.
  3. Air-entraining admixture.
  4. Chemical admixtures, including chloride ion content.
  5. Waterproof paper for curing concrete.
  6. Liquid membrane-forming compounds for curing concrete.

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7. Non-shrinking grout.
  8. Liquid hardener.
  9. Waterstops.
  10. Expansion joint filler.
  11. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures.

**1.7 DELIVERY, STORAGE, AND HANDLING:**

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

**1.8 PRE-CONCRETE CONFERENCE:**

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
  1. Submittals.
  2. Coordination of work.
  3. Availability of material.
  4. Concrete mix design including admixtures.

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5. Methods of placing, finishing, and curing.
  6. Finish criteria required to obtain required flatness and levelness.
  7. Timing of floor finish measurements.
  8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

#### 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 Concrete Institute (ACI):
- 117-10.....Tolerances for Concrete Construction and Materials
  - 211.1-91(R2009).....Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 211.2-98(R2004).....Selecting Proportions for Structural Lightweight Concrete
  - 214R-02.....Evaluation of Strength Test Results of Concrete
  - 301-10.....Structural Concrete
  - 304R-00(R2009).....Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305R-10.....Hot Weather Concreting
  - 306R-10.....Cold Weather Concreting
  - 308R-01(R2008).....Standard Practice for Curing Concrete

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VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
Mental Health Addition/Improvements, Project 608-313

309R-05.....Guide for Consolidation of Concrete

318-08.....Building Code Requirements for Reinforced  
Concrete and Commentary

347-04.....Guide to Formwork for Concrete

SP-66-04.....ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association  
(ANSI/AHA):

A135.4-2004.....Basic Hardboard

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

A82/A82M-07.....Steel Wire, Plain, for Concrete Reinforcement

A185/185M-07.....Steel Welded Wire Fabric, Plain, for Concrete  
Reinforcement

A615/A615M-09.....Deformed and Plain Billet-Steel Bars for  
Concrete Reinforcement

A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy-Coated (Galvannealed) by the Hot-Dip  
Process

A706/A706M-09.....Low-Alloy Steel Deformed and Plain Bars for  
Concrete Reinforcement

A767/A767M-09.....Zinc-Coated (Galvanized) Steel Bars for Concrete  
Reinforcement

A775/A775M-07.....Epoxy-Coated Reinforcing Steel Bars

A820-06.....Steel Fibers for Fiber-Reinforced Concrete

A996/A996M-09.....Rail-Steel and Axle-Steel Deformed Bars for  
Concrete Reinforcement

C31/C31M-09.....Making and Curing Concrete Test Specimens in the  
field

C33-08.....Concrete Aggregates

C39/C39M-09.....Compressive Strength of Cylindrical Concrete  
Specimens

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VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
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C94/C94M-09.....Ready-Mixed Concrete  
C143/C143M-10.....Slump of Hydraulic Cement Concrete  
C150-09.....Portland Cement  
C171-07.....Sheet Materials for Curing Concrete  
C172-08.....Sampling Freshly Mixed Concrete  
C173-10.....Air Content of Freshly Mixed Concrete by the  
Volumetric Method  
C192/C192M-07.....Making and Curing Concrete Test Specimens in the  
Laboratory  
C231-09.....Air Content of Freshly Mixed Concrete by the  
Pressure Method  
C260-06.....Air-Entraining Admixtures for Concrete  
C309-07.....Liquid Membrane-Forming Compounds for Curing  
Concrete  
C330-09.....Lightweight Aggregates for Structural Concrete  
C494/C494M-10.....Chemical Admixtures for Concrete  
C618-08.....Coal Fly Ash and Raw or Calcined Natural  
Pozzolan for Use as a Mineral Admixture in  
Concrete  
C666/C666M-03.....Resistance of Concrete to Rapid Freezing and  
Thawing  
C881/C881M-02.....Epoxy-Resin-Base Bonding Systems for Concrete  
C1107/1107M-08.....Packaged Dry, Hydraulic-Cement Grout (Non-  
shrink)  
C1315-08.....Liquid Membrane-Forming Compounds Having Special  
Properties for Curing and Sealing Concrete  
D6-95(R2006).....Loss on Heating of Oil and Asphaltic Compounds  
D297-93(R2006).....Rubber Products-Chemical Analysis

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VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
Mental Health Addition/Improvements, Project 608-313

D1751-04(R2008).....Preformed Expansion Joint Filler for Concrete  
Paving and Structural Construction (Non-  
extruding and Resilient Bituminous Types)

D4397-09.....Polyethylene Sheeting for Construction,  
Industrial and Agricultural Applications

E1155-96(R2008).....Determining  $F_F$  Floor Flatness and  $F_L$  Floor  
Levelness Numbers

E. American Welding Society (AWS):

D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel

F. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):

Report On.....Concrete Sealers for the Protection of Bridge  
Structures

H. U. S. Department of Commerce Product Standard (PS):

PS 1.....Construction and Industrial Plywood

PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

**PART 2 - PRODUCTS:**

**2.1 FORMS:**

A. Wood: PS 20 free from loose knots and suitable to facilitate finishing  
concrete surface specified; tongue and grooved.

B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20  
mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete  
Form Overlay optional.

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C. Form Lining:

1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

- D. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

**2.2 MATERIALS:**

- A. Portland Cement: ASTM C150 Type I or II.

- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.

- C. Coarse Aggregate: ASTM C33.

1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

- D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

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- E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150  $\mu$ m (No. 100) sieve.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures:
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
  2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
  3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
  4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  5. Air Entraining Admixture: ASTM C260.
  6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
  7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Vapor Barrier: ASTM D4397, 0.375 mm (15 mil).
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Welded Wire Fabric: ASTM A185.
- K. Reinforcing Bars to be Welded: ASTM A706.
- L. Cold Drawn Steel Wire: ASTM A82.
- M. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m<sup>2</sup> (1.5 pounds per square yard), or square mesh at .6Kg/m<sup>2</sup> (1.17 pounds per square yard).

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- N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- R. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .
1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
  2. MVE 15-Year Warranty:
    - a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.
- S. Non-Shrink Grout:
1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.

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2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

T. Adhesive Binder: ASTM C881.

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Water Stop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
5. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m<sup>3</sup> (1.5 lb. per cubic yard). Product shall have a UL rating.
6. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m<sup>3</sup> (30 lb. per cubic yard).
7. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
8. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

**2.3 CONCRETE MIXES:**

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
  1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
  2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, admixtures, weight of fine and coarse aggregate per m<sup>3</sup> (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and

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- consistency of each cylinder in terms of slump. Include dry unit weight (115 PCF) of lightweight structural concrete.
3. Prepare a curve showing relationship between water-cement ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
  4. If the field experience method is used, submit complete standard deviation analysis.
- B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and approval of design mix.
- C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums.

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
25 (3000) <sup>1,3</sup>	280 (470)	0.65	290 (490)	0.55
25 (3000) <sup>1,2</sup>	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

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4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

**TABLE II - MAXIMUM SLUMP, MM (INCHES)\***

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	
Slabs, Beams, Reinforced Walls	100 mm (4 inches)	100 mm (4 inches)

- E. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- F. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

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**TABLE III - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

**TABLE IV  
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

- G. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- H. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C  $\pm$  1.7 degrees C (73.4  $\pm$  3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

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- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.
- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:
1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
  2. Require additional curing and protection.
  3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
  4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
  5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

#### **2.4 BATCHING AND MIXING:**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Resident Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery

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temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
  1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
  2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.
  3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

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Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
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B. Treating and Wetting: Treat or wet contact forms as follows:

1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
3. Use sealer on reused plywood forms as specified for new material.

C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.

D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.

E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.

1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.

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2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, or columns except where shown or permitted by Resident Engineer. Install sleeves in beams, or columns that are not shown, but are permitted by the Resident Engineer, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering

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individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

### **3.2 PLACING REINFORCEMENT:**

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
  - 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
  - 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
  - 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
  - 1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
  - 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.

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- a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
  - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
  - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength ( $f_y$ ) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
  - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

### **3.3 VAPOR BARRIER:**

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
- 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.

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2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

**3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:**

- A. Sealer is applied on the day of the concrete pour or as as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.
- B. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
  1. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
  2. Spray apply Sealer at the rate of 20 m<sup>2</sup> (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
  3. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

**3.5 CONSTRUCTION JOINTS:**

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

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- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

### **3.6 EXPANSION JOINTS:**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

### **3.7 PLACING CONCRETE:**

- A. Preparation:
  - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
  - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
  - 3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
  - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
  - 1. Preparing surface for applied topping:
    - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.

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- b. Broom clean and keep base slab wet for at least four hours before topping is applied.
  - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
- 1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
  - 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
  - 3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
  - 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
  - 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
  - 6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

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7. Concrete on metal deck:

- a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

- 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

**3.8 HOT WEATHER:**

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

**3.9 COLD WEATHER:**

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

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### **3.10 PROTECTION AND CURING:**

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.
1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m<sup>2</sup>/L (400 square feet per gallon) on steel troweled surfaces and 7.5m<sup>2</sup>/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
  2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
  3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

### **3.11 REMOVAL OF FORMS:**

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
  2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in

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accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

### **3.12 CONCRETE SURFACE PREPARATION:**

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

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### 3.13 CONCRETE FINISHES:

#### A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Resident Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
  - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
  - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600  $\mu\text{m}$  (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
  - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
  - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
4. Textured: Finish as specified. Maximum quantity of patched area 0.2  $\text{m}^2$  (2 square feet) in each 93  $\text{m}^2$  (1000 square feet) of textured surface.

#### B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs

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- within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Resident Engineer and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Resident Engineer determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
  3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
  4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
  5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
  6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
  7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats

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- and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
  9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
  10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Resident Engineer from sample panel.
  11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    - a. Areas covered with carpeting, or not specified otherwise in b. below:
      - 1) Slab on Grade:

a) Specified overall value	$F_F$ 25/ $F_L$ 20
b) Minimum local value	$F_F$ 17/ $F_L$ 15
      - 2) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    - b. Areas that will be exposed, receive thin-set tile or resilient flooring:

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1) Slab on grade:

- a) Specified overall value                      FF 36/FL 20
- b) Minimum local value                          FF 24/FL 15

2) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Resident Engineer, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

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13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local  $F_F/F_L$  numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall  $F_F/F_L$  numbers, then whole slab shall be rejected and remedial measures shall be required.

14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Resident Engineer, until a slab finish constructed within specified tolerances is accepted.

**3.14 SURFACE TREATMENTS:**

- A. Use on exposed concrete floors and concrete floors to receive carpeting.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

**3.15 RESURFACING FLOORS:**

Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

**3.16 RETAINING WALLS:**

- A. Use air-entrained concrete.
- B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- D. Place porous backfill as shown.

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CAST-IN-PLACE CONCRETE



**SECTION 04 05 13**  
**MASONRY MORTARING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies mortar materials and mixes.

**1.2 RELATED WORK**

- A. Mortar used in Section:
  - 1. Section 04 05 16, MASONRY GROUTING.
  - 2. Section 04 05 31, MASONRY TUCK POINTING.
  - 3. Section 04 20 00, UNIT MASONRY

**1.3 TESTING LABORATORY-CONTRACTOR RETAINED**

- A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

**1.4 TESTS**

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
  - 2. Mortar:
    - a. Test for compressive strength and water retention; ASTM C270.
    - b. Mortar compressive strengths 28 days as follows:
      - Type S: Minimum 12400 kPa (1800 psi) at 28 days.
      - Type N: Minimum 5170 kPa (750 psi) at 28 days.
  - 3. Sand: Test for deleterious substances, organic impurities, soundness and grading.
- G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

**1.5 SUBMITTALS**

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

B. Certificates:

1. Testing laboratory's facilities and qualifications of its technical personnel.
2. Indicating that following items meet specifications:
  - a. Portland cement.
  - b. Hydrated lime.
  - c. Fine aggregate (sand).
  - d. Color admixture.
  - e. Potable water.

C. Laboratory Test Reports:

1. Mortar, each type.
2. Admixtures.

D. Manufacturer's Literature and Data:

1. Portland cement.
2. Hydrated lime.
3. Admixtures.

**1.6 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04.....Organic Impurities in Fine Aggregates for Concrete
  - C109-08.....Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
  - C144-04.....Aggregate for Masonry Mortar
  - C150-09.....Portland Cement
  - C207-06.....Hydrated Lime for Masonry Purposes
  - C270-10.....Mortar for Unit Masonry
  - C307-03(R2008).....Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
  - C321-00(R2005).....Bond Strength of Chemical-Resistant Mortars
  - C780-10.....Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
  - C979-10.....Pigments for Integrally Colored Concrete

## **PART 2 - PRODUCTS**

### **2.1 HYDRATED LIME**

ASTM C207, Type S.

### **2.2 AGGREGATE FOR MASONRY MORTAR**

A. ASTM C144 and as follows:

1. Light colored sand for mortar for laying face masonry units.
2. White plastering sand meeting sieve analysis for mortar joints for pointing.

B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

### **2.3 PORTLAND CEMENT**

A. ASTM C150, Type I.

B. Use white Portland cement wherever white mortar is specified.

### **2.4 WATER**

Potable, free of substances that are detrimental to mortar, masonry, and metal.

### **2.5 MASONRY MORTAR**

A. Conform to ASTM C270.

B. Admixtures:

1. Do not use mortar admixtures, except for water repellent for CMU exposed to weather, and color admixtures, unless approved by Resident Engineer.
2. Match water repellent admixture (added in field) to that used in CMU. Use admixture in setting mortar for CMU specified to receive water repellent admixture.
3. Submit laboratory test report showing effect of proposed admixture on water retention and water repellency of mortar.
4. Do not use antifreeze compounds.

C. Colored Mortar:

1. Maintain uniform mortar color for exposed work throughout.
2. Match mortar color in approved sample.
3. Color of mortar for exposed work in alteration work to match color of existing mortar.

D. Color Admixtures:

1. Proportion as specified by manufacturer.
2. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

### **2.6 COLOR ADMIXTURE**

A. Pigments: ASTM C979.

B. Use mineral pigments only. Organic pigments are not acceptable.

- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

### **PART 3 - EXECUTION**

#### **3.1 MIXING**

- A. Mix in a mechanically operated mortar mixer.
  - 1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
  - 1. Re-tempered by adding water to restore to proper consistency and workability.
  - 2. Discard mortar that has reached its initial set or has not been used within two hours.
- E. Pointing Mortar:
  - 1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
  - 2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
  - 3. Add water to bring mortar to a workable consistency prior to application.

#### **3.2 MORTAR USE LOCATION**

- A. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered).
- B. Use Type N mortar for other masonry work, except as otherwise specified.
- C. Use Type N mortar for tuck pointing work.

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**SECTION 04 05 16**  
**MASONRY GROUTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies grout materials and mixes.

**1.2 RELATED WORK**

- A. Grout used in Section:
  - 1. Section 04 20 00, UNIT MASONRY.
- B. Grout Color: Match existing.

**1.3 TESTS**

- A. Test grout and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
  - 2. Grout:
    - a. Test for compressive strength; ASTM C1019.
    - b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
  - 3. Sand: Test for deleterious substances, organic impurities, soundness and grading.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
  - 1. Indicating that following items meet specifications:
    - a. Portland cement.
    - b. Grout.
    - c. Hydrated lime.
    - d. Fine aggregate (sand).
    - e. Coarse aggregate for grout.
    - f. Color admixture.
    - g. Potable water.
- C. Laboratory Test Reports:
  - 1. Grout, each type.

2. Color admixtures.

D. Manufacturer's Literature and Data:

1. Portland cement.
2. Hydrated lime.
3. Color admixtures.

**1.5 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04.....Organic Impurities in Fine Aggregates for Concrete
  - C150-09.....Portland Cement
  - C207-06.....Hydrated Lime for Masonry Purposes
  - C404-07.....Aggregate for Masonry Grout
  - C476-10.....Grout for Masonry
  - C979-10.....Pigments for Integrally Colored Concrete
  - C1019-11.....Sampling and Testing Grout

**PART 2 - PRODUCTS**

**2.1 HYDRATED LIME**

ASTM C207, Type S.

**2.2 AGGREGATE FOR MASONRY GROUT**

ASTM C404, Size 8.

**2.3 PORTLAND CEMENT**

- A. ASTM C150, Type 1.
- B. Use white Portland cement wherever white or light colored mortar is specified or required to match existing colors.

**2.4 WATER**

Potable, free of substances that are detrimental to grout, masonry, and metal.

**2.5 GROUT**

- A. Conform to ASTM C476 except as specified.



B. Grout type proportioned by volume as follows:

1. Fine Grout:

- a. Portland cement: one part.
- b. Hydrated lime: 0 to 1/10 part.
- c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.

2. Coarse Grout:

- a. Portland cement: one part.
- b. Hydrated lime: 0 to 1/10 part.
- c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
- d. Coarse aggregate: one to two times sum of volumes of cement and lime used.

- 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

**2.6 COLOR ADMIXTURE**

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

**PART 3 - EXECUTION**

**3.1 MIXING**

- A. Mix in a mechanically operated grout mixer.
  - 1. Mix grout for at least five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

**3.2 GROUT USE LOCATIONS**

- A. Use fine grout for filling cavities and cells of concrete masonry units where the smallest dimension is 50 mm (2 inches) or less.
- B. Use either fine grout or coarse grout for filling cavities and cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).
- C. Do not use grout for filling bond beam or lintel units.

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**SECTION 04 05 31**  
**MASONRY TUCK POINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies requirements for tuck pointing of existing masonry and precast concrete work at locations where existing exterior wall will become an interior wall via construction.

**1.2 RELATED WORK**

Mortars: Section 04 05 13, MASONRY MORTARING.

**1.3 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):  
C270-07.....Mortar for Unit Masonry
- C. International Masonry Institute: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

**PART 2 - PRODUCTS**

**2.1 TUCK POINTING MORTAR**

As per appendix X3 of ASTM C270.

**2.2 REPLACEMENT MASONRY UNITS**

- A. Units to match existing.

**PART 3 - EXECUTION**

**3.1 CUT OUT OF EXISTING MORTAR JOINTS**

- A. Cut out existing mortar joints (both bed and head joints) and remove by means of a toothing chisel or a special pointer's grinder, to a uniform depth of to 19 mm (3/4-inch), or until sound mortar is reached. Take care to not damage edges of existing masonry units to remain.
- B. Remove dust and debris from the joints by brushing, blowing with air or rinsing with water. Do not rinse when temperature is below freezing.

**3.2 JOB CONDITIONS**

- A. Protection: Protect newly pointed joints from rain, until pointed joints are sufficiently hard enough to prevent damage.
- B. Cold Weather Protection:
  - 1. Tuck pointing may be performed in freezing weather when methods of protection are utilized.

2. Comply with applicable sections of "Recommended Practices for Cold Weather Construction" as published by International Masonry Industry All Weather Council.
3. Existing surfaces at temperatures to prevent mortar from freezing or causing other damage to mortar.

### **3.3 INSTALLATION OF TUCK POINTING MORTAR**

- A. Immediately prior to application of mortar, dampen joints to be tuck pointed. Prior to application of pointing mortar, allow masonry units to absorb surface water.
- B. Tightly pack mortar into joints in thin layers, approximately 6 mm (1/4-inch) thick maximum.
- C. Allow layer to become "thumbprint hard" before applying next layer.
- D. Pack final layer flush with surfaces of masonry units. When mortar becomes "thumbprint hard", tool joints.

### **3.4 TOOLING OF JOINTS**

- A. Tool joints in patch work with a jointing tool to match the existing surrounding joints.

### **3.5 REPLACEMENT OF MASONRY UNITS**

- A. Cut out mortar joints surrounding masonry units that are to be removed and replaced.
  1. Units removed may be broken and removed, providing surrounding units to remain are not damaged.
  2. Once the units are removed, carefully chisel out the old mortar and remove dust and debris.
  3. If units are located in exterior wythe of a cavity or veneer wall, exercise care to prevent debris falling into cavity.
- B. Dampen surfaces of the surrounding units before new units are placed.
  1. Allow existing masonry to absorb surface moisture prior to starting installation of the new replacement units.
  2. Butter contact surfaces of existing masonry and new replacement masonry units with mortar.
  3. Center replacement masonry units in opening and press into position.
  4. Remove excess mortar with a trowel.
  5. Point around replacement masonry units to ensure full head and bed joints.
  6. When mortar becomes "thumbprint hard", tool joints.

### **3.6 CLEANING**

- A. Clean exposed masonry surfaces on completion.
- B. Remove mortar droppings and other foreign substances from wall surfaces.

- C. First wet surfaces with clean water, then wash down with a solution of soapless detergent specially prepared for cleaning brick.
- D. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
- E. Free clean surfaces from traces of detergent, foreign streaks or stains. Protect materials during cleaning operations including adjoining construction.
- F. Use of muratic acid for cleaning is prohibited.

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**SECTION 04 20 00**  
**UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls and precast concrete sills.

**1.2 RELATED WORK**

- A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- D. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
  - 1. Concrete masonry units, when exposed in finish work.
  - 2. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
  - 3. Precast concrete sills
- C. Shop Drawings:
  - 1. Special masonry shapes.
  - 2. Precast concrete sills
  - 3. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
  - 4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- D. Certificates:
  - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
  - 2. Indicating that the following items meet specification requirements:
    - a. Solid and load-bearing concrete masonry units.
    - b. Precast concrete sills

3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Manufacturer's Literature and Data:

1. Anchors, ties, and reinforcement.
2. Shear keys.
3. Reinforcing bars.

**1.4 SAMPLE PANEL**

- A. Before starting masonry, lay up a sample panel illustrating all masonry types and precast concrete sill in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
  1. Use masonry units from random cubes of units delivered on site.
  2. Include reinforcing, ties, and anchors.
- B. Use sample panels approved by Resident Engineer for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

**1.5 WARRANTY**

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A951-06.....Steel Wire for Masonry Joint Reinforcement.
  - A615/A615M-07.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - A675/A675M-03.....Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
  - C90-06.....Load-Bearing Concrete Masonry Units
  - C476-02.....Standard Specification for Grout for Masonry
  - C612-04.....Mineral Fiber Block and Board Thermal Insulation
  - C744-05.....Prefaced Concrete and Calcium Silicate Masonry Units.
  - D1056-07.....Flexible Cellular Materials - Sponge or Expanded Rubber
  - D2000-06.....Rubber Products in Automotive Applications
  - D2240-05.....Rubber Property - Durometer Hardness



D3574-05.....Flexible Cellular Materials-Slab, Bonded, and  
Molded Urethane Foams

F1667-05.....Fasteners: Nails, Spikes and Staples

C. Masonry Industry Council:

All Weather Masonry Construction Manual, 2000.

D. American Welding Society (AWS):

D1.4-05 Structural Welding Code - Reinforcing Steel.

E. Federal Specifications (FS):

FF-S-107C-00.....Screws, Tapping and Drive

F. Masonry Standards Joint Committee; Specifications for Masonry Structures  
(ACI 530.1-05/ASCE 6-05/TMS 602-99) (MSJC).

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE MASONRY UNITS**

A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.

1. Unit Weight: Normal weight.

2. Sizes: Modular.

3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.

4. Customized units:

a. Honed Face Units: No score design; with integral water repellant. Color as selected. Makes faces and arises sharp and true.

b Integrshalal Water Repellant: Unpainted CMU exposed to weather l contain liquid polymeric integral water-repellant admixture that does not reduce flexural bond strength. Units made with integral water repellent as manufacturer by Addiment, Inc., Block Plus W-10; Master Builders, Rheopel; W.R. Grace & Co., Dry-Block.

### **2.2 PRECAST CONCRETE SILLS**

A. 3000 psi concrete

### **2.3 SHEAR KEYS**

A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).

B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

## **2.4 REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.
- B. Shop-fabricate reinforcement bars which are shown to be bent or hooked.
- C. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951.
  - 2. Galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcing at least 3000 mm (10 feet) in length.
  - 6. Joint reinforcing in rolls is not acceptable.
  - 7. Joint reinforcing that is crimped to form drip is not acceptable.
  - 8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
  - 9. Trussed Design:
    - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.
  - 10. Multiple Wythes and Cavity wall ties:
    - a. Longitudinal wires 2.6 mm (0.10 inch), two in each wythe with ladder truss wires 2.6 mm (0.10 inch) overlay, welded to each longitudinal wire.
    - b. Longitudinal wires 4 mm (0.16 inch) with U shape 2.6 mm (0.10 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches) minimum.

## **2.5 ANCHORS, TIES, AND REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951.
  - 2. Galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcement at least 3000 mm (10 feet) in length.
  - 6. Joint reinforcement in rolls is not acceptable.
  - 7. Joint reinforcement that is crimped to form drip is not acceptable.

8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
  9. Trussed Design:
    - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.
  10. Multiple Wythes and Cavity wall ties:
    - a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
    - b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).
- C. Adjustable Veneer Anchor for Frame Walls:
1. Two piece, adjustable anchor and tie.
  2. Anchor and tie may be either type; use only one type throughout.
  3. Loop Type:
    - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
    - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.
  4. Angle Type:
    - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
    - b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.
- D. Dovetail Anchors:
1. Corrugated steel dovetail anchors formed of 1.5 mm (0.0598 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry

units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.

2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend at least 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.0239 inch) thick galvanized steel (with felt or fiber filler).

E. Individual ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to a rectangular shape not less than 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not permitted.
2. Mesh wall ties formed of ASTM A82, W0.5, 2 mm, (16 gage) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
3. Rectangular wire wall ties formed of W1.4, 3 mm, (9 gage) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

F. Corrugated Wall Tie:

1. Form from 1.5 mm (0.0598 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths so as to extend at least 100 mm (4 inches) into joints of new masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

G. Adjustable Steel Column Anchor:

1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend at least 75 mm (3 inches) into joints of masonry.

H. Adjustable Steel Beam Anchor:

1. Z or C type steel strap, 30 mm (1-1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook not less than 38 mm (1-1/2 inches) long.
3. Length to embed in masonry not less than 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end not less than 40 mm (1-1/2 inches).

I. Ridge Wall Anchors:

1. Form from galvanized steel not less than 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as shown.

**2.6 PREFORMED COMPRESSIBLE JOINT FILLER**

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.

**2.7 ACCESSORIES**

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Box Board:
  1. Mineral Fiber Board: ASTM C612, Class 1.
  2. 25 mm (1 inch) thickness.
  3. Other spacing material having similar characteristics may be used subject to the Resident Engineer's approval.
- C. Masonry Cleaner:
  1. Detergent type cleaner selected for each type masonry used.
  2. Acid cleaners are not acceptable.
  3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

- A. Protection:
  1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
  2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:
  1. Masonry may be laid in freezing weather when methods of protection are utilized.
  2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

**3.2 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
  1. In 3000 mm (10 feet) - 6 mm (1/4 inch).

2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
  3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
  2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
1. Minus 6 mm (1/4 inch).
  2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
1. Accurate to minus 0 mm (0 inch).
  2. Plus 6 mm (1/4 inch).

### 3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  2. Tool while mortar is soft enough to be compressed into joints and not raked out.
  3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
  4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- E. Wall, Furring, and Partition Units:
1. Lay out field units to provide for running bond of walls with vertical joints in second course centering on first course units unless specified otherwise.
  2. Align head joints of alternate vertical courses.
  3. Use no piece shorter than 100 mm (4 inches) long.

4. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
- F. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- G. Wetting and Wetting Test:
  2. Do not wet concrete masonry units before laying.
- H. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- I. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- J. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

### 3.4 ANCHORAGE

- A. Veneer to Frame Walls:
  1. Use adjustable veneer anchors.
  2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
  3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.
- B. Veneer to Concrete Walls:
  1. Install dovetail slots in concrete vertically at 600 mm (2 feet) on centers.
  2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
- C. Anchorage of Abutting Masonry:
  1. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
- D. Anchorage to Steel Beams or Columns:
  1. Use adjustable beam anchors on each flange.
  2. At columns weld the 6 mm (1/4 inch) steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

### 3.5 REINFORCEMENT

#### A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of cavity walls and single wythe concrete masonry unit walls.
2. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
3. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
4. Joint reinforcement is required in every other course of stack bond CMU masonry.

#### B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement . Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Grout openings:
  - a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
  - b. Locate 75 mm x 75 mm (3 in. x 3 in.) min. clean-out holes at location of vertical reinforcement.
  - c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

### 3.6 CMU CONTROL JOINTS

- A. Provide CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls:
  1. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
  2. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.



- E. Interrupt steel joint reinforcement at control joints unless otherwise shown.
- F. Fill opening in exposed face of control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

### **3.7 BUILDING EXPANSION AND SEISMIC JOINTS**

- A. Keep joint free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

### **3.8 ISOLATION SEAL**

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.
- D. Cavity Type Exterior Walls:
  - 1. Keep air space clean of mortar accumulations and debris.
    - a. Clean cavity by use of hard rubber, wood or metal channel strips having soft material on sides contacting wythes.
    - b. Lift strips with wires before placing next courses of horizontal joint reinforcement or individual ties or adjustable cavity wall ties. //
  - 2. For each lift lay two courses of concrete masonry units, followed by six courses of brick facing.
  - 3. Insulated Cavity Type Exterior Walls:
  - 4. Install the insulation against the air and vapor barrier.

### **3.9 CONCRETE MASONRY UNITS**

- A. Kind and Users:
  - 1. Provide special concrete masonry shapes as required, including corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between existing construction,
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
8. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
9. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
10. Install deformed reinforcing bars of sizes shown.
11. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
12. Steel reinforcement in place before grouting.
13. Minimum clear distance between parallel bars: One bar diameter.
14. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
15. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
16. Reinforcement shall be fully encased by grout or concrete.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.

19. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
20. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

### **3.10 POINTING**

- A. Fill joints with pointing mortar using rubber float trowel to rub mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Finish exposed joints in finish work with a jointing tool to provide a smooth concave joint unless specified otherwise.
- D. At joints with existing work match existing joint.

### **3.11 GROUTING**

- A. Preparation:
  1. Clean grout space of mortar droppings before placing grout.
  2. Close cleanouts.
  3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
  4. Verify reinforcing bars are in cells of units or between wythes as shown.
- B. Placing:
  1. Place grout by hand bucket, concrete hopper, or grout pump.
  2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
  3. Do not slush with mortar or use mortar with grout.
  4. Interruptions:
    - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
    - b. Grout from dam to dam on high lift method.
    - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
- C. Puddling Method:
  1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.
  2. Consolidate by puddling with a grout stick during and immediately after placing.
  3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:

1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
2. Place grout in lifts not exceeding 1.5 m (5 ft).
3. Exception:  
Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).
  - a. The masonry has cured for at least 4 hours.
  - b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
  - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

**3.12 PLACING REINFORCEMENT**

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Resident Engineer. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- G. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- H. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- J. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

### **3.13 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY**

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
  - 1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
  - 2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for

vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

F. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm<sup>2</sup> (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap

at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm<sup>2</sup> (10 square inches), respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of

- masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
  14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Resident Engineer.
  15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Mechanically consolidate each grout lift during pouring operation.
  16. Place grout in lintels or beams over openings in one continuous pour.
  17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
  18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

### **3.14 CLEANING AND REPAIR**

#### **A. General:**

1. Clean exposed masonry surfaces on completion.
2. Clean existing exterior masonry which will become interior masonry via new construction
3. Protect adjoining construction materials and landscaping during cleaning operations.
4. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
5. Remove mortar droppings and other foreign substances from wall surfaces.

#### **B. Concrete Masonry Units:**



1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

### **3.15 WATER PENETRATION TESTING**

- A. Seven days before painting, in the presence of Resident Engineer, test solid exterior masonry walls for water penetration.
- B. Direct water on masonry for a period of one hour at a time when wind velocity is less than five miles per hour.
- C. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Resident Engineer.
- D. Correct the areas showing moisture on inside of walls, and repeat test at repaired areas, to insure that moisture penetration has been stopped.

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**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Decking: Section 05 31 00, STEEL DECKING.
- D. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.
- E. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

**1.3 QUALITY ASSURANCE:**

- A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Work shall be fabricated in an AISC certified Category Conventional Steel Structures fabrication plant.
- B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the Resident Engineer.

**1.4 TOLERANCES:**

Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145, except as follows:

- A. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
- B. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).

- C. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

**1.5 DESIGN:**

- A. Connections: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with the details shown on the Drawings, supplementing where necessary. The details shown on the Drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Resident Engineer of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Resident Engineer. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

**1.6 REGULATORY REQUIREMENTS:**

- A. AISC: Specification for Structural Steel Buildings - Allowable Stress Design.
- B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

**1.7 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete
- C. Certificates:
  - 1. Structural steel.
  - 2. Steel for all connections.
  - 3. Welding materials.
  - 4. Shop coat primer paint.
- D. Test Reports:
  - 1. Welders' qualifying tests.
- E. Design Calculations and Drawings:

1. Moment connection calculations.

F. Record Surveys.

#### **1.8 APPLICABLE PUBLICATIONS:**

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

B. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Second Edition, 2005)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
3. Code of Standard Practice for Steel Buildings and Bridges (2010).

C. American National Standards Institute (ANSI):

B18.22.1-65(R2008).....Plain Washers

B18.22M-81(R2000).....Metric Plain Washers

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

A6/A6M-09.....Standard Specification for General Requirements  
for Rolled Structural Steel Bars, Plates,  
Shapes, and Sheet Piling

A36/A36M-08.....Standard Specification for Carbon Structural  
Steel

A53/A53M-10.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated Welded and Seamless

A123/A123M-09.....Standard Specification for Zinc (Hot-Dip  
Galvanized) Coatings on Iron and Steel Products

A242/A242M-04(R2009)....Standard Specification for High-Strength Low-  
Alloy Structural Steel

A283/A283M-03(R2007)....Standard Specification for Low and Intermediate  
Tensile Strength Carbon Steel Plates

A307-10.....Standard Specification for Carbon Steel Bolts  
and Studs, 60,000 psi Tensile Strength

#### **STRUCTURAL STEEL FRAMING**

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

A490-10.....Standard Specification for Heat-Treated Steel  
Structural Bolts 150 ksi Minimum Tensile  
Strength

A500/A500M-10.....Standard Specification for Cold Formed Welded  
and Seamless Carbon Steel Structural Tubing in  
Rounds and Shapes

A501-07.....Standard Specification for Hot-Formed Welded and  
Seamless Carbon Steel Structural Tubing

A572/A572M-07.....Standard Specification for High-Strength  
Low-Alloy Columbium-Vanadium Structural Steel

A992/A992M-06.....Standard Specification for Structural Steel  
Shapes

E. American Welding Society (AWS):

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

F. Research Council on Structural Connections (RCSC) of The Engineering  
Foundation:

Specification for Structural Joints Using ASTM A325 or A490 Bolts

G. Military Specifications (Mil. Spec.):

MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing,  
Repair

H. Occupational Safety and Health Administration (OSHA):

29 CFR Part 1926-2001...Safety Standards for Steel Erection

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

A. Structural Steel: ASTM A992.

B. Structural Tubing: ASTM A500, Grade B.

C. Structural Tubing: ASTM A501.

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D. Steel Pipe: ASTM A53, Grade B.

E. Bolts, Nuts and Washers:

1. High-strength bolts, including nuts and washers: ASTM A325.
2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ANSI Standard B18.22.1.

F. Zinc Coating: ASTM A123.

G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

### **PART 3 - EXECUTION**

#### **3.1 CONNECTIONS (SHOP AND FIELD):**

- A. Welding: Welding in accordance with AWS D1.1. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

#### **3.2 FABRICATION:**

Fabrication in accordance with Chapter M, Specification for Steel Buildings - Allowable Stress Design and Plastic Design.

#### **3.3 SHOP PAINTING:**

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to following:
  1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
  2. Surfaces which will be encased in concrete.

#### **STRUCTURAL STEEL FRAMING**

3. Surfaces which will receive sprayed on fireproofing.

4. Top flange of members which will have shear connector studs applied.

- D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication):  
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

#### **3.4 ERECTION:**

- A. General: Erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

#### **3.5 FIELD PAINTING:**

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

#### **3.6 SURVEY:**

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to Resident Engineer for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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**SECTION 05 31 00**  
**STEEL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies material and services required for installation of steel decking as shown and specified.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09 91 00, PAINTING.

**1.3 DESIGN REQUIREMENTS:**

- A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".

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- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

**1.5 QUALITY ASSURANCE:**

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.
- B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.

**1.6 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):
- A36/A36M-08.....Standard Specification for Carbon Structural Steel
- A611-97.....Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
- A653/A653M-08.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
- C423-08.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (ninth Edition, 1989)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)
- D. American Iron and Steel Institute (AISI):
1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members

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VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
Mental Health Addition/Improvements, Project 608-313

E. American Welding Society (AWS):

D1.3-08.....Structural Welding Code - Sheet Steel

F. Factory Mutual (FM Global):

1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement

2. Factory Mutual Research Approval Guide (2002)

G. Military Specifications (Mil. Spec.)

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

A. Steel Decking: ASTM A653, Structural Quality.

B. Galvanizing: ASTM A653, G60.

C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.

D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.

E. Miscellaneous Steel Shapes: ASTM A36.

F. Welding Electrode: E60XX minimum.

G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:

1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.

2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads.

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The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.

3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).
5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.
6. Seat Angles for Deck: Provide where a beam does not frame into a column.
7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

## 2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
  1. Wide Rib (Type B) deck.
  2. Finish: Galvanized G-60.
- C. Do not use steel roof deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

## STEEL DECKING

### **PART 3 - EXECUTION**

#### **3.1 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:
  - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
  - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
  - 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
  - 4. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength

#### **STEEL DECKING**

equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.

5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (3 feet) o.c., or midspan, whichever is closer, using self-tapping No. 10 or larger machine screws.
6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 2.1 kPa (45 psf) at eave overhang and 1.4 kPa (30 psf) for other roof areas.
8. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet (maximum spacing of welds is 380 mm (15 inches).
9. Weld corrugated deck to intermediate supports in an X pattern. Weld in valley of side laps on every other support and in the valley of the center corrugation on the remaining supports (maximum spacing of welds is 760 mm (30 inches)).

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause

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for rejection of the work and removal and replacement of the affected metal deck.

6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

### **3.2 WELDING:**

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

### **3.3 FIELD REPAIR:**

1. Areas scarred during erection.
2. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint.

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**SECTION 05 36 00**  
**COMPOSITE METAL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies material and services required for installation of composite steel decking including shear connector studs and miscellaneous closures required to prepare deck for concrete placement as shown and specified.

**1.2 RELATED WORK:**

Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

**1.3 DESIGN REQUIREMENTS:**

- A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications for the Design of Cold Formed Steel Structural Members", except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:
  - 1. Shape of decking section to be used.
  - 2. Cleaning of steel decking prior to concrete placement.

COMPOSITE METAL DECKING

- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.
- F. Test Report - Stud base qualification.
- G. Welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.
- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".

**1.5 QUALITY ASSURANCE:**

Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):  
  
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition).
- C. American Society of Testing and Materials (ASTM):  
  
A36/A36M-08.....Standard Specification for Carbon Structural Steel  
  
A108-07.....Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality  
  
A653/A653M-10.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
- D. American Institute of Steel Construction (AISC):  
  
1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Latest Edition)

2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)

E. American Welding Society (AWS):

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

D1.3/D1.3M-08.....Structural Welding Code - Sheet Steel

E. Military Specifications (Mil. Spec.):

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing  
Repair

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Steel Decking and all Flashings: ASTM A653, Structural Quality suitable for shear stud weld-through techniques.
- B. Galvanizing: ASTM A653, G60.
- C. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 psi) minimum, tensile strength - 400 Mpa (60,000 psi) minimum, reduction of area 50 percent minimum. Studs of uniform diameter; heads shall be concentric and normal to shaft; stud, after welding free from any substance or defect which would interfere with its function as a shear connector. Studs shall not be painted or galvanized. Size of studs shall be as shown on drawings. Studs manufactured by a company normally engaged in the manufacture of shear studs and can furnish equipment suitable for weld-through installation of shear studs.
- D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
  - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.

COMPOSITE METAL DECKING

2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
4. Seat angles for deck: Where a beam does not frame into a column.

## **2.2 REQUIREMENTS:**

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.
- C. Steel decking capable of safely supporting total, normal construction service loads without damage to decking unit.
- D. Steel decking units shall include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items. System shall provide for minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm or 900 mm (24 or 36 inches) on centers transversely. Suspension system shall be capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at any one hanger attachment point. System may consist of fold-down type hanger tabs or a lip hanger.

## **PART 3 - EXECUTION**

### **3.1 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt,

paint, ice, water and rust from steel surfaces to which metal decking will be welded.

- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units to project in standard widths and cut to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to Government.
- H. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.
- I. Fastening Deck Units:
  - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
  - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
  - 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
- J. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.

COMPOSITE METAL DECKING

- K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- L. Provide metal concrete stops at edges of deck as required.
- M. Cutting and Fitting:
1. Cut all metal deck units to proper length in the shop prior to shipping.
  2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
  3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
  4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
  5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
  6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- N. Installation of shear connector studs through previously installed metal deck to conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:
1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.

COMPOSITE METAL DECKING

2. Steel deck sheets shall be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded shall be clean and dry.
3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.
4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Ferrules specially developed for the weld-through technique must be used. Ferrules shall be appropriate for size of studs used and be removed after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

### **3.2 CLEANING:**

Clean deck in accordance with manufacturer's recommendation before concrete placement.

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**SECTION 05 40 00**  
**COLD-FORMED METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:
1. Exterior load-bearing steel stud walls.

**1.2 RELATED WORK**

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.  
B. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.  
C. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.  
D. Seismic: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**1.3 DESIGN REQUIREMENTS**

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.  
B. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
1. Design connection of exterior cold-formed steel framing to flexural capacity of the member
  2. Connection Safety Factors (SF):
    - a. SF = 1 shall be allowed for connection elements that provide a ductile mode of failure (e.g. bolt bearing, tensile yielding, etc.)
    - b. SF = 1.5 shall be used for connection elements that provide a non-ductile mode of failure (e.g. weld fracture, concrete cone failure due to anchor bolt pull-out, etc.)
  3. Design Loads: As indicated.
  4. Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Load-Bearing Walls: Lateral deflection of 1/360 of the wall height.
  5. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure,

undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).

6. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
7. Design exterior non-load-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
8. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

#### **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 Iron and Steel Institute (AISI):
- C. Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- D. American Society of Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specifications for Carbon Structural Steel  
A123/A123M-09.....Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

- A153/A153M-09.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A307-10.....Standard Specifications for Carbon Steel Bolts and Studs
- A653/A653M-10.....Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- A1003/A1003M.....Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
- C1107/C1107M-08.....Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- E488-96(R2003).....Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
- E1190-95(R2007).....Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
- E. American Welding Society (AWS):
- D1.3/D1.3M-08.....Structural Welding Code-Sheet Steel
- F. Military Specifications (Mil. Spec.):
- MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Sheet Steel for studs and accessories 16 gage and heavier: ASTM A1003/A1003M, Structural Grade 50, Type H (ST50H), zinc coated , with a yield of 340 MPa (50 ksi) minimum.
1. Coating: ASTM A653/A653M, Grade 50, galvanized to G90.
- B. Galvanizing Repair Paint: MIL-P-21035B.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

### **2.2 WALL FRAMING**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
1. Design Uncoated-Steel Thickness: 1.52 mm (0.0598 inch).

2. Flange Width: Minimum 41 mm (1-5/8 inches).

3. Web: Punched.

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: Matching steel studs.

2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

### **2.3 FRAMING ACCESSORIES**

A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.

2. Bracing, bridging, and solid blocking.

3. Web stiffeners.

4. Gusset plates.

5. Deflection track and vertical slide clips.

6. Stud kickers and girts.

7. Reinforcement plates.

### **2.4 ANCHORS, CLIPS, AND FASTENERS**

A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

## **2.5 REQUIREMENTS**

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

## **PART 3 - EXECUTION**

### **3.1 FABRICATION**

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
  - 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - 2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

### **3.2 ERECTION**

- A. Securely anchor tracks to supports as shown.
- B. Install in accordance with seismic requirements.
- C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- G. Install headers in all openings that are larger than the stud spacing in that wall.
- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.

- I. Studs in one piece for their entire length, splices will not be permitted.
- J. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- K. Provide joist bridging and web stiffeners at reaction points where shown.
- L. Provide end blocking where joist ends are not restrained from rotation.
- M. Provide temporary bracing and leave in place until framing is permanently stabilized.
- N. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- O. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

### **3.3 TOLERANCES**

- A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

### **3.4 FIELD REPAIR**

Touch-up damaged galvanizing with galvanizing repair paint.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items
  - 2. Gratings
  - 3. Loose Lintels
  - 4. Ships Ladder
  - 5. Pipe Handrails
  - 6. Safety Nosings
  - 7. Platforms
  - 8. Miscellaneous Items

**1.2 RELATED WORK**

- A. Alternates: Section 01 00 00 - GENERAL REQUIREMENTS
- B. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- C. Prime and finish painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Floor gratings and safety nosings.

Grating, each type	
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- 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):
- B18.6.1-81(R1997).....Wood Screws
- B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
- A36/A36M-05.....Structural Steel
- A47-99(R2004).....Malleable Iron Castings
- A48-03.....Gray Iron Castings
- A53-06.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless
- A123-02.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products
- A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet and Strip
- A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
- A307-07.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength
- A312/A312M-06.....Seamless, Welded, and Heavily Cold Worked  
Austenitic Stainless Steel Pipes
- A391/A391M-01.....Grade 80 Alloy Steel Chain



- A653/A653M-07.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- A786/A786M-05.....Rolled Steel Floor Plate
- B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- 1107-07.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-04.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- F436-07.....Hardened Steel Washers
- F468-06.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02.....Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-05.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
- D1.1-04.....Structural Welding Code Steel
- D1.2-03.....Structural Welding Code Aluminum
- D1.3-98.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP521-01.....Pipe Railing Manual
- AMP 500-505-1988.....Metal Finishes Manual
- MBG 531-00.....Metal Bar Grating Manual
- MBG 532-00.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC):
- SP 1-05.....No. 1, Solvent Cleaning
- SP 2-05.....No. 2, Hand Tool Cleaning
- SP 3-05.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
- RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders : 120 kg (250 pounds) at any point.
- C. Handrails: 900 N (200 pounds) in any direction at any point.
- D. Floor GratingsPlatforms: 500 kg/m<sup>2</sup> (100 pounds per square foot). U

## 2.2 MATERIALS

- A. Structural Steel shapes, plates and bars: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- D. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- E. Malleable Iron Castings: A47.
- F. Primer Paint: As specified in Section 09 91 00, PAINTING.
- G. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- H. 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.
- I. Grout: ASTM C1107, pourable type.

## 2.3 HARDWARE

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
  - 2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.
- B. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
    - c. ASTM F468 for nonferrous bolts.

- d. ASTM F593 for stainless steel.
- 2. Screws: ASME B18.6.1.
- 3. Washers: ASTM F436, type to suit material and anchorage.
- 4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

## **2.4 FABRICATION GENERAL**

### **A. Material:**

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

### **B. Size:**

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

### **C. Connections:**

- 1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
- 2. Field riveting will not be approved.
- 3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
- 4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
- 5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
- 6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
- 7. Use stainless steel connectors for removable members machine screws or bolts.

### **D. Fasteners and Anchors:**

- 1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
- 2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.

3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship:

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- d. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.
- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- 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.
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.

## 2.5 SUPPORTS

A. General:

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

B. For Ceiling Hung Toilet Stall:

- 1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
- 2. Make provision for installation of stud bolts in lower flange of channel.
- 3. Provide a continuous steel angle at wall and channel braces spaced as shown.
- 4. Use threaded rod hangers.
- 5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:

- 1. For items supported by metal stud partitions.
- 2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
- 3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.

4. Steel hat channels where shown. Flange cut and 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.

## **2.6 GRATINGS**

- A. Fabricate galvanized gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.
- C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
- D. Fabricate in sections not to exceed 2.3 m<sup>2</sup> (25 square feet) in area and 90 kg (200 pounds) in weight.
- E. Fabricate sections of grating with end-banding bars.
- F. Fabricate angle frames and supports, including anchorage as shown.
  1. Fabricate intermediate supporting members from "T's" or angles.
  2. Locate intermediate supports to support grating section edges.
  3. Fabricate frame to finish flush with top of grating.
  4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
  5. Butt or miter, and weld angle frame at corners.
- G. Steel Bar Gratings:
  1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
  2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for gratings in concrete floors.
  3. Use serrated bars for gratings.
  4. Use riveted gratings.
- H. Galvanized.

## **2.7 LOOSE LINTELS**

- A. Furnish galvanized lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
  1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).

- 2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

## **2.8 SAFETY NOSINGS**

- A. Fed. Spec. RR-T-650, Type C.
  - 1. Aluminum: Class 2, Style 2.
  - 2. Cast iron: Class 4.
- B. Fabricate nosings for exterior use from cast aluminum. Use one Class throughout.
- C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.
- D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.
- E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.

## **2.9 LADDERS**

- A. Steel Ships Ladder:
  - 1. Stringers: 3 inch steel channels, spaced 24 inches apart.
  - 2. Treads: Safety plate, 4 inches wide.
  - 3. Railings: Steel pipe with radial corners, supported at top and bottom. Provide intermediate supports for maximum unsupported length of 6 feet, plus or minus 3 inches. Weld to stringers.

## **2.10 HANDRAILS**

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
  - 1. Fittings: Elbows, T-shapes, wall brackets; manufacturers standard cast non-corrosive.
  - 2. Mounting: Adjustable brackets; prepare backing plate for mounting in wall construction.
  - 3. Splice Connectors: Provide concealed spigot; cast non-corrosive.



4. Exposed Fasteners: Flush countersunk screws or bolts; consistent with railing design.
5. Form handrail brackets to size and design shown.

C. Handrails:

1. Fabricate of galvanized steel.
2. Close free ends of rail with flush galvanized caps welded in place except where flanges for securing to walls with bolts are shown.
3. Make provisions for attaching handrail brackets to wall and handrail as shown.
4. Gates:
  - a. Fabricate from steel pipe as specified for railings.
  - b. Fabricate gate fittings from either malleable iron or wrought steel.
  - c. Hang gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
  - d. Provide suitable stops, so that gate will swing as shown.

**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, 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.
- B. Ceiling Hung Toilet Stalls:
  - 1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
  - 2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
  - 3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
  - 4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
  - 5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
- 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.
- D. Support for Cantilever Grab Bars:
  - 1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
  - 2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
  - 3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
  - 4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

### **3.3 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.

### **3.4 GRATINGS**

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.
- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

### **3.5 STEEL LINTELS**

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

### **3.6 SAFETY NOSINGS**

- A. Install safety nosings at the following:
  - 1. Exterior concrete steps.
- B. Install flush with horizontal and vertical surfaces.
- C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

### **3.7 LADDERS**

- A. Anchor ladder to walls and floors with expansion bolts through turned lugs or angle clips or brackets.

### **3.8 HANDRAILS**

- A. Handrails:
  - 1. Anchor brackets for galvanized handrails as detailed.
  - 2. Install sleeves in concrete formwork.
  - 3. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
  - 4. Expansion bolt to concrete or solid masonry.
  - 5. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

### **3.9 STEEL COMPONENTS FOR MILLWORK ITEMS**

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

### **3.10 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 05 51 00**  
**METAL STAIRS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies galvanized steel stairs with galvanized railings.
- B. Types:
  - 1. Galvanized industrial grating type stairs and railings.

**1.2 RELATED WORK**

- A. Grating platforms and railings: Section 05 50 00, METAL FABRICATIONS
- B. Requirements for shop painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

**1.4 APPLICATION PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.
- B. American Society for Testing and Materials (ASTM):
  - A36/A36M-08.....Structural Steel
  - A47-99 (R2009).....Ferritic Malleable Iron Castings
  - A48-03(R2008).....Gray Iron Castings
  - A53-10.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated  
Welded and Seamless
  - A307-10.....Carbon Steel Bolts and Studs, 60000 psi Tensile  
Strength
  - A653/653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc  
Alloy Coated (Galvannealed) by the Hot-Dip  
Process
  - A563-07.....Carbon and Alloy Steel Nuts
  - A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural,  
High-Strength, Low-Alloy
  - A786/A786M-09.....Rolled Steel Floor Plates
  - A1011-10.....Steel, Sheet and Strip, Strip, Hot-Rolled  
Carbon, Structural, High-Strength, Low-Alloy
- C. American Welding Society (AWS):
  - D1.1-10.....Structural Welding Code-Steel
  - D1.3-08.....Structural Welding Code-Sheet Steel

D. The National Association of Architectural Metal Manufactures (NAAMM)

Manuals:

Metal Bar Gratings (ANSI/NAAMM MBG 531-09)

AMP521-01.....Pipe Railing Manual, Including Round Tube

E. American Iron and Steel Institute (AISI):

2001.....Design of Cold-Formed Steel Structural Members

**PART 2 - PRODUCTS**

**2.1 DESIGN CRITERIA**

- A. Design stairs to support a live load of 500 kg/m<sup>2</sup> (100 pounds per square foot).
- B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.
- C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.
- D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

**2.2 MATERIALS**

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Steel Grating: Metal bar type grating NAAMM BG.
- C. Sheet Steel: ASTM A1008.
- D. Structural Steel: ASTM A36.
- E. Steel Plate: ASTM A1011.

**2.3 FABRICATION GENERAL**

- A. Fasteners:
  - 1. Conceal bolts and screws wherever possible.
  - 2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.
- B. Welding:
  - 1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
  - 2. Where possible, locate welds on unexposed side.
  - 3. Grind exposed welds smooth and true to contour of welded member.
  - 4. Remove welding splatter.
- C. Remove sharp edges and burrs.
- D. Fit stringers to head channel and close ends with steel plates welded in place where shown.
- E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
- F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09 91 00, PAINTING.

## **2.4 RAILINGS**

- A. Fabricate railings, including handrails, from steel pipe with flush.
  - 1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
  - 2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.
- B. Return ends of handrail to wall and close free end.
- C. Provide standard terminal castings where fastened to newel.
- D. Space intermediate posts not over six feet on center between end post // or newel post //.
- E. Fabricate handrail brackets from cast malleable iron.
- F. Provide standard terminal fittings at ends of post and rails.

## **2.5 INDUSTRIAL STAIRS**

- A. Provide treads, railings, stringers and other supporting members as shown.
- B. Treads of steel grating:
  - 1. Fabricate steel grating treads in accordance with requirements of NAAMM Metal Bar Grating Manuals.
  - 2. Provide end banding bars, except where carrier angle are used at tread ends.
  - 3. Support treads by use of carrier plates or carrier angle. Use carrier plate end banding bars on exterior stairs.
  - 4. Provide abrasive nosing on treads and edge of platforms at head of stairs.
  - 5. Provide toe plates on platforms where shown or required.

## **PART 3 - EXECUTION**

### **3.1 STAIR INSTALLATION**

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.
- C. Set stairs and other members in position and secure to structure as shown.
- D. Install stairs plumb, level and true to line.

### **3.2 RAILING INSTALLATION**

- A. Install standard terminal fittings at ends of posts and rails.
- B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.
- C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).

- D. Set posts plumb and aligned to within 3 mm in 3650 mm (1/8-inch in 12 feet).

**3.3 FIELD PRIME PAINTING**

- C. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies wood blocking, sheathing, furring, nailers, and rough hardware, including all wall blocking for items such as furniture, fixtures and equipment.

**1.2 RELATED WORK**

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY AND PLASTIC FABRICATIONS.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing fasteners, connections and dimensions, and relationship to adjacent materials.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 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.

**1.5 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 Forest and Paper Association (AFPA):  
National Design Specification for Wood Construction  
NDS-05.....Conventional Wood Frame Construction
- C. American Society of Mechanical Engineers (ASME):  
B18.2.1A-96(R2005).....Square and Hex Bolts and Screws  
B18.2.2-87(R2005).....Square and Hex Nuts  
B18.6.1-81 (R97).....Wood Screws
- D. American Plywood Association (APA):  
E30-03.....Engineered Wood Construction Guide
- E. American Society for Testing And Materials (ASTM):

- A47-99(R2004).....Ferritic Malleable Iron Castings  
A48-03.....Gray Iron Castings  
A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) by the Hot Dip  
Process  
C954-04.....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  
C1002-04.....Steel Self-Piercing Tapping Screws for the  
Application of Gypsum Panel Products or Metal  
Plaster Bases to Wood Studs or Metal Studs  
D1760-01.....Pressure Treatment of Timber Products  
F844-07.....Washers, Steel, Plain (Flat) Unhardened for  
General Use  
F1667-05.....Nails, Spikes, and Staples  
F. Federal Specifications (Fed. Spec.):  
MM-L-736C.....Lumber; Hardwood  
G. Commercial Item Description (CID):  
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self  
Threading Anchors)  
H. Military Specification (Mil. Spec.):  
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated  
I. 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. 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. 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.

C. 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.

D. 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.

E. Fire Retardant Treatment:

1. All interior concealed wood shall be fire resistant.
2. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
3. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

F. 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; furring; nailers, edge strips, blocking, crickets, curbs, cant, 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.

## **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. Masonry: Type I, Style 27.
  - e. 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 MISCELLANEOUS WOOD MEMBERS**

#### **A. 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.

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**SECTION 06 20 00**  
**FINISH CARPENTRY AND PLASTIC FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior millwork.
- B. Items specified.
  - 1. Plastic laminate cabinets
  - 2. Solid Surface countertops
  - 3. Chair Rail
  - 4. Handrail

**1.2 RELATED WORK**

- A. Alternates: Section 01 00 00, GENERAL REQUIREMENTS
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Wood doors: Section 08 14 00, WOOD DOORS.
- D. Seismic requirements: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- E. Resilient base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- F. Plumbing sinks, faucets and trim: Section 22 40 00, PLUMBING FIXTURES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Millwork items - Half size scale for sections and details, 1:50 (1/4-inch) for elevations and plans. Indicate AWS Standards.
  - 2. Show construction materials, dimensions, hardware, jointing details, plastic laminate grades, accessories and installation.
  - 3. Show sink or lavatory layout, dimensions, locations and joint details. Locate built-in equipment, electrical or plumbing devices. Obtain templates and rough-in measurements as required.
- C. Samples:
  - 1. Plastic laminate finished particleboard, 150 mm by 300 mm (6 inches by 12 inches).
  - 2. Solid surface, 300 mm (6 inch) square of each specified color and finish.
  - 3. Hinges and exposed hardware items, in specified finish.
- D. Certificates:

1. Indicating moisture content of materials meet the requirements specified.
3. Special Warranty: Warrant cast plastic against defects in material for ten years from acceptance by Owner.

E. Manufacturer's literature and data:

1. Care and maintenance of plastic surfaces.
2. Finish hardware.

**1.4 QUALITY ASSURANCE**

- A. Casework and Shelves: Architectural Woodwork Standards (AWS), Section 10.
- B. All work shall be installed in accordance with seismic requirements

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21 degrees C (70 degrees F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

**1.6 WARRANTY**

Warrant solid surface products against defects in material. Warranty shall provide material and labor to repair or replace defective materials. Warranty period shall be for ten years from acceptance by Owner.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
  - D638.....Standard Test Method for Tensile Properties of Plastics.
  - D790.....Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - E84.....Surface Burning Characteristics of Building Materials



G21.....Standard Practice for Determining Resistance of  
Synthetic Polymeric Materials to Fungi

C. American Hardboard Association (AHA):

A135.4-04.....Basic Hardboard

D. Builders Hardware Manufacturers Association (BHMA):

A156.9-03.....Cabinet Hardware

A156.11-04.....Cabinet Locks

E. Composite Panel Association (CPA):

CPA A208.1 and A208.2 (2009) Medium Density Fiberboard (MDF) For  
Interior Applications

F. National Particleboard Association (NPA):

A208.1-99.....Wood Particleboard

G. Architectural Woodwork Institute (AWI):

1st Edition (2009).....Architectural Woodwork Standards (AWS)

H. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High-Pressure Decorative Laminates

I. U.S. Department of Commerce, Product Standard (PS):

PS20-05.....American Softwood Lumber Standard

J. Military Specification (Mil. Spec):

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

K. Federal Specifications (Fed. Spec.):

A-A-1922A.....Shield Expansion

A-A-1936.....Contact Adhesive

FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle

FF-S-111D(1).....Screw, Wood

MM-L-736(C).....Lumber, Hardwood

L. United States Green Building Council (USGBC)

~~~~~LEED Version 3.0, 2009

**PART 2 - PRODUCTS**

**2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0,  
2009.

**2.2 LUMBER**

A. Grading and Marking:

1. Lumber shall bear the grade mark, stamp, or other identifying marks  
indicating grades of material.

2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: Moisture content between 5 and 10 percent, concealed to view grades.

### **2.3 PANEL PRODUCTS**

A. Particleboard: NPA A208.1.

1. Plastic Laminate Particleboard Cores:

- a. Use Type 1, Grade 1-M-2, density 45 pcf; moisture resistant.
- b. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin.

B. Fiberboard: CPA A208.2.

C. Hardboard: ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless indicated otherwise.

### **2.4 HIGH PRESSURE PLASTIC LAMINATE**

A. NEMA LD-3 and ANSI A161.2.

B. Exposed decorative surfaces, both sides of cabinet doors, and for items having plastic laminate finish.

C. Horizontal General Purpose Standard HGS Grade:

1. Plastic laminate shall be 1.22 mm (plus or minus 0.127 mm) 0.048 inches (plus or minus 0.005 inches) in thickness; where postforming is not required.

D. Vertical General Purpose Standard VGS Grade:

1. Plastic laminate shall be 0.71 mm (plus or minus 0.012 mm) 0.028 inches (plus or minus 0.004 inches) in thickness; where postforming is not required.

E. Horizontal General Purpose Postformable (HGP) Grade:

1. Plastic laminate shall be 1.07 mm (plus or minus 0.127 mm) 0.042 inches (plus or minus 0.005 inches) in thickness.

F. Cabinet Liner Standard (CLS) Grade:

1. Interiors including Shelving: Plastic laminate shall be 0.51 mm (0.020 inches) in thickness.

G. Backing Sheet (BK) Grade:

1. Undecorated backing sheet grade laminate used on bottom of plastic laminate panel substrates; backing sheet shall be 0.51 mm (0.020 inches) in thickness.
2. Provide for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

## 2.5 SOLID SURFACE MATERIAL

- A. Solid surface: Solid, non-porous, homogeneous sheet blend of acrylic resins and ATH mineral fillers and pigment, with integral color and pattern; not coated or laminated.
1. Material shall be capable of being cut, shaped, routed, drilled, or sanded, using standard woodworking tools.
  2. Minor damages to material shall be field repairable.
  3. Performance Characteristics:
    - a. Tensile Strength: ASTM D638; 6,000 psi.
    - b. Flexural Strength: ASTM D790; 10,000 psi.
    - c. Fungus Resistance: ASTM G21; does not support microbial growth.
- B. Refer to details on Drawings for material thickness, dimensions and configurations of countertops, and side and back splashes.

## 2.6 ACCESSORIES

- A. Undermounting Lavatory Hardware: As manufactured by plastic manufacturer.
- B. Setting Adhesives:
1. For Plastic Laminate: Fed. Spec. A-A-1936.
  2. For Interior Millwork: Use adhesives as recommended by AWI.
  3. For Solid Surface: Use adhesives as recommended by manufacturer.
- C. Sealants: Silicone based, mildew resistant, as provided or recommended by solid surface manufacturer. Color to match solid surface.

## 2.7 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 electric-galvanizing process. Galvanized where specified.

2. Fasteners:

- a. Bolts with Nuts: FF-N-836.
- b. Expansion Bolts: A-A-1922A.
- c. Screws: Fed. Spec. FF-S-111.

B. Finish Hardware:

1. Cabinet Hardware: ANSI A156.9.

- a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
- b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
- c. Adjustable Shelf Pin Holes and Supports in Cabinets: 1/4 inch diameter pin holes and L-shaped steel pins with bright nickel or zinc finish, 4 supports per self.
- d. Concealed Hinges: B1601, minimum 110 degree opening.
- e. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
- f. Cabinet Door Catch: B0371 or B03172.
- g. Vertical Slotted Wall Shelf Standards: B04103 with shelf brackets B04113, sized for shelf depth.

2. Cabinet Locks: ANSI A156.11.

- a. Drawers and Hinged Door: E07262.

**2.8 MOISTURE CONTENT**

A. Moisture content of lumber and millwork at time of delivery to site.

- 1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
- 2. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

**2.9 FABRICATION**

A. General:

- 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
- 2. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
- 3. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.

4. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
  5. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
  6. Refer to Drawings for millwork dimensions and configurations.
- B. Plastic Laminate Work:
1. Factory glued to either a particle board core unless otherwise shown, thickness as shown or specified.
  2. Apply plastic laminate finish in maximum size sheets. Fit corners and joints hairline tight. Slightly bevel arrises.
  3. Cover exposed edges with plastic laminate.
  4. Apply backing sheet to reverse side of finished surfaces.
- C. Solid Surface Countertops:
1. Fabricate to thickness, edge treatment and dimensions shown.
  2. Whenever possible, shop cut and drill cast plastic. Use templates to make cutouts for wall and countertop mounted accessories and fittings.
  3. Exposed surfaces shall have uniform gloss. Ease and sand edges..
  4. Form joint between components as recommended by manufacturer and use manufacturer's standard joint adhesive without conspicuous joints.
- D. Wood chair rails and handrails with mounting wood member:
1. Fabricate from White Maple .
  2. AWI Premium Grade.
  3. Fabricate in one piece and one length when practical.
  4. Joints are permitted only where rail changes direction, or where necessary for field erection or shipping.
  5. Tongue and groove including end matched.
  6. Scarf or dowel all joints to provide a smooth and rigid connection. Glue all joints.
  7. Fit joints, to produce a hair-line crack. Grain/color shall appear consistent through joint.
  8. Completely shop fabricated in accordance with approved shop drawings.
  9. For handrail, provide satin finish stainless steel handrail bracket as detailed. Provide at maximum 48 inches o.c.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install finish lumber or millwork in any room or space where wet process systems such as painting work is not complete and dry.

### **3.3 WALL PREPARATION**

Walls shall be clean, smooth, oil free, contain no protrusions, and be properly prepared.

### **3.4 INSTALLATION**

- A. Install work rigid, plumb, level and true.
- B. Installation shall be in accordance with seismic requirements.
- C. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
- D. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
- E. Scribe work where butting other surfaces; maximum gap 1/32 inch. Do not use additional overlay trim.
- F. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.
- G. Secure base cabinet to floor.
- H. Adjust doors, drawers, and hardware to function smoothly and correctly.
- I. Repair damaged work; replace damaged work which cannot be repaired to Owner's satisfaction.
- J. Clean finished surfaces and leave free of imperfections.
- K. Protect finished surfaces throughout duration of construction until acceptance by Owner.
- L. Chair and Hand rails with wood mounting member:
  - 1. Install in one piece and one length when practical.
  - 2. Glue all field joints.
  - 3. Secure rails securely to backer plate or bracket.

4. Install brackets within 300 mm (12 inches) of ends of handrails and at every spaced intervals between not exceeding 4 feet on centers at intervals between as shown. Anchor brackets as detailed and rails to brackets with screws.
5. Install with butt joints in straight runs and miter at corners.

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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 Contractor is responsible to execute the commissioning process as 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. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
- C. 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 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, is required in cooperation with the VA and the Commissioning Agent.

B. The following Facility exterior closure systems will be commissioned:

1. Roofs (thermoplastic polyolefin (TOP), flashing and sheet metal, roof specialties, and roof accessories).
2. Curtain Wall Systems (Mullions, glazing, and sealing)3. Exterior Doors.
3. Sealants (Caulking, mechanical seals, and wind and vapor barriers).

#### **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 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.

1. 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.
2. 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.

3. 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.

B. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

### **3.2 CONTRACTORS 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. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.3 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.

### **3.4 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. 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.

----- END -----



**SECTION 07 21 13**  
**THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

**1.2 RELATED WORK**

- A. Insulation in connection with roofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing insulation: Section 07 84 00, FIRESTOPPING.

**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. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

**1.4 STORAGE AND HANDLING**

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

**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 basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C552-07.....Cellular Glass Thermal Insulation.
  - C553-08.....Mineral Fiber Blanket Thermal Insulation for  
Commercial and Industrial Applications
  - C578-08.....Rigid, Cellular Polystyrene Thermal Insulation
  - C591-08.....Unfaced Preformed Rigid Cellular
  - C612-04.....Mineral Fiber Block and Board Thermal  
Insulation

C665-06.....Mineral Fiber Blanket Thermal Insulation for  
Light Frame Construction and Manufactured  
Housing

C728-05.....Perlite Thermal Insulation Board

C954-07.....Steel Drill Screws for the Application of  
Gypsum Panel Products or Metal Plaster Base to  
Steel Studs From 0.033 (0.84 mm) inch to 0.112  
inch (2.84 mm) in thickness

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

D312-00(R2006).....Asphalt Used in Roofing

E84-08.....Surface Burning Characteristics of Building  
Materials

F1667-05.....Driven Fasteners: Nails, Spikes and Staples.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION - GENERAL**

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

| Material Type          | Percent by Weight             |
|------------------------|-------------------------------|
| P                      |                               |
| Rigid foam             | 9 percent recovered material  |
| Glass fiber reinforced | 6 percent recovered material  |
| Rock wool material     | 75 percent recovered material |

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

## **2.2 MASONRY CAVITY WALL INSULATION**

- A. Mineral Fiber Board: ASTM C612, Type II having a perm rating of not more than 0.5.
- C. Extruded Polystyrene Board: ASTM C578, Type X.
- D. Perlite Board: ASTM C728.
- E. Cellular Glass Block: ASTM C552, Type I or IV.

## **2.3 PERIMETER INSULATION IN CONTACT WITH SOIL**

- A. Extruded Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.
- B. Cellular Glass Block: ASTM C552, Type I or IV.

## **2.4 ACOUSTICAL INSULATION**

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

## **2.5 RIGID INSULATION**

- A. On the interior of exterior walls, bottom of slabs, and where shown.
- B. Mineral Fiber Board: ASTM C612, Type IB or 2.
- C. Perlite Board: ASTM C728.
- D. Cellular Glass Block: ASTM C552, Type I.
- E. Extruded polystyrene: ASTM C578

## **2.6 FASTENERS**

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

## **2.7 ADHESIVE**

- A. As recommended by the manufacturer of the insulation.

## **2.8 TAPE**

- A. Pressure sensitive adhesive on one face.

B. Perm rating of not more than 0.50.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

#### **3.2 MASONRY CAVITY WALLS**

- A. Mount insulation on exterior faces of vapor barrier of masonry cavity walls. Fill joints with same material used for bonding.
- B. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- C. Bond mineral fiberboard or perlite board to surfaces with adhesive as recommended by insulation manufacturer.

#### **3.3 PERIMETER INSULATION**

- A. Vertical insulation:
  - 1. Fill joints of insulation with same material used for bonding.
  - 2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- B. Horizontal insulation under concrete floor slab:
  - 1. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
  - 2. Extend insulation from foundation walls towards center of building not less than 600 mm (24 inches) or as shown.

#### **3.4 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS AND UNDERSIDE OF SLABS**

- A. On the interior face of concrete foundation walls, underside of slabs, and within exterior stud and masonry walls on the exterior of vapor barrier where shown.
- B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.



- C. Fasten board insulation to face of studs with screws, nails or staples.  
Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.

### 3.5 ACOUSTICAL INSULATION

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.
- F. Where sound deadening board is shown, secure with adhesive to masonry or concrete walls and with screws to metal framing. Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

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**SECTION 07 22 00**  
**ROOF AND DECK INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Roof and deck insulation, substrate board, vapor retarder, and cover board on new construction ready to receive roofing or waterproofing membrane.
- B. Repairs and alteration work to existing roof insulation.

**1.2 RELATED WORK**

- A. Wood cants, blocking, and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Perimeter, rigid, and batt or blanket insulation not part of roofing system: Section 07 21 13, THERMAL INSULATION.
- C. TPO roofing assembly: Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.
- D. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):
  - 90.1-07.....Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. ASTM International (ASTM):
  - C1177/C1177M-08.....Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - C1278/C1278M-07.....Standard Specification for Fiber-Reinforced Gypsum Panel
  - C1289-10.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - C1396/C1396M-09.....Standard Specification for Gypsum Board
  - D41-05.....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
  - D312-06.....Asphalt Used in Roofing

- D1970-09.....Standard Specification for Self-Adhering  
Polymer Modified Bituminous Sheet Materials  
Used as Steep Roofing Underlayment for Ice Dam  
Protection
- D2178-04.....Asphalt Glass Felt Used in Roofing and  
Waterproofing
- D2822-05.....Asphalt Roof Cement
- D4586-07.....Standard Specification for Asphalt Roof Cement,  
Asbestos-Free
- E84-09.....Standard Test Method for Surface Burning  
Characteristics of Building Material
- F1667-05.....Driven Fasteners: Nails, Spikes, and Staples
- D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.
- 4450-89.....Approved Standard for Class 1 Insulated Steel  
Deck Roofs
- 4470-10.....Approved Standard for Class 1 Roof Coverings
- 1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.
- 1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof  
Components
- 1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing
- E. National Roofing Contractors Association: Roofing and Waterproofing  
Manual
- F. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,  
[www.biopreferred.gov](http://www.biopreferred.gov)
- G. Underwriters Laboratories, Inc. (UL): Fire Resistance Directory (2009)
- H. U.S. Department of Commerce National Institute of Standards and  
Technology (NIST):
- DOC PS 1-09.....U.S. Product Standard for Construction and  
Industrial Plywood
- DOC PS 2-04.....Performance Standard for Wood-Based Structural-  
Use Panels.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Provide roof insulation meeting minimum overall  
average R-value of 33, with minimum R-value at any location of 10.
- B. FM Approvals: Provide roof insulation complying with requirements in  
FM Approvals 4450 and 4470 as part of specified roofing system, listed  
in FM Approvals "RoofNav" as part of roofing system meeting  
Fire/Windstorm Classification in Division 07 roofing section.

### 1.5 QUALITY CONTROL

- A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.
- B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.
- C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.
- D. Requirements of roofing system uplift pressure design for specified roofing system.
- E. Requirements of applicable FM Approval for specified roofing system insulation attachment.

### 1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Asphalt and adhesive materials, each type.
  - 2. Roofing cement, each type.
  - 3. Roof insulation, each type.
  - 4. Substrate board, each type.
  - 5. Cover board, each type.
  - 6. Fastening requirements.
  - 7. Insulation span data for flutes of metal decks.
- C. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Nailers, cants, and terminations.
  - 2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
- D. Samples:
  - 1. Roof insulation, each type.
  - 2. Nails and fasteners, each type.
- E. Certificates:
  - 1. Indicating type, thermal conductance, and minimum and average thickness of insulation.
  - 2. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.
- F. Laboratory Test Reports: Thermal values of insulation products.
- G. Layout of tapered roof system showing units required.

H. Documentation of supervisors' and inspectors' qualifications.

#### **1.7 DELIVERY, STORAGE AND MARKING**

A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation requirements.

#### **1.8 QUALITY ASSURANCE**

A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.

1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.
2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."
3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

### **PART 2 - PRODUCTS**

#### **2.1 ADHESIVE MATERIALS**

A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - a. Plastic Foam Adhesives: 50 g/L.
  - b. Multipurpose Construction Adhesives: 70 g/L.
  - c. Fiberglass Adhesives: 80 g/L.
  - d. Contact Adhesives: 80 g/L.
  - e. Other Adhesives: 250 g/L.

- f. Nonmembrane Roof Sealants: 300 g/L.
- g. Sealant Primers for Nonporous Substrates: 250 g/L.
- h. Sealant Primers for Porous Substrates: 775 g/L.
- B. Primer: ASTM D41.
- C. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- D. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- E. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- F. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- G. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II, ; or, D4586, Type I or Type II.

## **2.2 ROOF AND DECK INSULATION**

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Roof Insulation System:
  - 1. Fabricate of polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
  - 2. Cut to provide high and low points with crickets and slopes as shown.
  - 3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
  - 4. Minimum slope 1:48 (1/4 inch per 12 inches).

## **2.3 INSULATION ACCESSORIES**

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips: Comply with requirements of roofing assembly.
  - 1. Wood Cant Strips: Refer to Section 06 10 00, ROUGH CARPENTRY.
  - 2. Tapered Edge Strips: Refer to Section 06 10 00, ROUGH CARPENTRY.

C. Vapor Retarder:

1. Self-Adhering Sheet Vapor Retarder: ASTM D1970, minimum of 1.0 mm (40 mil) thick, polyethylene film laminated to layer of rubberized asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mil) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm).

D. Substrate Board:

1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, minimum 13 mm (1/2 inch) thick Type X, factory primed.

E. Cover Board:

1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, minimum 16 mm (5/8 inch) thick, factory primed.

**2.4 FASTENERS**

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.
- B. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Comply with requirements of Division 07 roofing section.

**3.2 PREPARATION**

- A. Comply with requirements of Division 07 roofing section.

**3.3 SUBSTRATE BOARD INSTALLATION**

- A. Fasten substrate board to top flanges of steel deck to resist uplift pressures according to roofing system manufacturer's instructions and requirements of FM Approvals listing for specified roofing system.

**3.4 VAPOR RETARDER INSTALLATION**

A. General:

1. Install continuous vapor retarder on roof decks where indicated.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
4. Seal penetrations with roof cement.



B. Cast-in-Place Concrete Decks, Except Insulating Concrete:

1. Prime deck as specified.
2. Apply two plies of asphalt saturated felt mopped down to deck.

C. Steel Deck:

1. Material and method of application of roofing systems used on metal decks shall meet the requirements of FM Approvals for Class I-A Insulated Steel Roof Deck.
2. Attach substrate board and subsequent components to meet the requirements of FM Approval's "RoofNav" listing for specified system meeting Fire/Windstorm Classification indicated in Division 07 roofing section.
3. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.

**3.5 RIGID INSULATION INSTALLATION**

A. Insulation Installation, General:

1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
3. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate prior to installation of insulation.
4. Cant Strips: Comply with requirements of roofing assembly. Install wood cant strips specified in Division 06 Section ROUGH CARPENTRY at junctures of roofing system with vertical construction.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.
2. Insulation on Metal Decks: Provide minimum thickness of insulation for metal decks recommended by the insulation manufacturer to span rib opening (flute size) of metal deck used. Support edges of insulation on metal deck ribs.
3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.

4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).
5. Use not less than two layers of insulation when insulation is 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
- C. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tight against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
- H. Installation Method:
  1. Adhered Insulation:
    - a. Prime substrate as required.
    - b. Set each layer of insulation firmly in solid mopping of hot asphalt.
    - c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
    - d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
  2. Mechanically Fastened Insulation:
    - a. Fasten insulation in accordance with FM Approval's "RoofNav" requirement in Division 07 roofing section.
    - b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section.
  3. Mechanically Fastened and Adhered Insulation:
    - a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
    - b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.
  4. Cover Board: Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset

cover board joints from insulation joints minimum 150 mm (6 inches).  
Fasten cover boards according to "Adhered Insulation" and  
"Mechanically Fastened Insulation" requirements at locations  
indicated on Drawings.

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**SECTION 07 27 28**  
**AIR-VAPOR BARRIER MEMBRANE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies air-vapor barrier membranes at exterior wall assemblies and at locations required by code.

**1.2 RELATED WORK**

A. Sealants: Section 07 92 00, JOINT SEALANTS.

**1.3 PERFORMANCE CRITERIA**

A. Air-Vapor Barriers: The building envelope shall be designed and constructed with a continuous air-vapor barrier to control air leakage into, or out of the conditioned space. The air-vapor barrier shall have the following characteristics:

1. It shall be continuous, with all joints made air-tight.
2. It shall have an air permeability not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 inch water.
3. It shall have a vapor permance of 0.02 perm when tested in accordance with ASTM E96.
4. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
5. It shall be durable or maintainable.
6. The air-vapor barrier shall be joined in an air-tight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
  - a. Foundation and walls.
  - b. Walls and windows or doors.
  - c. Different wall systems.
  - d. Wall and roof.
  - e. Wall and roof over unconditioned space.
  - f. Walls, floor and roof across construction, control and expansion joints.
  - g. Walls, floors and roof to utility, pipe and duct penetrations.
7. Elongation: ASTM D412; minimum 175 percent.

- B. Air-Vapor Barrier Penetrations: All penetrations of the air-vapor barrier and paths of air infiltration/exfiltration shall be made air-tight.
- C. Design Intent: Air-vapor barrier membrane shall be located, constructed and flashed to perform as an air and water barrier to discharge to the outside any incidental condensation or water penetration. Air-vapor barrier membrane shall accommodate movements of building materials by providing expansion and control joints as required, with appropriate air seal materials at such locations, changes in substrate and perimeter conditions.

#### **1.4 MANUFACTURER'S QUALIFICATIONS**

- A. Approval by Contracting Officer is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:
  - 1. Manufacturer regularly and presently manufactures air-vapor barrier sheet membranes as one of its principal products.
  - 2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items. Submit qualifications of firm installing air-vapor barrier membrane materials, including name and qualifications of supervisor for this project, and name and location of three projects where similar work was performed by both firm and supervisor.
  - 3. Manufacturer's product submitted has been in satisfactory and efficient operation on three similar installations for at least three years.
  - 4. Submit list of installations, include name and location of project and name of owner.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit manufacturer's product data for each material. Include standard details, certified test results, installation instructions, and recommendations for sealing penetrations and perimeter.
- C. Certificates:
  - 1. Indicating air-vapor barrier membrane manufacturer's approval of primer.

2. Indicating air-vapor barrier membrane manufacturer's qualifications as specified.
  3. Approval of installer by air-vapor barrier membrane manufacturers.
  4. Water test report.
- D. Samples: Submit three labeled samples of each product, not less than 150 mm x 300 mm (6 x 12 inches) in size.
- E. Shop Drawings for Air/Vapor Barrier Membrane Mock-up: Submit shop drawings for mock-up indicating size of mock-up, details of construction, and expansion and control joints. Include relationship with adjacent materials, sequence of installation and materials and methods for sealing penetrations. Obtain approval of shop drawings prior to construction of mock-up. Revise to show changes necessary to obtain approval of mock-up.
- F. Shop Drawings for Construction: Submit shop drawings indicating details of construction, including expansion and control joints. Include relationship with adjacent materials, sequence of installation and materials and methods for sealing penetrations. At a minimum, shop drawings shall include details of the following connections, as applicable to the project:
1. Foundation and walls.
  2. Walls and windows or doors.
  3. Different wall systems.
  4. Wall and roof.
  5. Wall over unconditioned space.
  6. Walls across construction, control and expansion joints.
  7. Walls to utility, pipe and duct penetrations.

#### **1.6 MOCK-UPS**

- A. Mock-ups of Air Barrier Membrane Installation: Prior to installation on the building, construct mock-up of typical exterior wall assembly, including connection between wall and roof, and connection between wall and glazing to indicate relationship of materials with air-vapor barrier and quality of workmanship. Mock-up shall use actual air-vapor barrier membrane, wall, and window materials. Provide several mock-ups if necessary to include the various conditions. Remove mock-up assemblies from site at completion of project unless used as part of the final building construction. Rebuild mockups which are not approved at no additional cost to the Owner.

1. Construct mock-up in accordance with details indicated on the Drawings.

#### **1.7 FIELD TESTING OF MOCK-UP**

- A. Static Test for Exterior Wall Mock-up Including Window Penetration and Intersection of Roof and Wall:
  1. Install air seal components and assemblies to resist air leakage caused by static air pressure across exterior wall assemblies and other interruptions to the integrity of the building enclosure systems.
  2. Condition the sample by cycling in four pounds per square foot increments to 40 lbs./sq.ft., or to the highest pressure below 40 lbs./sq.ft. as practical without damaging components and return pressure to zero prior to commencing test.
  3. Test to pressure differential of 0.3 inch water as specified in code and as measured in accordance with ASTM E283.
  4. Assembly shall have an air permeability not to exceed 0.004 cfm/sq.ft. under a pressure differential of 0.3 inch water (1.57 psf) (equal to 0.02L/s/m<sup>2</sup> at 75 Pa). Determine cause if assembly fails, rebuild assembly and retest until assembly passes, at no additional expense to the Owner.
- B. Qualifications of Testing Laboratory: Testing shall be performed by an acceptable independent testing laboratory. If requested, submit qualifications of laboratory using criteria conforming to ASTM E699.

#### **1.8 PROJECT MEETINGS**

- A. Pre-Construction Meeting: After approval of mock-up shop drawings, but prior to construction of mock-up, convene a meeting with representatives of materials to be incorporated in the mock-up and installers of mock-up. Agenda shall include sequence and details of construction to ensure continuity of air barrier.
- B. Pre-Installation Meeting: Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Attendees shall include representatives of air/vapor barrier manufacturer, exterior wall installers and project superintendent. Agenda shall include the following:
  1. Review of approved submittals.
  2. Review of mock-ups.



3. Coordination with sequence of installation with adjacent materials.
4. Schedule for subsequent work covering air-vapor barrier.
5. Procedures for quality assurance.

#### **1.9 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to job in manufacturer's original unopened container.
- B. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F) or where prolonged temperature is above 32 degrees C (90 degrees F).

#### **1.10 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - D412.....Vulcanized Rubber and Thermoplastic Elastomers
    - Tension
  - D570.....Water Absorption of Plastics
  - D882.....Tensile Properties of Thin Plastic Sheeting
  - D903.....Peel or Stripping Strength of Adhesive Bonds
  - E96/E96M.....Water Vapor Transmission Materials
  - E154.....Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
  - E283.....Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - E330.....Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - E699.....Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
  - E2178.....Air Permeance of Building Materials
  - E2357.....Determining Air Leakage of Air Barrier Assemblies

## **PART 2 - PRODUCTS**

### **2.1 SELF-ADHERING AIR-VAPOR BARRIER MEMBRANE**

- A. Self-Adhering Air and Vapor Barrier Membrane: Self-adhering, self-sealing and self-healing rubberized asphalt integrally bonded to cross-laminated polyethylene film; nominal 1.0 mm (40 mil) thickness overall.
  - 1. Provide compatible membrane joint tape recommended by manufacturer.
  - 2. Provide primer to substrate as recommended by membrane manufacturer.
- B. Transition Materials: To provide an air-vapor barrier between the membrane and adjacent materials, provide transition materials consisting of extruded low-modulus silicone sheet and silicone sealant designed to adhere to polyethylene side of membrane and adjacent material. Provide the following materials as acceptable to the manufacturer of the air-vapor barrier membrane:
  - 1. Cleaning Agent.
  - 2. Silicone Sheet.
  - 3. Silicone Sealant.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean substrate surfaces to receive air-vapor barrier membrane in accordance with manufacturer's instructions. Apply primer if recommended by manufacturer.

### **3.2 INSTALLATION**

- A. Strictly comply with air-vapor barrier membrane manufacturer's printed instructions, approved submittals and the following:
  - 1. Apply materials within manufacturer's requirements for temperature and weather conditions.
  - 2. Do not apply to wet or frozen substrates.
  - 3. Do not allow contamination with dust or dirt.
  - 4. Seal completely at edges, perimeter and penetrations.
- B. Protect installed work from damage due to harmful weather exposures, physical abuse, and other causes.
- C. Provide temporary protection over air-vapor barrier membrane if materials covering air-vapor barrier membrane will not be installed within manufacturer's recommended time limit for exposure.
- D. Repair damage to air-vapor barrier membrane caused by construction activities or subsequent work prior to covering.

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**SECTION 07 40 00**  
**SIDING PANELS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies exterior horizontal uninsulated metal wall panels as shown.

**1.2 RELATED WORK**

- A. Stud backup: Section 05 40 00, COLD FORMED METAL FRAMING.
- B. Insulation: Section 07 21 13, THERMAL INSULATION.
- C. Air-vapor membrane: Section 07 27 28, AIR-VAPOR BARRIER MEMBRANE.
- D. Sealant: Section 07 92 00, JOINT SEALANTS.
- E. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Metal wall panels shall be products of a manufacturer regularly engaged in the fabrication and erection of metal panels of the type and design shown and specified.

**1.4 DESIGN AND PERFORMANCE CRITERIA**

- A. Air Infiltration: Not to exceed 0.06 cfm/ft of fixed area at 6.24 psf, when tested in accordance with ASTM E283.
- B. Water Infiltration: No "uncontrolled water" (defined as water other than condensation on indoor face) when tested at 6.24 psf static air pressure differential with water rate of 5 gallons/hour/sq ft, when tested in accordance with ASTM E331.
- C. Structural Performance: Engineer, fabricate, and erect insulated metal wall panels to withstand design loads within limits and under conditions required.
  - 1. Design the connections of the panels to develop the flexural capacity of the panel in the inward direction. For the rebound (i.e. suction) direction, 85% of the inward reaction can be utilized.
  - 2. Connection Safety Factors (SF):
    - a. SF = 1 shall be allowed for connection elements that provide a ductile mode of failure (e.g. bolt bearing, tensile yielding, etc.)
    - b. SF = 1.5 shall be used for connection elements that provide a non-ductile mode of failure (e.g. weld fracture, concrete cone failure due to anchor bolt pull-out, etc.)

**1.5 SUBMITTALS**

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

- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall panels, showing details of construction and installation. Collateral steel framing thickness and kind of material, closures, flashing, fastenings and related components and accessories.
- D. Manufacturer's Literature and Data: Wall panels.
- E. Fire Test Report: Report of fire test by recognized testing laboratory for fire rating specified, showing details of construction.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A653/A653M-10 ..... Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - A1008/A1008M-10 ..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
  - B209/209M-07 ..... Aluminum and Aluminum Alloy Sheet and Plate
  - E283 ..... Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - E331 ..... Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

### **PART 2 - PRODUCTS**

#### **2.1 ALUMINUM PLATE AND SHEET**

ASTM B209/209M.

#### **2.2 FASTENERS**

- A. Fasteners for aluminum panels shall be aluminum or stainless steel.
- B. Fasteners of size, type and holding strength as recommended by manufacturer.

#### **2.3 FABRICATION**

- A. Uninsulated metal wall panels shall be single sheets on cold formed metal framing with concealed fasteners, approximate overall depth and configuration shown on drawings. Connection between panels shall be by interlocking joints filled with sealing compound as specified in Section 07 92 00, JOINT SEALANTS. Furnish wall panels in longest practical lengths, true to shape, accurate in size, square, and free of

defects. Bend lines, breaks, and angles shall be sharp and true, and surfaces shall be free from warp or buckle.

B. Construct panels as follows:

1. Wall Panels:
  - a. 1.0 mm (0.040 inch) thick aluminum.
  - b. Smooth texture.
2. Accessories and flashing shall be the same material as the panels. Thickness and installation of accessories and flashing shall be as recommended by the panel manufacturer.
3. Provide panel clips designed to engage into panel flange, providing for a minimum 12 mm (1/2 inch) drainage plane and ventilation cavity.

**2.4 FINISH**

A. For uninsulated wall panels, the finishes shall be as follows for aluminum face sheets:

1. AA-R1X Finish: Fluoropolymer enamel finish, consisting of a chemical pre-treatment of the base aluminum; then applying a primer coat of 0.1 to 0.4 mil dry film thickness; a polyvinylidene fluoride resin finish coat of 0.8 mil minimum dry film thickness on one side, and a wash coat of 0.3 to 0.4 mil minimum dry film thickness applied to reverse side. Color shall be as selected from manufacturers standard color.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an approved manner. Replace materials which cannot be corrected in an approved manner with nondefective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.
- B. Wall Panels: Apply panels with the configuration in a horizontal position. Provide panels in the longest obtainable lengths, with end

laps occurring only at structural members. Seal side and end laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.

- C. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- D. Fasteners: Concealed fastener spacings shall be in accordance with the manufacturer's written recommendations, and as necessary to withstand the design loads indicated. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

### **3.2 ISOLATION OF ALUMINUM**

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
  - 1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.
  - 2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of alkali-resistant bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, that may become repeatedly wet, with two coats of bituminous paint, or two coats of aluminum paint. Seal joints with caulking material.

### **3.3 PROTECTION AND CLEANING**

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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**SECTION 07 54 23**  
**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

**1.2 RELATED WORK**

- A. Treated blocking and nailers: Section 06 10 00, ROUGH CARPENTRY  
B. Roof Insulation: Section 07 22 00, ROOF AND DECK INSULATION.  
C. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.  
D. Roof hatches, Equipment supports and dome type skylights: Section 07 71 00, ROOF ACCESSORIES

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):  
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other Structures
- D. ASTM International (ASTM):  
C67-09.....Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile  
C140-09.....Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units  
C1371-04.....Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers  
C1549-04.....Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer  
D4263.....Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method  
D4434-06.....Standard Specification for Poly (Vinyl Chloride) Sheet Roofing

- D6878-08.....Standard Specification for Thermoplastic  
Polyolefin Based Sheet Roofing
- E108-10.....Standard Test Methods for Fire Tests of Roof  
Coverings
- E408-71(R2008).....Standard Test Methods for Total Normal Emittance  
of Surfaces Using Inspection-Meter Techniques
- E1918-06.....Standard Test Method for Measuring Solar  
Reflectance of Horizontal and Low-Sloped  
Surfaces in the Field
- E1980-01.....Standard Test Method for Measuring Solar  
Reflectance of Horizontal and Low-Sloped  
Surfaces in the Field
- E. American Society of Heating, Refrigeration, and Air Conditioning  
Engineers (ASHRAE)  
ASHRAE 90.1-2007.....Energy Standard for Buildings Except Low-Rise  
Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:  
CRRC-1.....Product Rating Program, [www.coolroofs.org](http://www.coolroofs.org)
- G. FM Approvals: RoofNav Approved Roofing Assemblies and Products.  
4450-89.....Approved Standard for Class 1 Insulated Steel  
Deck Roofs  
4470-10.....Approved Standard for Class 1 Roof Coverings  
1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.  
1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof  
Components  
1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing
- H. National Roofing Contractors Association: Roofing and Waterproofing  
Manual
- I. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,  
[www.biopreferred.gov](http://www.biopreferred.gov)
- J. U.S. Department of Energy (DoE): Roof Products Qualified Product List,  
[www.energystar.gov](http://www.energystar.gov)

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that that have been successfully tested



by a qualified independent testing and inspecting agency to meet the following requirements:

1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
2. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.
3. Energy Performance, CRRC-1: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.
4. Energy Performance, Aged: Provide roofing system with minimum three-year aged solar reflectance not less than 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and in addition, a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with ASTM C1371 or ASTM E408.
  - a. Where tested aged values are not available for proposed product, submit calculations to adjust initial solar reflectance to demonstrate compliance as indicated in ASHRAE 90.1-2007 Addendum f.
  - b. Alternatively, provide roofing system with minimum three-year aged Solar Reflectance Index of not less than 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft<sup>2</sup> (12 W/m<sup>2</sup>K).

#### 1.5 QUALITY CONTROL

A. Installer Qualifications:

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

C. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.

D. Roofing system design standard requirements:

1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
3. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
  - a. Fire/Windstorm Classification: Class 1A-60.
  - b. Hail Resistance: Severe.

E. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Resident Engineer.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
3. Inspect roof deck at this time to:
  - a. Verify that work of other trades which penetrates roof deck is completed.
  - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
  - c. Examine samples and installation instructions of manufacturer.

#### **1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
  - 1. Adhesive materials.
  - 2. Membrane sheet roofing and flashing membrane.
  - 3. Roofing cement.
  - 4. Roof walkway.
  - 5. Fastening requirements.
  - 6. Application instructions.
- C. Samples:
  - 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Base flashings and terminations.
- E. Certificates:
  - 1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.
  - 2. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.
- G. Documentation of supervisors' and inspectors' qualifications.
- H. Field reports of roofing inspector.
- I. Contract Close-out Submittals:
  - 1. Maintenance Manuals.
  - 2. Warranty signed by installer and manufacturer.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

#### **1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

## **1.9 WARRANTY**

Roofing work subject to the terms of the Article "Warranty of Construction," FAR clause 52.246-21, except extend the warranty period to 10 years.

## **PART 2 - PRODUCTS**

### **2.1 TPO MEMBRANE ROOFING**

- A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, without backing .
  - 1. Color: White.

### **2.2 ACCESSORIES**

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard, water based.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 25 mm wide by 1.3 mm (1 inch wide by 0.05 inch) thick, prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.
- F. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 5 mm (3/16 inch) thick, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

### **2.3 ADHESIVE AND SEALANT MATERIALS**

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
  - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - a. Plastic Foam Adhesives: 50 g/L.
  - b. Gypsum Board and Panel Adhesives: 50 g/L.
  - c. Multipurpose Construction Adhesives: 70 g/L.
  - d. Fiberglass Adhesives: 80 g/L.
  - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
  - f. Other Adhesives: 250 g/L.
  - g. PVC Welding Compounds: 510 g/L.
  - h. Adhesive Primer for Plastic: 650 g/L.
  - i. Single-Ply Roof Membrane Sealants: 450 g/L.
  - j. Nonmembrane Roof Sealants: 300 g/L.
  - k. Sealant Primers for Nonporous Substrates: 250 g/L.
  - l. Sealant Primers for Porous Substrates: 775 g/L.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

#### **3.2 PREPARATION**

- A. Complete roof deck construction prior to commencing roofing work:
  1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
  2. Complete deck and insulation to provide designed drainage to working roof drains.
  3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks:

1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
2. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
3. Allow primer to dry before application of adhesive.

### **3.3 TEMPORARY PROTECTION**

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by Resident Engineer, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

### **3.4 INSTALLATION, GENERAL**

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.
- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
  1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.

2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
  - a. Do not apply materials when the temperature is below 4 degrees C (40 degrees F).
  - b. Do not apply materials to substrate having temperature of 4 degrees C (40 degrees F) or less.

### **3.5 INSTALLATION OF TPO ROOFING**

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
  1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.
  2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
  3. Check seams to ensure continuous adhesion and correct defects.
  4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
  5. Finish seams as the membrane is being installed (same day).
  6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
  1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.

2. Mechanically Fastened Metal Fastening Strip:

- a. Set top of mechanical fastener set flush with top surface of the metal fastening strip. Space mechanical fasteners a maximum 300 mm (12 inches) on center starting 25 mm (one inch) from the end of the nailing strip.
- b. When strips are cut round corners and eliminate sharp corners.
- c. After mechanically fastening strip cover and seal strip with a six-inch wide roof membrane strip; heat weld to roof membrane and seal edges.
- d. At roof edge metal, turn the membrane down over the front edge of the blocking or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; or, if required by the membrane manufacturer with fasteners spaced not over 300 mm (12 inches) on centers.

I. Adhered System on concrete:

1. Apply adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturers application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

J. Mechanically-Attached System on metal deck:

1. Secure the membrane to the structural deck with fasteners through stress plate or batten strips spaced and patterned in accordance with the membrane manufacturer's instructions to achieve specified wind uplift performance.
2. When fasteners are installed within the laps of adjoining sheets, position the fastener so that the stress plates are a minimum 13 mm (1/2)inch) from the edge of the sheets.
3. Where fasteners are installed over the membrane after the seams have been welded, cover the fasteners with a minimum 175 mm (seven inch) wide round TPO membrane cap centered over the fasteners. If batten strips are used cover the strip with a minimum 175 mm (seven inch) wide TPO strip centered over the batten. Heat weld to the roof membrane and finish edges with sealant as specified. Finish edges with sealant as specified.



4. Before installing fasteners into cast in place concrete, pre-drill the correct size hole into the deck. Drill the hole 9 mm (3/8 inch) deeper than the fastener penetration.

### **3.6 INSTALLATION OF FLASHING**

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
  1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
    - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
    - b. Do not allow the roof cement to come in contact with the TPO roof membrane.
    - c. Adhere the TPO roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
  2. Turn down the metal drain flashing and TPO roof membrane into the drain body and install clamping ring and strainer.
- C. Installing TPO Base Flashing and Pipe Flashing:
  1. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.
    - a. Adhere flashing to pipe, wall or curb with adhesive.
    - b. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
    - c. Lap ends not less than 100 mm (four inches).
    - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
    - e. Install flashing membranes in accordance with NRCA manual.
  2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
  3. Apply sealant to top edge of flashing.
- D. Installing Building Expansion Joints:
  1. Install base flashing on curbs as specified.
  2. Coordinate installation with metal expansion joint cover or roof expansion joint system.

3. Install flexible tubing 1-1/2 times width of joint over joint. Cover tubing with TPO flashing strip adhered to base flashing and lapping base flashing 100 mm (four inches). Finish edges of laps with sealants as specified.

E. Repairs to membrane and flashings:

1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.
2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

**3.7 FLEXIBLE WALKWAYS**

- A. Use reinforced sheet not less than 900 mm (three feet) wide.
- B. Heat weld walkway sheet to roof sheet at edges. Weld area 50 mm (two inches) wide by the entire length of the walkway sheet.
- C. Finish edges of laps with sealants as specified.

**3.8 FIELD QUALITY CONTROL**

- A. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
- B. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 7 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports.
  1. Examine and probe seams in the membrane and flashing in the presence of Resident Engineer and Membrane Manufacturer's Inspector.
  2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
  1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.9 PROTECTING AND CLEANING**

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

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**THE SECTION 07 60 00  
FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Formed sheet metal work for wall and roof flashing, and drainage specialties are specified in this section.

**1.2 RELATED WORK**

- A. Equipment supports and integral flashing: Section 07 71 00 ROOF SPECIALTIES.
- B. Membrane base flashings and stripping: Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TOP) ROOFING.
- C. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- E. Integral flashing components of manufactured roof specialties and accessories or equipment: Division 22, PLUMBING sections and Division 23 HVAC sections.
- F. Paint materials and application: Section 09 91 00, PAINTING.
- G. Flashing of Roof Drains: Section 22 14 00, FACILITY STORM DRAINAGE.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. Aluminum Association (AA):
  - AA-C22A41.....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
  - AA-C22A42.....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
  - AA-C22A44.....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute

(ANSI/SPRI):

ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with  
Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620.....Voluntary Specification for High Performance  
Organic Coatings on Coil Coated Architectural  
Aluminum

AAMA 621.....Voluntary Specification for High Performance  
Organic Coatings on Coil Coated Architectural  
Hot Dipped Galvanized (HDG) and Zinc-Aluminum  
Coated Steel Substrates

E. ASTM International (ASTM):

A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet, and Strip

A653/A653M-09.....Steel Sheet Zinc-Coated (Galvanized) or Zinc  
Alloy Coated (Galvanized) by the Hot- Dip  
Process

B32-08.....Solder Metal

B101-07.....Lead-Coated Copper

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-09.....Copper Sheet and Strip for Building  
Construction

D173-03.....Bitumen-Saturated Cotton Fabrics Used in  
Roofing and Waterproofing

D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-  
Tension

D1187-97(R2002).....Asphalt Base Emulsions for Use as Protective  
Coatings for Metal

D1784-08.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly (Vinyl Chloride) (CPVC)  
Compounds

D3656-07.....Insect Screening and Louver Cloth Woven from  
Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association

(SMACNA): Architectural Sheet Metal Manual.

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

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

H. Federal Specification (Fed. Spec):

A-A-1925A.....Shield, Expansion; (Nail Anchors)

UU-B-790A.....Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code,  
Current Edition

**1.4 PERFORMANCE REQUIREMENTS**

A. Wind Uplift Forces: Resist the forces required by FM Approvals 1-49.

B. Wind Design Standard: Fabricate and install copings, roof-edge  
flashings, etc. as tested per ANSI/SPRI ES-1 to resist design pressure  
indicated on Drawings (if not indicated 100).

**1.5 SUBMITTALS**

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

B. Shop Drawings: For all specified items, including:

1. Flashings

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing

2. Thru wall flashing

4. Nonreinforced, elastomeric sheeting

5. Lead covered copper

D. Certificates: Indicating compliance with specified finishing  
requirements, from applicator and contractor.

**PART 2 - PRODUCTS**

**2.1 FLASHING AND SHEET METAL MATERIALS**

A. Lead coated copper ASTM B101, cold-rolled temper.

B. Nonreinforced, Elastomeric Sheetting: Elastomeric substances reduced to  
thermoplastic state and extruded into continuous homogenous sheet  
(0.056 inch) thick. Sheetting shall have not less than 7 MPa (1,000 psi)  
tensile strength and not more than seven percent tension-set at 50  
percent elongation when tested in accordance with ASTM D412. Sheetting  
shall show no cracking or flaking when bent through 180 degrees over a  
1 mm (1/32 inch) diameter mandrel and then bent at same point over same  
size mandrel in opposite direction through 360 degrees at temperature  
of -30 degrees C (-20 degrees F).

## **2.2 FLASHING ACCESSORIES**

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m<sup>2</sup>( 6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
  - 1. Use copper, copper alloy, bronze, brass, or stainless steel for lead-coated copper
  - 2. Nails:
    - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
    - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Roof Cement: ASTM D4586.

## **2.3 SHEET METAL THICKNESS**

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
  - 1. Lead-coated copper: 10 oz copper plus 12 to 15 lb lead. 99.5% copper.
- C. Exposed Locations:
  - 1. Lead-coated copper: 16 oz copper plus 12 to 15 lb lead. 99.5% copper.
- D. Thickness of aluminum or galvanized steel is specified with each item.

## **2.4 FABRICATION, GENERAL**

- A. Jointing:
  - 1. In general, lead-coated copper, joints, except expansion and contraction joints, shall be locked and soldered.
  - 2. Jointing of lead-coated copper over 20 oz weight shall be done by lapping, riveting and soldering.
  - 3. Joints shall conform to following requirements:



- a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
- b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
- c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of nonreinforced elastomeric sheeting shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
  - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
  - b. Wire brush to produce a bright surface before soldering lead coated copper.
  - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
  - d. Completely remove acid and flux after soldering is completed.
- B. Expansion and Contraction Joints:
  1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
  2. Space joints as shown or as specified.
  3. Space expansion and contraction joints for lead-coated copper, at intervals not exceeding 7200 mm (24 feet).
  4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
  5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
  6. Fabricate joint covers of same thickness material as sheet metal served.
- C. Cleats:
  1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.

2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to ensure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.

3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

## 2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
  1. Lead-coated copper: Mill finish.
  2. Stainless Steel: Finish No. 2B or 2D.

## 2.6 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
  1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
  2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
  1. Either copper, stainless steel, or copper clad stainless steel.
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
  1. Use same metal and thickness as counter flashing.
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. Window Sill Flashing and Lintel Flashing:

1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

E. Door Sill Flashing:

1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

**2.7 BASE FLASHING**

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
1. Use either copper, or stainless steel, thickness specified unless specified otherwise. Galvanized steel base flashing is not permitted.
  2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
  3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
  4. Use either lead-coated copper, or stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
  - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
  - b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
  - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
  - b. Allow for loose fit around pipe.

## **2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. Use either copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
  1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
  2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
  3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
  4. Manufactured assemblies may be used.
  5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
  6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:
  1. Back edge turned up and fabricate to lock into reglet in concrete.
  2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
- D. Two-Piece Counterflashing:
  1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.

2. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
  2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
  3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.
- F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
  2. Fabricate 100 mm (4 inch) over lap at end.
  3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
  4. Use stainless steel bolt on draw band tightening assembly.
  5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.
- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

## **2.9 BITUMEN STOPS**

- A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.
- B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.
- C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

## **2.10 REGLETS**

- A. Fabricate reglets of one of the following materials:
  - 1. 0.4 Kg (16 ounce) copper.
  - 2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

## **2.11 INSULATED EXPANSION JOINT COVERS**

- A. Either type optional, use only one type throughout.
- B. Types:
  - 1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
  - 2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.
- C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.
- D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
  2. Hem bottom edge of hood 13 mm (1/2 inch).
  3. Provide a 50 mm (2 inch) deep drawband.
- E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.



9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
  - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
  - b. Paint dissimilar metal with a coat of bituminous paint.
  - c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
  - a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
  - b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

### **3.2 THROUGH-WALL FLASHING**

#### **A. General:**

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.

2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
  - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
  - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed.  
Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.
- C. Flashing at Top of Concrete Floors (except where shelf angles occur):  
Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.
- E. Flashing at Veneer Walls:
1. Install near line of finish floors over shelf angles or where shown.
  2. Turn up against sheathing.
  3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
  4. At concrete backing, extend flashing into reglet as specified.
  5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- F. Lintel Flashing when not part of shelf angle flashing:
1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
  2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
  3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- G. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
  2. Turn back edge up to terminate under window frame.
  3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- H. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.

2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

**3.3 BASE FLASHING**

- A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
  2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
  3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
  4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

**3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
  - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
    - 1) Locate fasteners in masonry mortar joints.
    - 2) Use screws to sheet metal or wood.
  - b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
  - a. Secure with draw band tight against pipe.
  - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
  - c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
  - a. Secure to face construction in accordance, with manufacturers instructions.

- b. Completely fill space at the top edge of receiver with sealant.
- 3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

### **3.5 REGLETS**

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
  - 1. Coordinate reglets for anchorage into concrete with formwork construction.
  - 2. Coordinate reglets for masonry to locate horizontally into mortar joints.
  - 3. Use sealant to seal joint with fascia gravel stops at ends.
  - 4. Coordinate to lap over conductor head and to discharge water into conductor head.

### **3.6 EXPANSION JOINT COVERS, INSULATED**

- A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.
- B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.
- C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

- - - E N D - - -

**SECTION 07 71 00**  
**ROOF SPECIALTIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies roof hatches, dome skylights, equipment supports, other than those for mechanical, electrical, and structural items..

**1.2 RELATED WORK**

- A. Alternates: Section 01 00 00 - GENERAL REQUIREMENTS
- B. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- C. General insulation: Section 07 21 13, THERMAL INSULATION.
- D. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

**1.3 QUALITY CONTROL**

- A. Roof equipment supports specified in this Section shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- C. Manufacturer's Literature and Data: Each item specified.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):
  - A653/A653M-02.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process
  - C612-00.....Mineral Fiber Block and Board Thermal Insulation
  - D1187-97.....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum Sheet: ASTM B209/B209M.
- B. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.

### **2.2 ROOF HATCH (SCUTTLE)**

- A. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
  - 1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
  - 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
  - 4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 5. Make curb minimum 300 mm (12 inches) above roof surface.
  - 6. Form cover to lap curb and cap flashing.
  - 7. Size opening as shown.
- C. Hardware:
  - 1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
  - 2. Provide pintle hinges.
  - 3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
  - 4. Covers shall automatically lock in the open position at not less than 70 degrees.
  - 5. Provide weatherstripping at cover closure.
  - 6. Galvanize all hardware items.
- D. Assembly:
  - 1. Completely shop assemble roof scuttle.
  - 2. Fully weld all joints exposed to the weather and built into the roofing.
  - 3. Finish weld smooth where exposed.
  - 4. Operation with minimum force to open and close.

### **2.3 DOME SKYLIGHT (ALTERNATE No. 1)**

- A. Skylight: Double skin polycarbonate dome, square shape, gray tinted outer dome, clear inner dome.
- B. Size 60 x 60 inches
- C. Frame: Extruded aluminum, with integral flashing to receive roof flashing system and insulated curb



D. Aluminum finish: Mill.

#### **2.4 EQUIPMENT SUPPORTS**

- A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.
- B. Form exterior curb with integral base, and deck closures for curbs installed on steel decking.
- C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).
- D. Fabricate curb with a minimum height of 200 mm (8 inches) above roof surface.
- E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.
- F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

#### **2.5 FINISH**

- A. In accordance with NAAMM Amp 500 Series.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install roof specialties in accord with seismic requirements.
- B. Install roof equipment supports where shown.
- C. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- D. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- E. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- F. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
  - a. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
  - b. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.

- c. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

G. Equipment Supports: Do not anchor to metal deck. Anchor only to building structure as per manufacturers recommendations.

### **3.2 PROTECTION OF ALUMINUM**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

### **3.3 ADJUSTING**

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

### **3.4 PROTECTION**

Protect roof specialties from damage during installation and after completion of the work from subsequent construction.

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**SECTION 07 72 00**  
**ROOF ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies fascias, and expansion joints.

**1.2 RELATED WORK**

- A. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. General insulation: Section 07 21 13, THERMAL INSULATION
- C. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION
- D. Roofing: Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

**1.3 QUALITY CONTROL**

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. EACH ACCESSORY SHALL BE COMPLETELY ASSEMBLED TO THE GREATEST EXTENT

**1.4 PERFORMANCE REQUIREMENTS**

- A. Wind Uplift Forces: Resist the forces required by FM Approvals 1-49:
- B. Wind Design Standard: Fabricate and install copings, roof-edge flashings, etc. as tested per ANSI/SPRI ES-1 to resist design pressure indicated on Drawings (if not indicated 100).

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (4 by 4 inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):

B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate  
B221/221M-07.....Aluminum-Alloy Extruded Bars, Rods, Wire,  
Shapes, and Tubes  
C612-04.....Mineral Fiber Block and Board Thermal Insulation  
D1187-97 (R2002).....Asphalt-Base Emulsions for Use as Protective  
Coatings for Metal  
C. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-505-88.....Metal Finishes Manual  
D. American Architectural Manufacturers Association (AAMA):  
605-98.....High Performance Organic Coatings on  
Architectural Extrusions and Panels.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- D. Insulation: ASTM C612, Class 1 or 2.
- E. Asphalt Coating: ASTM D 1187, Type I, quick setting.

### **2.2 EXTRUDED ALUMINUM FASCIA-CANT SYSTEM**

- A. The fascia-cant system consists of three pieces, an extruded aluminum fascia, a galvanized steel cant, and an aluminum compression clamp.
- B. Furnish in-stock lengths of not more than 3000 mm (10 feet) long.
- C. Form fascia from not less than 2 mm (0.070 inch) thick aluminum.  
Provide 4 inch wide 0.8 mm (0.032 inch) thick concealed sheet aluminum joint cover plates in back of fascia.
- D. Form cant strip from galvanized steel not less than 0.8 mm (0.0299 inch) thick, to profile shown and design to hold lower edge of the fascia.
- E. Form compression clamp of not less than 0.8 mm (0.032 inch) thick aluminum designed to hold the top edge of the fascia and the built-up flashing.
- F. Internal and External Corners:
  - 1. Factory fabricate and fully weld mitered joints.
  - 2. Furnish corner sections in manufacturers standard sizes, unless otherwise shown on drawings, with not less than 300 mm (12 inch) leg lengths.

### **2.3 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS**

- A. Fabricate in 3000 mm (10 foot) lengths with fastener openings slotting for expansion not over 600 mm (24 inch) centers.
- B. Provide four-way expansion, for joint widths shown.

- C. Mill finish on aluminum.
- D. Form waterstop or moisture seals of continuous sheets of neoprene, not less than 0.8 mm (0.032 inch) thick.
- E. Fabricate corners as one piece assembly with mitered and welded joint and least dimension legs not less than 300 mm (12 inches) long.
- F. Factory fabricate end caps and transitions to ensure waterproof assembly.
- G. Three piece assembly:
  - 1. Roof expansion joint cover system consists of an extruded aluminum cover, extruded frame or curb vertical section, galvanized steel cant, and aluminum compression clamp counter flashing, complete with moisture seals. Form cover and vertical section from extruded aluminum, 2 mm (0.080 inch) minimum thickness with spring stainless steel tension or pivot bar.
  - 2. Form cant from galvanized steel not less than 0.8 (0.029 inch) thick formed to profile shown.
  - 3. Form splice plates of not less than 0.8 mm (0.032 inch) thick aluminum sheet.
  - 4. Form counter flashing member of 1.3 mm (0.050 inch) thick sheet aluminum, secured with screws to the top edge of the vertical section and providing compression clamp over base flashing.
  - 5. Provide compression gasket separating cover from curb bearing.
- H. Two piece assembly:
  - 1. Roof expansion joint system consists of an extruded aluminum cover combination extruded aluminum frame or curb with integral adjustable counter flashing flange, and moisture seals.
  - 2. Form cover from extruded aluminum 2 mm (0.078 inch) minimum thickness.
  - 3. Form cover anchor system of stainless steel pivot bar.
  - 4. Form frame assembly of not less than 2 mm (0.076 inch) aluminum except for flashing portion.
  - 5. Provide compression gasket separating cover from curb at bearing.

## **2.4 FINISH**

- A. In accordance with NAAMM Amp 500-505.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Fluorocarbon Finish: AAMA 605.2 high performance organic coating.
  - 1. Fluoropolymer enamel finish, consisting of a chemical pre-treatment of the base aluminum; then applying a primer coat of 0.1 to 0.4 mill dry film thickness; a polyvinylidene fluoride resin finish coat of 0.8 mil dry film thickness

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof accessories where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- F. Fascia-Cant System:
  - 1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown.
  - 2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
  - 3. Offset joints in extruded aluminum members from galvanized steel cant joints.
- G. Expansion Joint Covers:
  - 1. Install to terminate base flashing 200 mm (8 inches) above roof.
  - 2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
  - 3. Use stainless steel screws when exposed.
  - 4. Three piece assembly:
    - a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
    - b. Install cant to wood blocking by nailing along horizontal flange every 150 mm (6 inches), with galvanized roofing nails 25 mm (one inch) long.
    - c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 450 mm (18 inches) on center.

- d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
  - e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than four inches.
5. Two piece assembly:
- a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
  - b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
  - c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
  - d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

### **3.2 PROTECTION OF ALUMINUM**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

### **3.3 ADJUSTING**

Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

### **3.4 PROTECTION**

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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**SECTION 07 81 00**  
**APPLIED FIREPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

**1.2 RELATED WORK**

Fireproofing: Section 07 81 23, INTUMESCENT FIREPROOFING

**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. Manufacturer's complete and detailed application instructions and specifications.
  - 2. Manufacturer's repair and patching instructions.
- C. Certificates:
  - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
    - a. List thickness and density of material required to meet fire ratings.
    - b. Accompanied by complete test report and test record.
  - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
  - 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
  - 2. Manufacturer's written approval of completed installation.
  - 3. Manufacturer's written approval of the applicators of fireproofing material.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.

- E. Remove materials that have been exposed to water before installation from the site.

#### 1.5 QUALITY CONTROL

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
  - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
    - a. Apply to one column.
    - b. Apply for the hourly ratings used.
  - 2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
  - 3. Perform Bond test on painted steel in accordance with ASTM E736.
  - 4. Do not proceed in other areas until installation of test area has been completed and approved.
  - 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

#### 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C841-03.....Installation of Interior Lathing and Furring
  - C847-06.....Metal Lath
  - E84-08.....Surface Burning Characteristics of Building Materials
  - E119-08.....Fire Tests of Building Construction and Materials

- E605-93 (R2006).....Thickness and Density of Sprayed Fire-Resistive  
Materials Applied to Structural Members
- E736-00.....Cohesion/Adhesion of Sprayed Fire-Resistive  
Materials Applied to Structural Members
- E759-92 (R2005).....The Effect of Deflection on Sprayed Fire-  
Resistive Material Applied to Structural  
Members
- E760-92 (R2005).....Impact on Bonding of Sprayed Fire-Resistive  
Material Applied to Structural Members
- E761-92 (R2005).....Compressive Strength of Fire-Resistive Material  
Applied to Structural Members
- E859-93 (R2006).....Air Erosion of Sprayed Fire-Resistive Materials  
Applied to Structural Members
- E937-93 (R2005).....Corrosion of Steel by Sprayed Fire-Resistive  
Material Applied to Structural Members
- G21-96 (R2002).....Determining Resistance of Synthetic Polymeric  
Materials to Fungi
- C. Underwriters Laboratories, Inc. (UL):  
Fire Resistance Directory...Latest Edition including Supplements
- D. Warnock Hersey (WH):  
Certification Listings..Latest Edition
- E. Factory Mutual System (FM):  
Approval Guide.....Latest Edition including Supplements
- F. United States Green Building Council (USGBC)

## **PART 2 - PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0,  
2009

### **2.2 SPRAYED-ON FIREPROOFING**

- A. ASTM E1042, Class (a), Category A.
1. Type I, factory mixed cementitious materials with approved aggregate.
  2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m<sup>3</sup> (15 lb/ft<sup>3</sup>) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.
- B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

|    | Characteristic                                                      | Test      | Results                                                                                                                                                |
|----|---------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Deflection                                                          | ASTM E759 | No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)                                 |
| 2. | Corrosion-Resistance                                                | ASTM E937 | No promotion of corrosion of steel.                                                                                                                    |
| 3. | Bond Impact                                                         | ASTM E760 | No cracking, spalling, or delamination.                                                                                                                |
| 4. | Cohesion/Adhesion<br>(Bond Strength)                                | ASTM E736 | Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft <sup>2</sup> ) for protected areas. 19.15 kPa (400 lbf/ft <sup>2</sup> ) for exposed areas. |
| 5. | Air Erosion                                                         | ASTM E859 | Maximum gain weight of the collecting filter 0.27gm/m <sup>2</sup> (0.025 gm/ft <sup>2</sup> ).                                                        |
| 6. | Compressive Strength                                                | ASTM E761 | Minimum compressive strength 36 kPa (5 lbf/in <sup>2</sup> ).                                                                                          |
| 7. | Surface Burning Characteristics with adhesive and sealer to be used | ASTM E84  | Flame spread 25 or less smoke developed 50 or less                                                                                                     |
| 8. | Fungi Resistance                                                    | ASTM G21  | Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)                                                     |

### 2.3 ADHESIVE

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

### 2.4 SEALER

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant.
- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

## **2.5 WATER**

- A. Clean, fresh, and free from organic and mineral impurities.
- B. pH of 6.9 to 7.1.

## **2.6 MECHANICAL BOND MATERIAL**

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m<sup>2</sup> (1.7 pounds per square yard).
- B. Fasteners: ASTM C841.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fireproofing material manufacturer.

## **3.2 APPLICATION**

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.
- C. Application of Metal Lath:
  - 1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
  - 2. Apply to beam flanges 300 mm (12-inches) or more in width.
  - 3. Apply to column flanges 400 mm (16-inches) or more in width.
  - 4. Apply to beam or column web 400 mm (16-inches) or more in depth.
  - 5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
  - 6. See design criteria section of the approved assemblies used.
  - 7. Lap and tie lath member in accordance with ASTM C841.
- D. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) shall be as follows:
  - a. Type I -  $240 \text{ kg/m}^3$  ( $15 \text{ lb/ft}^3$ ); use in high traffic areas and in areas not covered by subsequent construction (steel structure exposed in mechanical rooms).
  - b. Type II -  $350 \text{ kg/m}^3$  ( $22 \text{ lb/ft}^3$ ); use in areas covered by subsequent construction (steel structure enclosed in gypsum board partitions and above ceiling line).
- E. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.

### **3.3 FIELD TESTS**

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
  1. Test for cohesion/adhesion: ASTM E736.
  2. Test for bond impact strength: ASTM E760.

### **3.4 PATCHING AND REPAIRING**

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
  1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.

2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
3. Hand mixing of material is not permitted.

C. Repair:

1. Respray all test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

**3.5 SCHEDULE**

- A. Apply fireproofing material to interior structural steel members, except on following surfaces:
2. Steel to be encased in concrete or designated to receive other type of fireproofing.
- B. Type I:
1. One hour fire rating.
- C. Type II:
1. One hour fire rating.

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**SECTION 07 81 23**

**INTUMESCENT FIREPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the intumescent fireproofing to provide one hour fire resistance to specific interior steel columns.
  - 1. For three steel tube columns in SW-100A - Vestibule

**1.2 RELATED WORK**

- A. Spray on fireproofing: 07 81 00, APPLIED FIREPROOFING
- B. Painting: Section 09 91 00, PAINTING

**1.3 PERFORMANCE CRITERIA**

- A. Material: Water-based intumescent fireproofing material free of all forms of asbestos and asbestos contamination, and tested and reported by UL in accordance with ASTM E119.
- B. Dry applied density: 85 pcf.
- C. Shore D hardness: 45 - 50.
- D. Weight per gallon: 11.90 plus or minus 0.02 lb./gal.
- E. Percent solids by weight: 70 plus or minus 2.0.
- F. Abrasion resistance: ASTM D1044 - 0 gram loss.
- G. Impact: ASTM D256 - 0.77 ft.lb/inch of notch.
- H. Flame spread: ASTM E84 - 2 (Class A).
- I. Smoke development: ASTM E84 - 5 (Class A).

**1.4 SUBMITTALS**

- A. Follow Section 01 33 23.
- B. Shop Drawings: Show each structural member and surface to receive fireproofing. Indicate type of fireproofing, UL Test Design, thickness and hourly rating. Drawings are subject to approval of agencies having jurisdiction.
- C. Product Data: Describe physical characteristics of fireproofing.
- D. Samples: Three 2 inch square samples of fireproofing.
- E. Informational Submittals:
  - 1. Copy of UL Test Design for each condition.
  - 2. Statement of applicator qualifications, and certificate of approval by fireproofing manufacturer.
  - 3. Certification that steel primer paints used are compatible with the fireproofing and will not impair performance under fire exposure for applications indicated.

### **1.5 QUALIFICATIONS**

- A. Applicator: Approved in writing by fireproofing manufacturer, as to experience and capability related to knowledge of applicable UL Test Designs, handling, mixing and application of fireproofing material. The applicator shall have attended the manufacturer's required training program.

### **1.6 QUALITY ASSURANCE: COMPLY WITH:**

- A. Approved UL designs as published in UL Fire Resistance Directory, as to products, installation and thickness.

### **1.7 MOCK-UP**

- A. Make mock-up at least 100 square feet. Include column and beam or girder.
- B. Mock-up shall exhibit proposed thickness, density, and finish texture.
- C. Approved mock-up may remain part of the work.

### **1.8 DELIVERY, STORAGE AND HANDLING**

- A. Follow Section 01 60 00.
- B. Deliver fireproofing material in original unopened packages bearing name of manufacturer, brand, and proper UL labels for fire hazard and fire resistance classifications.
- C. Protect material from extreme heat, moisture, sunlight or freezing. Rotate and use material before its expiration date.

### **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Provide ventilation during and 72 hours after application. Provide forced air ventilation in areas lacking natural ventilation.
- B. Follow manufacturer's instructions regarding temperature and humidity conditions before, during and after application of fireproofing.

### **1.10 APPLICABLE PUBLICATIONS**

United States Green Building Council (USGBC)

## **PART 2 - PRODUCTS**

### **2.1 VOC'S**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009.

### **2.2 MATERIALS**

- A. Single component, waster based, factory mixed, asbestos free, intumescent material blended for uniform texture; conforming to the

### **2.3 ACCESSORIES**

- A. Provide surface primers, reinforcing mesh, and other accessories as required to meet hourly ratings as predetermined by UL testing.

- B. Provide compatible topcoats as specified.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Review product data on steel primer paint submitted under Section 05 12 00. Primer must be approved by fireproofing manufacturer as to compatibility and adhesion.
- B. Verify that surfaces are free of substances which may impair proper adhesion. Where necessary, clean surfaces to meet requirements of fireproofing manufacturer.
- C. Verify that clips, hangers, supports, sleeves and, other items required to penetrate fireproofing are in place.
- D. Verify ducts, piping, equipment, or other items which would interfere with application of fireproofing are not installed until fireproofing is complete.

#### **3.2 PREPARATION**

- A. Protect adjacent surfaces and equipment from damage by overspray, fallout, and dusting.
- B. Seal off ductwork in areas where fireproofing is being applied.

#### **3.3 APPLICATION**

- A. Apply primers where required or recommended by manufacturer.
- B. Apply fireproofing in sufficient thickness to achieve rating, with as many passes as necessary to cover substrate with a monolithic blanket of uniform hardness, density and texture.
- C. Finish: Standard spray-on and rolled smooth texture and finish.
- D. Extend fireproofing onto hangers, anchors, tight gauge metal framing anchored to fireproofed steel as required by UL Design.

#### **3.4 PATCHING, REPAIRING AND CLEANING**

- A. Patch and repair fireproofing damaged by weather, cutting for installation of other work, or other causes. Provide continuity of coating as required by UL Design for fire rating, and for application of topcoats.
- B. Clean fireproofing from other work not intending to receive fireproofing.

#### **3.5 TESTING LABORATORY SERVICES**

- A. Field testing will be performed under provisions of Section 01 45 23.
- B. Thickness tests and inspection in accordance with AWCI Technical Manual 12-B, Second Edition; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials.

C. Quantity and Location of Tests:

1. Thickness Testing: Structural Columns as defined in International Building Code: A minimum 25 percent of each of these members.

**3.6 SCHEDULE**

- A. The steel tube columns in SW-100A - Vestibule
- B. All fireproofing within a singular space shall be by the same manufacturer with the same topcoat for visual consistency.

- - - END - - -

**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. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
- B. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING.
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- D. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS and Section 23 37 00, AIR OUTLETS AND INLETS.

**1.3 SUBMITTALS**

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

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**

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):
  - E84-07.....Surface Burning Characteristics of Building Materials
  - E814-06.....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
  - 1479-03.....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
  - Annual Issue Certification Listings
- F. United States Green Building Council (USGBC)

## **PART 2 - PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009.

### **2.2 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.

### **2.3 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**

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.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed aluminum curtain wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- F. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- G. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING and 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 Contracting Officer.
  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.
- E. VOC: Acrylic latex and Silicone sealants shall have less than 50g/l VOC content.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

#### **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, each type.
  2. Primers, bonding agents, cleaners.
  3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  4. Joint backing and filler, each type.

#### **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 degrees C (40 degrees F).
- b. When joint substrates are wet.

B. Joint-Width Conditions:

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

C. Joint-Substrate Conditions:

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

#### **1.6 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 degrees C (90 degrees F) or less than 5 degrees C (40 degrees 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 sealants and caulking against 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. Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of the 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.
  - C570.....Oil and Resin-Base Caulking Compound for Building Construction.
  - C612-10.....Mineral Fiber Block and Board Thermal Insulation.
  - C717-10.....Standard Terminology of Building Seals and Sealants.
  - C790.....Use of Latex Sealing Compounds.
  - C804.....Use of Solvent-Release Type of Sealants.
  - C834-10.....Latex Sealants.
  - C919-08.....Use of Sealants in Acoustical Applications.
  - C920-10.....Elastomeric Joint Sealants.
  - C962.....Use of 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
- D. United States Green Building Council (USGBC)  
LEED Version 3.0, 2009

## **PART 2 - PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009

### **2.2 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-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.

F. 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.

G. 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.

H. 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.

**2.3 CAULKING COMPOUND**

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.
- C. C-3: ASTM C1085, butyl rubber.
- D. When used in exposed areas provide a product capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

**2.4 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.

**2.5 JOINT SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers,

and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C1330, Type C, closed-cell material with a surface skin. Backing size and density sufficient to control sealant depth and contribute to producing optimum sealant performance:
- 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 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- E. Back-up Rod: Type A, joint fillers; closed cell neoprene, butyl, polyurethane, vinyl or polyethylene rod; diameter approximately 1-1/3 times the joint width.

## **2.6 FILLER**

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

## **2.7 PRIMER**

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

## **2.8 NON-POUROUS SURFACE CLEANERS**

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, 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 mineral fiber filler and bond breaker 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 degrees C and 38 degrees C (40 degrees and 100 degrees 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 manufacturer 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.
- D. Follow requirements of ASTM C790 for application of C-1 caulking.
- E. Follow requirements of ASTM C804 for application of C-3 caulking.

### **3.6 FIELD QUALITY CONTROL**

- A. Inspect for uniform joint widths and that dimensions are within tolerances established by sealant manufacturer.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
  1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Ensure that original sealant surfaces are clean and new sealant contacts original sealant. Retest failed applications until test results prove sealants comply with indicated requirements.
- G. Make necessary modifications for compliance with applicable criteria. Accomplish all necessary field settings, adjustments and modifications to comply with the project intent. Demonstrate results compared to acceptable values.

### **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 Precast Concrete: Type S-1
  3. Masonry to Masonry or Precast Concrete: Type S-1
  4. Precast Concrete to Precast concrete: Type S-1
  5. Threshold Setting Bed: Type S-1, S-3, S-4

6. Masonry Expansion and Control Joints: Type S-6
7. 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. Horizontal Traffic Joints:
  1. Use Type S-11, Shore A hardness of between 35 and 50 for minimal movement joints.
  2. Use Type S-12, Shore A hardness of between 25 and 30 for joints requiring of greater movement range of plus or minus 50 percent.
  3. Use Type S-3, Shore A hardness between 15 and 25, for joints not in direct traffic patterns, such as adjacent to walls or columns, where greater movement is expected.
- E. High Temperature Joints over 204 degrees C (400 degrees F):
  1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8
- F. Interior Caulking:
  1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
  2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
  3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
  4. Perimeter of Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
  5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
  6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
  7. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

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**SECTION 07 95 13**  
**EXPANSION JOINT COVER ASSEMBLIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies floor, wall, and ceiling, seismic and building expansion joint assemblies. All expansion joints shall be in accordance with the appropriate seismic requirements.
- B. Types of assemblies:
  - 1. Metal Plate Cover
  - 2. Elastomeric Joint Covers
  - 3. Preformed/Precompressed Elastomeric Sealant Joint

**1.2 RELATED WORK**

- A. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.
- B. Roof Expansion Joint Cover Assemblies: Section 07 72 00, ROOF ACCESSORIES.

**1.3 QUALITY ASSURANCE**

- A. Project Conditions:
  - 1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.
  - 2. Show recorded measurements on final shop drawings.
- B. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

**1.4 DELIVERY STORAGE AND HANDLING**

- A. Take care in handling of materials so as not to injure finished surface and components.
- B. Store materials under cover in a dry and clean location off the ground.
- C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Submit copies of manufacturer's current literature and data for each item specified.

2. Clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for ultraviolet exposure .
- C. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.
- D. Shop Drawings:
  1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.
  2. Include description of materials and finishes and installation instructions.
- E. Samples:
  1. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.
  2. Samples of each type and color of flexible seal used in work.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/A36M-05.....Structural Steel
  - A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A283/A283M-03.....Low and Intermediate Tensile Strength Carbon Steel Plates
  - A786/A786M-05.....Rolled Steel Floor Plates
  - B209M-06.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
  - B221M-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
  - C864-05.....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
  - C920-05.....Elastomeric Joint Sealants

- D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective  
Coatings for Metal
- D2287-96 (R2001).....Non-rigid Vinyl Chloride Polymer and Copolymer  
Molding and Extrusion Compounds
- E119-07.....Fire Tests of Building Construction and  
Materials
- E814-06.....Fire Tests of Through-Penetration Fire Stops
- C. Federal Specifications (Fed. Spec):
- TT-P-645B.....Primer, Paint, Zinc-Molybdate, Alkyd Type
- D. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series.....Metal Finishes Manual.
- E. National Fire Protection Association (NFPA):
- 251-05.....Tests of Fire Endurance of Building  
Construction and Materials
- F. Underwriters Laboratories Inc. (UL):
- 263-03.....Fire Tests of Building Construction and  
Materials

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302 or 304.
- B. Structural Steel Shapes: ASTM A36.
- C. Steel Plate: ASTM A283, Grade C.
- D. Rolled Steel Floor Plate: ASTM A786.
- E. Aluminum:
1. Extruded: ASTM B221, alloy 6063-T5.
  2. Plate and Sheet: ASTM B209, alloy 6061-T6.
- F. Elastomeric Sealant:
1. ASTM C920, polyurethane.
  2. Type.
  3. Class 25.
  4. Grade P or NS.
  5. Shore A hardness 25, unless specified otherwise.
- G. Thermoplastic Rubber:
1. ASTM C864.
  2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.

H. Vinyl Invertor Sealant Waterstops: Manufacturers' standard shapes and grade.

I. Fire Barrier:

1. Designed for indicated or required dynamic structural movement without material degradation or fatigue.
2. Tested in maximum joint width condition as a component of an expansion joint cover assembly in accordance with UL 263 NFPA 251, or ASTM E119 and E814, including hose steam test at full-rated period.

J. Zinc-Molybdate Primer: Fed. Spec. TT-P-645.

K. Accessories:

1. Manufacturer's standard anchors, fasteners, set screws, spaces, flexible secondary water stops or seals and filler materials, drain tubes, adhesive and other accessories as indicated or required for complete installations.
2. Compatible with materials in contact.
3. Water stops.

## **2.2 FABRICATION**

A. General:

1. Use ceiling and wall expansion joint cover assemblies of same design as floor-to-wall and floor-to-floor expansion joint cover assemblies. Unless shown otherwise.
2. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement.
3. Deliver to job site ready for use and fabricated in as large sections and assemblies as practical. Assemblies identical to submitted and reviewed shop drawings, samples and certificates.
4. Furnish units in longest practicable lengths to minimize number of end joints. Provide mitered corners where joint changes directions or abuts other materials.
5. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
6. Fire Performance Characteristics:
  - a. Provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ASTM



E119 and E814, NFPA 251, or UL 263 including hose stream test at full-rated period.

- b. Fire rating: Not less than rating of adjacent floor or wall construction.
7. Fire Barrier Systems:
- a. Material to carry label of approved independent testing laboratory, and be subject to follow-up system for quality assurance.
  - b. Include thermal insulation where necessary, in accordance with above tests, with factory cut miters and transitions.
  - c. For joint widths up to and including 150 mm (6 inches), supply barrier in lengths up to 15000 mm (50 feet) to eliminate field splicing.
  - d. For joints within enclosed spaces such as chase walls, include 1 mm (0.032 inch) thick galvanized steel cover where conventional expansion joint cover is not used.
8. Seal Strip factory - formed and bonded to metal frames and anchor members.
9. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.
- B. Floor-to-Floor Metal Plate Joints:
- 1. Frames on each side of joint designed to support cover plate of design shown.
    - a. Continuous frame designed to finish flush with adjacent floor of profile indicated with seating surface and raised floor rim to accommodate flooring.
    - b. Provide concealed bolt and steel anchors for embedment in concrete.
    - c. Designed for filler materials between raised rim of frame and edge of cover plate where shown.
    - d. Frame and cover plates of some metal where exposed.
      - 1) Design cover plates to support 180 Kg (400 lbs) per 0.3 square meters (1-square foot).
      - 2) Cover plates free of rattle due to traffic.
      - 3) No gaps or budes occur on filler material during design movement of joint.
      - 4) Provide manufacturer's continuous standard flexible vinyl water stop under floor joint cover assemblies.

C. Floor-to-Wall Metal Plate Joints:

1. Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
2. Angle Cover Plates: Provide angle cover plates for joints to wall with countersunk flat-head exposed fasteners for securing to wall unless shown otherwise.
3. Space fasteners as recommended by manufacturer.
4. Match cover of adjacent floor to floor cover.

D. Ceiling and Soffit Assemblies:

1. Variable movement vinyl insert in metal frame on both sides of joint.
2. Designed for flush mounting with no exposed fasteners.
3. Vinyl insert locked into metal frame.
4. Vinyl and metal finish as scheduled on Drawings.
5. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.

E. Preformed/precompressed Sealant Joint: Factory installed elastomeric sealant between extruded aluminum angle frame both sides.

1. Elastomeric Sealant: Two part polyurethane sealant with movement capability of +/- 25% of joint width per ASTM-C-920, Type M, Grade P, Class 25, Shore A hardness of 25+/-5.
  - a. Color:
2. Frame: Extruded Aluminum: Clear // Bronze // anodized.

## 2.3 METAL FINISHES

A. General:

1. Apply finishes in factory after products are fabricated.
2. Protect finishes on exposed surfaces with protective covering before shipment.

B. Aluminum Finishes:

1. Finish letters and numbers for anodized aluminum are in accordance with the NAAMM AMP 501, Aluminum Association's Designation System).
  - a. Clear anodized finish: AA-C22A41 Chemically etched medium matte, clear anodic coating, Class I Architectural, 0.7 mil thick.
2. Factory-Primed Concealed Surface: NAAMM AMP 505 Protect concealed aluminum surfaces that will be in contact with plaster, concrete or masonry surfaces when installed by applying a shop coat of zinc-molybdate primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils.

- C. Stainless Steel: NAAMM AMP 503, finish No. 2B.
- D. Carbon Steel: NAAMM AMP 504, Galvanized 690.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Manufacturer's representative shall make a thorough examination of surfaces receiving work of this section.
- B. Before starting installation, notify prime contractor of defects which would affect satisfactory completion of work.

#### **3.2 PREPARATION**

- A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.
- B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.
- C. Provide templates to related trade for location of support and anchorage items.

#### **3.3 INSTALLATION**

- A. Install in accordance with manufacturers installation instructions unless specified otherwise.
- B. Provide anchorage devices and fasteners for securing expansion joint assemblies to in-place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
- C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
- D. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
- E. Allow for thermal expansion and contraction of metal to avoid buckling.
- F. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.
- G. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer's instructions.
- H. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.

- I. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3-inches) from each ends, and, not more than 600 mm (24-inches) on centers.
- J. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
- K. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.
- L. Flush Metal Cover Plates:
  - 1. Secure flexible filler between frames so that it will compress and expand.
  - 2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- M. Waterstops:
  - 1. Install in conjunction with floor joints and where shown, run continuously to prevent water damage to finish spaces.
  - 2. Provide seal with frame to prevent water leakage.
  - 3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.
- N. Fire Barriers:
  - 1. Install in compliance with tested assembly.
  - 2. Install in floors and in fire rated walls.
  - 3. Use fire barrier sealant or caulk supplied with system.
- O. Sealants: Install to prevent water and air infiltration.
- P. Vertical Exterior Extruded Thermoplastic Rubber.
  - 1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with independent continuous PVC back seal.
  - 2. Install primary seals retained in extruded aluminum side frames.
- Q. Installation of Extruded Thermoplastic Rubber or Seals:
  - 1. For straight sections, provide preformed seals in continuous lengths.
  - 2. Vulcanize or heat-seal field splice joints to provide watertight joints using manufacturer's recommended procedures.
- R. Installation of Preformed Elastomeric Sealant Joint:
  - 1. Locate joint directly over joints in wall or floor substrates.

2. Full length shall be fastened to substrate using a construction adhesive.
3. Install flush or slightly below finish material.

#### **3.4 PROTECTION**

- A. Take proper precautions to protect the expansion joint covers from damage after they are in place.
- B. Cover floor joints with plywood where wheel traffic occurs.

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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. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- B. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONT WALL SYSTEM.
- C. Door Blast Requirements: Section 08 39 53, BLAST REQUIREMENTS FOR BLAST RESISTANT DOORS.
- D. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- E. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- F. Glazing Blast Requirements: Section 08 80 50, BLAST REQUIREMENTS FOR GLAZED SYSTEMS.
- G. Deal trays of a Forced Entry/Ballistic Resistant rating: Section 08 56 59, SERVICE AND TELLER WINDOW UNITS.
- H. Intrusion Alarm: Section 28 16 11, INTRUSION DETECTION SYSTEM.

**1.3 TESTING**

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 and temperature rise rating for stairwell doors. Submit proof of temperature rating.
  - 2. Sound rated doors, including test report from Testing Laboratory.

**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. Door and Hardware Institute (DHI):
  - A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)
- C. Steel Door Institute (SDI):
  - 113-01.....Thermal Transmittance of Steel Door and Frame Assemblies
  - 128-1997.....Acoustical Performance for Steel Door and Frame Assemblies
  - A250.8-03.....Standard Steel Doors and Frames
- D. American Society for Testing and Materials (ASTM):
  - A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A568/568-M-07.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
  - A1008-08.....Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
  - B209/209M-07.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221/221M-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
  - D1621-04.....Compressive Properties of Rigid Cellular Plastics
  - E90-04.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
- E. The National Association Architectural Metal Manufacturers (NAAMM):
  - Metal Finishes Manual (1988 Edition)
- F. National Fire Protection Association (NFPA):
  - 80-09.....Fire Doors and Fire Windows
- G. Underwriters Laboratories, Inc. (UL):
  - Fire Resistance Directory



- H. Intertek Testing Services (ITS):  
Certifications Listings...Latest Edition
- I. Factory Mutual System (FM):  
Approval Guide

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

### **2.2 METAL DOORS**

- A. General:
  - 1. Follow SDI 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 SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
  - 2. Close top edge of exterior doors flush and seal to prevent water intrusion.
  - 3. Use vertical steel stiffeners for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction type f for interior doors.
- C. Extra Heavy Duty Doors: SDI A250.8, Level 3, Model 2 of size and design shown. Core construction Type f for exterior doors.
- D. Smoke Doors:
  - 1. Close top and vertical edges flush.
  - 2. Provide seamless vertical edges.
  - 3. Apply Steel astragal to the meeting style 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.
- E. 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.

### **2.3 METAL FRAMES**

#### **A. General:**

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for Exterior Doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors and viewing windows.
  - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Intertek 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.
4. Frames for doors specified to have service window: minimum 1.7 mm (0.067 inch) thick.
5. Knocked-down frames are not acceptable.

#### **B. Reinforcement and Covers:**

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

#### **C. Terminated Stops: SDI 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 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.

## **2.4 SHOP PAINTING**

SDI 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.

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

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

Install doors and hardware as specified in Section 08 11 13, HOLLOW  
METAL DOORS AND FRAMES; Section 08 14 00, WOOD DOORS; and Section 08 71  
00, DOOR HARDWARE.

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**SECTION 08 14 00**  
**INTERIOR WOOD DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior flush doors with prefinish, prefit option.
- B. Section includes fire rated doors, and smoke doors.

**1.2 RELATED WORK**

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- C. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES and Section 08 71 00, DOOR HARDWARE.
- D. Glazing: Section 08 80 00, GLAZING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
  - 2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.
- C. Shop Drawings:
  - 1. Show every door in project and schedule location in building.
  - 2. Indicate type, grade, finish and size; include detail of glazing, louvers, sound gasketing, and pertinent details.
  - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.
- D. Manufacturer's Literature and Data:
  - 1. Sound rated doors, including test report indicating STC rating per ASTM E90 from test laboratory.
  - 2. Labeled fire rated doors showing conformance with NFPA 80.
- E. Laboratory Test Reports:
  - 1. Screw holding capacity test report in accordance with WDMA T.M.10.
  - 2. Split resistance test report in accordance with WDMA T.M.5.

3. Cycle/Slam test report in accordance with WDMA T.M.7.

4. Hinge-Loading test report in accordance with WDMA T.M.8.

#### **1.4 WARRANTY**

A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:

1. For interior doors, manufacturer's warranty for lifetime of original installation.

#### **1.5 DELIVERY AND STORAGE**

A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.

B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.

C. Label package for door opening where used.

#### **1.6 APPLICABLE PUBLICATIONS**

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

A. Window and Door Manufacturers Association (WDMA):

I.S.1-A-04.....Architectural Wood Flush Doors

I.S.4-07A.....Water-Repellent Preservative Non-Pressure  
Treatment for Millwork

I.S.6A-01.....Architectural Wood Stile and Rail Doors

T.M.5-90.....Split Resistance Test Method

T.M.6-08.....Adhesive (Glue Bond) Durability Test Method

T.M.7-08.....Cycle-Slam Test Method

T.M.8-08.....Hinge Loading Test Method

T.M.10-08.....Screwholding Test Method

B. National Fire Protection Association (NFPA):

80-07.....Protection of Buildings from Exterior Fire

252-08.....Fire Tests of Door Assemblies

C. ASTM International (ASTM):

E90-04.....Laboratory Measurements of Airborne Sound  
Transmission Loss

## **PART 2 - PRODUCTS**

### **2.1 FLUSH DOORS**

A. General:



1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
  2. Adhesive: Type II
  3. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Face Veneer:
1. In accordance with WDMA I.S.1-A.
  2. One species throughout the project unless scheduled or otherwise shown.
  3. For Transparent Finishes: Premium Grade, rotary cut, white maple .
    - a. AA grade face veneer
    - b. Match face veneers for doors for uniform effect of color and grain at joints.
    - c. Door edges shall be same species as door face veneer.
    - d. In existing buildings, where doors are required to have transparent finish, use wood species and grade of face veneers to match adjacent existing doors.
  4. Factory sand doors for finishing.
- C. Wood for stops, muntins and moldings of flush doors required to have transparent finish:
1. Solid Wood of same species as face veneer, except maple may be used on birch doors.
  2. Glazing:
    - a. On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers.
- D. Fire Rated Wood Doors:
1. Labels:
    - a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry an identifying label from a qualified testing and inspection agency for class of door or opening shown designating fire performance rating.
    - b. Metal labels with raised or incised markings.
  2. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
    - a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for Extra Heavy Duty doors.
    - b. Direct screw withdrawal: WDMA T.M.10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.

- c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA T.M.7.
- 3. Additional Hardware Reinforcement:
  - a. Provide fire rated doors with hardware reinforcement blocking.
  - b. Size of lock blocks as required to secure hardware specified.
  - c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.
  - d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
  - e. Mineral material similar to core is not acceptable.
- 4. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
- 5. Provide steel frame approved for use in labeled doors for vision panels.
- 6. Provide steel astragal on pair of doors.
- E. Smoke Barrier Doors:
  - 1. For glazed openings use steel frames approved for use in labeled doors.
  - 2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

## **2.2 PREFINISH, PREFIT**

- A. Flush doors shall be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.
- C. Flush doors to receive transparent finish (in addition to being prefit) shall be factory finished as follows:
  - 1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
  - 2. Use stain when required to produce the finish specified in Section 09 06 00 SCHEDULE FOR FINISHES.

## **2.3 IDENTIFICATION MARK**

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:

1. An identification mark or a separate certification including name of inspection organization.
2. Identification of standards for door, including glue type.
3. Identification of veneer and quality certification.

#### **2.4 SEALING**

Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

### **PART 3 - EXECUTION**

#### **3.1 DOOR PREPARATION**

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
  1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
  2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness, undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

#### **3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE**

Install doors and hardware as specified in this Section.

#### **3.3 DOOR PROTECTION**

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.

- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by Resident Engineer.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies access doors or panels.

**1.2 RELATED WORK**

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- B. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.
- C. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS and Section 23 37 00, AIR OUTLETS AND INLETS.

**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-2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - A1008-07.....Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):
  - D1.3-98.....Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
  - 80-06.....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 or stainless steel sheet as required, 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.
- 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. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
  - 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 or of 1.5 mm (0.0598 inch) thick stainless steel sheet as specified.
2. Reinforce to maintain flat surface.

#### **B. Frame:**

1. Form of 1.5 mm (0.0598 inch) thick steel or stainless 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.

#### **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.
- C. Stainless Steel: No. 4 for exposed surfaces.

### **2.5 SIZE**

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.

- D. Use stainless steel access doors or panels in wet areas . Use painted steel access doors or panels elsewhere.

### **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.

### **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 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONT WALL SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies aluminum entrance work including exterior storefront construction, interior storefront wall system construction, hung doors, and other components to make a complete assembly.

**1.2 RELATED WORK**

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Blast resistance: 08 56 53, BLAST RESISTANT GLAZED SYSTEMS FOR MISSION CRITICAL RATED BUILDINGS

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Doors, each type.
  - 2. Entrance and Storefront construction.
- D. Samples:
  - 1. Door corner section, 450 mm x 450 mm (18 x 18 inches), of each door type specified, showing vertical and top hinge edges, door closer reinforcement and internal reinforcement of flush panel door.
- E. Manufacturer's Certificates:
  - 1. Stating that aluminum has been given specified thickness of anodizing.
  - 2. Indicating manufacturer's qualifications specified.

**1.4 QUALITY ASSURANCE**

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - E283-04.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - E331-00(R2009).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
  - F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):
  - D1.2-08.....Structural Welding Code Aluminum

### **1.7 PERFORMANCE REQUIREMENTS**

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than 1.4 kilopascals (30 pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.

- B. Air Infiltration: When tested in accordance with ASTM E283, air infiltration shall not exceed 2.63 x 10<sup>-5</sup> cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
- C. Water Penetration: When tested in accordance with ASTM E331, there shall be no water penetration at a pressure of 0.38 kPa (8 pounds per square foot) of fixed area.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, ASTM B209 and B221:
  - 1. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights storefronts.
  - 2. Alloy 6061 temper T6 for extruded structural members.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.
- C. Fasteners:
  - 1. Aluminum: ASTM F468, Alloy 2024.
  - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

### **2.2 FABRICATION**

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.
- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.

- E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.
- F. Reference Section 08 56 53 - BLAST RESISTANT GLAZED SYSTEMS FOR MISSION CRITICAL RATED BUILDINGS for additional requirements.

### **2.3 PROTECTION OF ALUMINUM**

- A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:
  - 1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
  - 2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
  - 3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

### **2.4 FRAMES**

- A. Fabricate doors, frames, frames for fixed glass, and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.
- C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- D. Fabricate framework with thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.

### **2.5 STILE AND RAIL DOORS**

- A. Nominal 45 mm (1-3/4 inch) thick, with stile and head rail 90 mm (3-1/2 inches) wide, and bottom rail 250 mm (10 inches) wide.
- B. Bevel single-acting doors 3 mm (1/8 inch) at lock, hinge and meeting stile edges. Provide clearances of 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds. Form glass rebates integrally with stiles and rails. Glazing beads may be formed integrally with stiles and rails or applied type secured with fasteners at 150 mm (six inches) on centers.
- C. Construct doors with a system of welded joints or interlocking dovetail joints between stiles and rails. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel rod extending into the stiles, and having a self-locking nut and washer at each end. Reinforce stiles and rails to prevent door distortion when tie rods are tightened. Provide a compensating spring-type washer under each nut to

take up any stresses that may develop. Construct joints between rails and stiles to remain rigid and tight when door is operated.

- D. Weather-stripping for Exterior Doors: Provide removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder. Make slots for applying weather-stripping integral with doors and door frame stops. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames. Install weather-stripping so doors can swing freely and close positively.

## **2.6 FLUSH PANEL DOORS**

- A. Nominal 45 mm (1-3/4 inches) thick. Form from aluminum face sheets not less than 1.5 mm (0.060 inch) thick with internal impact reinforcement, laminated to the door edges and the core.
- B. Provide extruded aluminum tubular members to form the perimeter of the door. Reinforce doors internally with extruded tubular members welded in place, and extending full width of door at top, bottom, and intermediate points.
- C. Fill voids between tubular members with noncombustible mineral insulation.

## **2.7 REINFORCEMENT FOR BUILDERS HARDWARE**

- A. Fabricate from stainless steel plates.
- B. Hinge and pivot reinforcing: 4.55 mm (0.1793 inch) thick.
- C. Reinforcing for lock face, flush bolts, concealed holders, concealed or surface mounted closers: 2.66 mm (0.1046 inch) thick.
- D. Reinforcing for all other surface mounted hardware: 1.5 mm (0.0598 inch) thick.

## **2.8 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  - 1. Clear Finish: Chemically etched medium matte, with clear anodic coating, Class I Architectural, 7 mils thick.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (8 feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.

- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.
- D. Install hardware specified under Section 08 71 00, DOOR HARDWARE.

### **3.2 ADJUSTING**

After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

### **3.3 PROTECTION, CLEANING AND REPAIRING**

Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies glazed aluminum curtain wall system.
  - 1. Thermally isolated, pressure equalized on interior.
  - 2. Type: Stick system to include following:
    - a. Glass.
    - b. Integral reinforcing.
    - c. Closures, trim, subsills and flashings.
    - d. Fasteners, anchors, and related reinforcement.

**1.2 RELATED WORK**

- A. Structural steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Miscellaneous metal members: Section 05 50 00, METAL FABRICATIONS.
- C. Sheet metal flashing and trim: Section 07 60 00, FLASHING AND SHEET METAL.
  - 1. Joint sealants: Section 07 92 00, JOINT SEALANTS.
- D. Aluminum and glass hinged entry doors and storefront construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- E. Aluminum windows: Section 08 51 13, ALUMINUM WINDOWS.
- F. Blast resistance: Section 08 56 53, BLAST RESISTANT GLAZED SYSTEMS FOR MISSION CRITICAL RATED BUILDINGS
- G. Metal framed skylights: Section 08 63 00, METAL-FRAMED SKYLIGHTS.
- H. Glazing: Section 08 80 00, GLAZING.
- I. Seismic requirements: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

**1.3 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
    - a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of type and size required for that project.
    - b. Installer: Manufacturer approved in writing. Continuously installed glazed aluminum curtain walls systems for previous five (5) years.
    - c. Manufacturer shall provide technical field representation at project site, as a minimum, at start of project, during middle,

towards end of project, and during field testing of field mockup panel.

- d. Testing Laboratory: Contractor retained. Engage an AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to perform testing specified in this section.
- e. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
  - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- f. Qualification of Welders:
  - 1) Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials, and equipment of the type required for this work.

B. Mockup

- 1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and design shall be as indicated. Orient mockup to be facing full sun when constructed.
- 2. Performance Test:
  - a. Conduct performance test after approval of visual aspects has been obtained. Finished work shall match approved mock-up.
  - b. Refer to Performance Requirements and Field Quality Control Articles, included hereinafter, for testing requirements.
- 3. Approved Mock-up:
  - a. After completion and approval of test results of job site mockup, as directed, approved mock-up panel shall be used as minimum standard of comparison for entire curtain wall system.

C. Pre-Installation Conference:

- 1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
  - a. Clear understanding of drawings and specifications.



- b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
- c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

#### **1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
  - 1. Manufacturer's standard details and fabrication methods.
  - 2. Data on finishing, components, and accessories.
  - 3. Instructions: Submit descriptive literature, detail specifications, available performance test data and instructions for installation, and adjustments.
  - 4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings:
  - 1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
  - 2. Submit for curtain wall system, accessories, and mock-up. Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings shall be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full size sections, framing, jointing, panels, types and thickness of metal anchorage details, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.
  - 3. Operation and Maintenance Manuals:
    - a. Submit cleaning and maintenance instructions.
- D. Samples:
  - 1. Submit pairs of samples of each specified color and finish on 300 mm (12-inch) long section by width of each tubular, or extruded shape section or 300 mm by 300 mm (12-inch by 12-inch) wide sections of sheet shapes.
  - 2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one

sample minimum 300 mm by 300 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one composite sample incorporating all components and features listed may be submitted.

3. Where normal color variations are anticipated, include 2 or more units in set indicating extreme limits of color variations.

E. Glass:

1. Specified in Section 08 80 00, GLAZING.

F. Quality Control Submittals:

1. Design Data:

- a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings shall be signed and sealed by a structural engineer registered in state in which project is to be located.

2. Factory Test Reports:

- a. Test Reports: Provide certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Manufacturer shall submit appropriate testing numbers for specific tests indicated below.

- 1) Deflection and structural tests.
- 2) Water penetration tests.
- 3) Air infiltration tests.
- 4) Delamination tests.
- 5) Thermal conductance tests.
- 6) Sound transmission loss test.
- 7) Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.

G. Manufacturer's Certificates:

1. Submit Certificates of Compliance, with specification requirements, for the following:
  - a. Metal extrusions.
  - b. Metal accessories.
  - c. Stating that aluminum has been given specified thickness of anodizing or organic coating finish.

- d. Indicating manufacturer's and installer's meet qualifications as specified.
  - e. Submit list of equivalent size installations, for both manufacturer and installer, which have had satisfactory and efficient operation.
- H. Manufacturer's Field Reports:
- 1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project. Indicate results of field testing of mockup field panel, and any directions given Contractor for corrective action.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.
- C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.
- D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Section 07 92 00 JOINT SEALANTS.

#### **1.6 PROJECT CONDITIONS**

Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):  
MCWM-1-89.....Metal Curtain Wall Manual

- CW 10-04.....Care and Handling of Architectural Aluminum from  
Shop to Site
- CW 11-85.....Design Windloads for Buildings and Boundary  
Layer Wind Tunnel Testing
- CW 13-85.....Structural Sealant Glazing Systems (A Design  
Guide)
- CWG 1-89.....Installation of Aluminum Curtain Walls
- TIR A1-04.....Sound Control for Fenestration Products
- TIR A8-08.....Structural Performance of Composite Thermal  
Barrier Framing Systems
- TIR A9-91.....Metal Curtain Wall Fasteners
- TIR A11-04.....Maximum Allowable Deflection of Framing Systems  
for Building Cladding Components of Design Wind  
Loads
- 101/I.S.2/A440-08.....Windows, Doors and Unit Skylights
- 501-05.....Methods of Test for Exterior Walls
- 503-08.....Field Testing of Metal Storefronts, Curtain  
walls and Sloped Glazing Systems
- 2605-98.....High Performance Organic Coatings on  
Architectural Extrusions and Panels
- 1503-09.....Thermal Transmission and Condensation Resistance  
of Windows, Doors and Glazed Wall Sections
- C. American National Standards Institute (ANSI):
- Z97.1-09.....Glazing Materials Used in Buildings, Safety  
Performance Specifications and Methods of Test
- D. American Society of Civil Engineers (ASCE):
- ASCE 7-10.....Minimum Design Loads for Buildings and Other  
Structures
- E. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Structural Steel
- A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products
- A193-10.....Alloy-Steel and Stainless Steel Bolting  
Materials for High Temperature Service
- A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength
- B209-10.....Aluminum and Aluminum Alloy Sheet and Plate
- B211-03.....Aluminum and Aluminum Alloy Bar, Rod, Wire
- B221/B221M-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods,  
Wire, Shapes and Tubes

- B316/B316M-10.....Aluminum and Aluminum Alloy Rivet and Cold-  
Heading, Wire, and Rods
- C578-10.....Rigid Cellular Polystyrene Thermal Insulation
- C612-10.....Mineral Fiber Block and Board Thermal Insulation
- C920-11.....Elastomeric Joint Sealants
- C794-10.....Standard Test Method for Adhesion-In-Peel of  
Elastomeric Joint Sealants.
- C1363-05.....Thermal Performance of Building Materials and  
Envelope Assemblies by Means of a Hot Box  
Apparatus
- D1037-06.....Evaluating the Properties of Wood-Base Fibers  
and Particle Panel Materials
- E84-10.....Surface Burning Characteristics of Building  
Materials
- E90-09.....Laboratory Measurement of Airborne Sound  
Transmission Loss of Building Partitions and  
Elements
- E283-04.....Determining Rate of Air Leakage Through Exterior  
Windows, Curtain Walls, and Doors under  
Specified Pressure Difference Across this  
Specification
- E330-02(R2010).....Structural Performance of Exterior Windows,  
Curtain Walls, and Doors by Uniform Static Air  
Pressure Difference
- E331-00(R2009).....Water Penetration of Exterior Windows, Curtain  
Walls, and Doors By Uniform Static Air Pressure  
Difference
- E413-10.....Classification for Rating Sound Insulation
- E783-02(R2010).....Test Method for Field Measurement of Air Leakage  
Through Installed Exterior Windows and Doors.
- E1105-00(R2008).....Field Determination of Water Penetration of  
Installed Exterior Windows, Curtain Walls, and  
Doors By Uniform or Cyclic Static Air Pressure  
Differences
- F. American Welding Society, Inc. (AWS):
- D1.2-08.....Structural Welding Code-Aluminum
- G. Consumer Product Safety Commission (CPSC):
- 16 CFR 1201.....Architectural Glazing Standards and Related  
Material
- H. Federal Specifications (FS):
- TT-P-645B-90.....Primer, Paint, Zinc-Molybdate, Alkyd Type

- I. Glass Association of North America (GANA):
  - 2010 Edition.....GANA Glazing Manual
  - 2008 Edition.....GANA Sealant Manual
  - 2009 Edition.....GANA Laminated Glazing Reference Manual
  - 2008 Edition.....Tempered Glass Engineering Standard Manual
- J. Military Specifications (MIL):
  - MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent,  
Coal Tar Base
- K. National Association of Architectural Metal Manufacturers (NAAMM):
  - 500 Series (2006).....Metal Finishes Manual.
- L. Steel Structures Painting Council (SSPC)
  - Paint 25-97 (2004).....Red Iron Oxide Raw Linseed Oil and Alkyd Primer  
(Without Lead and Chromate Pigments)

## **1.8 WARRANTY**

- A. Submit manufacturer's written warranty for materials, installation and weathertightness, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Curtain Wall System: Tubular aluminum sections with thermal break condition self supporting supplementary support framing, factory prefinished, glass, insulated metal panel; related flashings, anchorage and attachment devices.
  - 2. System Assembly: Site assembled.
  - 3. No curtain wall framing member shall deflect, in a direction normal to plane of wall, more than 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of TIR A11 and tested in accordance with ASTM E330, except that when a gypsum wallboard surface will be affected, deflection shall not exceed 1/360 of span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E330 for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements. No glass breakage, damage to fasteners, hardware or accessories shall be permitted due to deformation stated above:

- a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with MCWM-1.
  - b. Curtain wall system components and integral door shall be furnished by one manufacturer or fabricator; however, all components need not be products of same manufacturer.
  - c. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.
  - d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).
  - e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.
- B. Manufacturer's Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of curtain walls that are similar to those indicated for this Project in material, design, and extent.
- C. Performance Requirements:
1. Reference Section 08 56 53 - BLAST RESISTANT GLAZED SYSTEMS FOR MISSION CRITICAL RATED BUILDINGS for additional requirements.
  2. System shall meet or exceed all performance requirements specified.
  3. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:
  4. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as indicated on Structural Drawing as measured in accordance with ASTM E330.
  5. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with Section 13 05 41 - SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
  6. Water Penetration:

- a. No water penetration shall occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
  - b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
7. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783
- a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
  - b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq ft) of surface maximum.
8. Deflections Test: ASTM E330, Procedure B:
- a. No member shall deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, shall have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door shall be minimum 1.5 mm (1/16 inch).
9. Delamination Test:
- a. Adhesively bonded metal-faced panels shall show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D1037.
10. Thermal Conductance Tests: ASTM C236.
11. Sound Attenuation Through Wall System (Exterior to Interior):
- a. STC 50, measured in accordance with ASTM E413.

## **2.2 MATERIALS**

- A. Extruded Aluminum Framing Members: ASTM B221M; 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.
  - B. Sheet Aluminum: ASTM B209M; 6065-T5 temper and alloy as recommended by manufacturer.
1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
  2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.



C. Steel Sections: ASTM A36M.

D. Primer: TS TT-P-645; red, for shop application and field touch-up.

E. Fasteners:

1. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.
2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.
3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.

F. Shims: Metal or plastic.

G. Joint Sealants and Accessories:

1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
4. Structural silicone shall not be used to support dead weight of vertical glass or panels.
5. Comply with recommendations of sealant manufacturer for specific sealant selections.
6. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
7. Exposed metal to metal joints: Silicone sealant selected from manufacturer's standard colors.

H. Glazing Materials:

1. As specified under Section 08 80 00, GLAZING.
2. Glazing Gaskets:
  - a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
  - b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
3. Glass Sizes and Clearances:
  - a. Accommodate up to 25 mm (1 inch) glazing.
  - b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove

flares or to reduce oversized dimensions. All cutting shall occur in factory.

4. Glass Setting Materials:

- a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacturer's recommendations.
- b. If used in psychiatric facilities, the glass shall be retained in the framing system in such a manner that it can withstand lateral forces in excess of force required to break the glass. Plastic clips for holding glass are not permitted.

I. Firestopping: Refer to Section 07 84 00, FIRESTOPPING for requirements.

**2.3 FABRICATION**

- A. Curtain wall components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Maintain sightlines indicated on drawings. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- B. Joints: Joints exceeding +1.5 mm (+1/16") shall be mechanically fastened.
- C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
  1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
  2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.
- E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.

- F. Concealed Interior Mullion Reinforcing: ASTM A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123.

## **2.4 PROTECTION**

- A. Provide protection for aluminum against galvanic action, wherever dissimilar materials are in contact, by painting contact surfaces of dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one side.

## **2.5 METAL FINISHES**

- A. In accordance with NAAMM AMP500 series.
- B. Fluorocarbon Finish: AAMA 2605.
  - 1. Color as selected.
- C. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- D. Touch-Up Primer for galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- E. Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 gm/sq m (2.0 oz/sq ft). Primed with iron oxide paint.
- F. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
- B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

## **3.2 PREPARATION**

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

### 3.3 INSTALLATION

- A. Installation and erection of glazed curtain wall system and all components shall be in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.
- B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.
- C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.
- D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).
- E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.
- F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.
- G. Install entire system so that fasteners are not visible.
- H. Tolerances:
  - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
  - 2. Maximum offset from true alignment between two identical members abutting end to end in line: 0.8 mm (1/32 inch).
  - 3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).
- I. Joint Sealants:
  - 1. Joint Sealants: Shall be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
  - 2. Surfaces to be primed and sealed shall be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents

- used to remove coatings shall be of type that leave no residue on metals.
3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters (5 gallons).
  4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.
  5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
  6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
  7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

J. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawing for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.
3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer. All

sashes shall be designed for outside glazing. Provide continuous snap in glazing beads to suit glass as specified.

4. Insulating and tempered glass, and glass of other types that exceed 100 united inches in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Perimeter frames and ventilator sections shall have glazing rebates providing an unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
5. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Weeping of lock-strip gaskets should be in accordance with recommendation of glass manufacturer.

### **3.4 ADJUSTING**

- A. Adjust doors to provide a tight fit at contact points and operate easily.
- B. Adjust weather-stripping to make even contact with surfaces.
- C. Adjust operating hardware and moving parts.

### **3.5 CLEANING**

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

### **3.6 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Contracting Officer for approval.
- B. Conduct field check test for water leakage on designated wall areas after erection to comply with MCWM-1. Conduct test on two wall areas,

two bays wide by two stories high where directed. Conduct test and take necessary remedial action as directed by Contracting Officer.

C. Test Specimen:

1. Test specimen shall include curtain wall assembly and construction. Test chamber shall be affixed to exterior side of test specimen and test shall be conducted using positive static air pressure.
2. Test specimens shall be selected by Contracting Officer after curtain wall system has been installed in accordance with contract drawings and specification.

D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer's field representative, in a minimum of two areas and as follows:

1. Test weatherseal sealant as recommended in writing by sealant manufacturer.

E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.

1. Field air leakage testing is not required for continuous curtain wall systems.
2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.

F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.

1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water shall be present.

G. Retesting:

1. Should system fail field test, system may be modified or repaired, and retested.
2. Should system fail second field test, system may be additionally modified or repaired, and retested.
3. All modifications and repairs made to tested areas shall be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, Contracting Officer may require testing of additional areas of the curtain wall.

H. Rejection:

1. Failure of any of specimens to meet test requirements of third test shall be cause for rejection of wall system and adjacent construction on project.

### 3.7 PROTECTION

- A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -



**SECTION 08 56 53**  
**BLAST RESISTANT WINDOWS**

**PART I - GENERAL**

**1.1 DESCRIPTION**

The extent of exterior metal window units required to provide specified resistances is indicated on Contract Drawings by elevations/details/schedules/notations.

**1.2 RELATED DOCUMENTS**

- A. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- B. Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Mission Critical Facilities, Final Draft.
- C. WinGARD Version 5.5.1 or later.

**1.3 SYSTEM PERFORMANCE**

- A. General: Fabricate and install window assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, glass retention, and hardware. Security attacks shall be unable to penetrate through closed/locked security window assemblies in manner described; it is recognized that such attacks may damage units beyond repair and reuse, requiring replacement.
- B. Blast Resistance: Provide resistance as follows:
  - 1. General:
    - a. Design exterior windows and frames to meet the performance requirements for a 'Mission Critical' facility in accordance with the PSDM.
    - b. Glazed doors shall be designed such that they seat within a continuous door stop, which is mechanically attached to a door frame. Doors may fail outward in response to blast loading and hardware (i.e. hinges and locks) may fail. Glazing for entrance doors shall be laminated. Mullions and structure serving to support doors shall be designed for blast loading.
  - 2. Acceptable Glass Response:
    - a. Blast Resistant Window Systems: windows and glazed doors are to meet the equivalent of GSA Performance Condition 3B or better. Condition 3B is defined as when the glazing breaks, glass fragments enter the space, and land on the floor no further than 10 feet (3 meters) from the window.

3. Window System Design:

- a. Use WinGARD 5.5.1 or latest to design exterior glass panes to resist pressures and impulses as specified herein.
- b. Design Blast Loads: Ramp down load with a peak pressure of 4 psi and impulse of 28 psi-msec (GP2 cap load). This design load shall be applied over the areas tributary to the element being analyzed.
- c. Supporting Structure: Design framing members and mullions to resist the applied blast load over the glass tributary to the mullion applied over the appropriate effective area of the mullion.
  - i. Support Rotation: Limit mullion deformation to no greater than  $L/30$ . Analysis must show that glazing will not disengage from the window framing system when mullion rotations exceed  $2^\circ$  or provide a minimum 1/4-in. of structural silicone sealant in accordance with this specification.
- d. Connections: Design connections to the lesser of the following:
  - i. Design connections to the average peak dynamic loads from the glazing by distributing the dynamic loads over the perimeter length of the frame or the ultimate resistance of the glass panes over the appropriate tributary area, whichever is greater.
  - ii. Sum all mullion reaction forces framing into a connection joint based on each element's flexural yield capacity.
- e. Connection Safety Factors (SF):
  - i.  $SF = 1$  shall be allowed for connection elements that provide a ductile mode of failure (e.g. bolt bearing, tensile yielding, etc.)
  - ii.  $SF = 1.5$  shall be used for connection elements that provide a non-ductile mode of failure (e.g. weld fracture, concrete cone failure due to anchor bolt pull-out, etc.)
  - iii. Connection assembly may be designed for the lesser of a  $SF = 1.5$  or the strength of the actual failure mechanism

in the assembly, provided it is governed by a ductile mode.

f. Spandrel Panels: Analysis should be performed to determine the response of the spandrel glass, panels and/or the back-up wall system. Performance should focus on the limitation of flying debris into occupied space.

i. Glass: Laminated meeting a Performance Condition Level 3B or better.

#### 1.4 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS.

1. Shop drawings showing dimensioned details of metal window units.

Show application of intended glazing materials. Show typical window unit interior and exterior elevations at not less than  $3/4" = 1'-0"$  (1:20) scale. Indicate how window units, not necessarily including basic sub-frames, are to be subsequently removed/replaced; and how glazing unit removal/replacement is to be accomplished. After final modifications and corrections have been incorporated, submit drawings as AutoCAD files with .DWG extension:

a. Details: Show sections at  $3" = 1'-0"$  (1:5) scale of members indicating construction, size, and thickness of components, together with connections, fastenings, and means of separating dissimilar metals.

B. Calculations: Provide calculations prepared by qualified blast consultant verifying that window and glazing meet specific blast resistance requirements detailed in this Section.

1. Prior to performing engineering calculations intended to address the blast loading identified, submit a description of the technique(s) that will be employed to calculate the response of the system to the defined dynamic loading.

2. Calculation package is to include a summary sheet briefly outlining the following:

- a. Evaluation criteria
- b. Calculation assumptions
- c. Table of results by window type/location
- d. Statement of Conformance with specification requirements.

3. Calculation submittal is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed Quality Assurance criteria.
4. Submit single degree of freedom (or better) dynamic analysis for window system. Submit engineering calculations to show that window response meets specified performance requirements under design load. Additionally, illustrate that brittle modes of failure (such as shear and buckling) are avoided. These calculations must include, but may not be limited to, analysis of the following:
  - a. Glass. Determine glass pane performance using an analysis program such as WinGARD (Version 5.5.1 or later), developed by the General Service Administration. If a program other than WinGARD is used, it must be approved by the Owner prior to calculations. WinGARD calculations provided in the calculation package are to include the complete text rather than the "concise" text printout.
  - b. Mullions and framing members. Provide a clear load path from the glass to the primary element and supporting analysis which illustrates each component's ability to transfer the design load to the primary element. Analysis of primary element shall illustrate flexural and shear capacity. Analysis will include verification that the structural silicone sealant can hold the glass in the frame under design loads.
  - c. Anchorage. Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Analyze the window wall anchor clip inserts and fasteners and assemblies, including bolts and stiffeners. Include exact loadings to be transferred to the building structure in the analysis.
  - d. Mechanical Anchors. Mechanical anchor capacities shall be developed from dynamic testing. An International Code Council (ICC-ES) evaluation report showing testing for dynamic loading (i.e. seismic or blast) is to be submitted with calculations.
  - e. Supporting structure. Coordination of the window/supporting structure interaction shall be the contractors' responsibility. The window contractor's engineer performing blast calculations for the window system shall coordinate loading scenarios with the cladding contractor's engineer

providing design for the exterior cladding system. Forces transmitted from the appropriate window tributary area shall be the maximum capacity or design loads, whichever is greater, from the glazing area.

5. Analysis is required to verify its ability to develop its plastic capacity without instability. Additional calculations must include, but may not be limited to, analysis of the following:
  - a. Global performance of mullion. Analysis shall verify that the plastic moment of the mullion, acting in a composite manner with its individual components, can be attained under maximum calculated deflections. Fasteners between each component shall be designed for the plastic capacity of the mullion.
  - b. Lateral torsional buckling. Analysis shall verify the ability of the mullion to provide adequate resistance against lateral torsional buckling under maximum calculated deflections.
  - c. Local buckling. Analysis shall verify the ability of the mullion and its individual components and connections to provide adequate resistance against localized buckling along the entire load path under maximum calculated deflections.
  - d. Structural silicone stress. Analysis shall verify the capacity of the silicone to retain the glass under maximum calculated deflections.

#### **1.5 QUALITY ASSURANCE**

Provide products that meet the requirements of Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Mission Critical-Facilities, Final Draft.

- A. Engineer: Engage an Engineering Professional to perform dynamic analysis of the Blast Resistant Windows. The Engineer shall have a minimum of 5 years experience performing dynamic analysis for blast resistant design and demonstrable experience designing blast resistant window systems in the past 18 months.
- B. Window Bite: The required window system bite must be verified in the field.
- C. Installation Orientation: Windows delivered to the construction site are to be clearly labeled as to the proper installation orientation (i.e. laminated pane of glass to be installed as the interior pane.)

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with Manufacturer's directions and as required to prevent edge damage or other damage to assembly resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, and contact with chemical solvents.
- B. Deliver prefabricated units to Project as completely assembled units, ready for anchorage into supporting structure, and for interfacing with other work.

## **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - ASTM A36/A36M-08..... Standard Specification for Carbon Structural Steel
  - ASTM A123/A123M-09..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - ASTM B221-08..... Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- C. National Association of Architectural Metal Manufacturers (NAAMM)
  - AMP 500-06.....Metal Finishes Manual
- D. Physical Security Design Manual (PSDM) July 2007, for Veteran Affair Mission Critical Facilities, Final Draft.
- E. WinGARD Version 5.5.1 or latest

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER/FABRICATOR**

Certified Units: Provide units and sub-frames which are manufactured/fabricated by firms which have produced identical units required for this Project and which have been certified to comply with requirements for levels of resistance to attack specified.

### **2.2 MATERIALS**

- A. Steel Shapes/Plates/Bars: ASTM A 36, except where another designation is indicated.
- B. Stainless Steel: Provide formed members of AISI Type 304 stainless steel sheet, with No. 4 directional polish.

- C. Bolts and Fasteners: Provide AISI Type 300-series stainless steel screws, bolts, nuts, and washers; comply with ASTM A 320. Provide non-removable type where accessible from attack side.
- D. Aluminum Extrusions/Bars: Provide members complying with ASTM B 221, alloy 6063-T5, -T6, or -T52, or alloy 6061-T6, for principal framing members; provide alloy 6063-T5, -T6, or -T52 for trim and stops which are not exposed to forced entry attack.
- E. Framing Members:
1. Yield Strength: Provide supporting references that grade of steel or aluminum used is capable of achieving calculated ductility ratio.
  2. If dynamic analysis is used, the yield strength of framing members may be increased to account for static increase factors and dynamic strain rate effects as follows:
    - a. Structural Steel: For  $f_y = 36$  ksi, the yield strength may be increased by a factor of 1.42. For  $f_y = 46$  ksi, the yield strength may be increased by a factor of 1.31.
    - b. Structural Aluminum: 6063-T6 Alloy -  $F_y = 25$  ksi, the yield strength may be increased by a factor of 1.14, 6061-T6 Alloy -  $F_y = 35$  ksi, the yield strength may be increased by a factor of 1.09.
  3. Section Modulus: The plastic section modulus may be used in dynamic design calculations.
  4. Built-up Sections: Design built-up sections using ultimate stress and strain compatibility approaches as defined by industry standards. If built-up section is analyzed as one unit, full shear stress transfer along the line of contact between the individual sections must be illustrated.
- F. Glazing Materials: Refer to Section 08 80 00.
1. Glass-to-Glass Interlayers: Clear polyvinyl butyrl (PVB) laminating film/sheet shall be used on the inner lite of exterior window systems.
  2. Window bite: The minimum allowable bite is 1/2" [12.7 mm].
  3. Probability of Failure. To determine the response of the glass and the anchorage loads, the probability of breakage for the glass is to be 750 breaks per 1000.
- G. Structural Silicone Sealant:
1. Ultimate Tensile Stress: Minimum 350 psi in tension.

2. Safety Factors: ultimate tension and shear capacities are to be used with a safety factor of 1.0.
3. Apply the silicone sealant to the interior perimeter of the glass to bond the glass to the frame. The minimum bead size is 1/4" [6 mm].

### **2.3 FABRICATION**

- A. Unit Framing: Shop fabricate unit framing system of section profiles in metal as shown. Provide full-strength, mitered-and-welded corner joints. Provide framing units to achieve specified performances, but not less than metal thicknesses and dimensions shown. Comply with applicable AWS standards for welding, with exposed welds ground reasonably smooth. Provide welded-in-place reinforcements, including anchorage devices as shown. Fabricate metal glazing stops for removal, with mitered corners and countersunk screw attachment to frame.
  1. New Building: Each exterior frame system shall have inner frame, outer frame, and fasteners to connect them together. The outer frame shall be continuous steel frame embedded in exterior wall as concrete wall is constructed. The inner frame shall be preassembled with glazing and shall be bolted to outer frame. Both frames shall be supplied by one manufacturer.
  2. Existing Buildings: The frame shall be continuous steel frame anchored to existing wall with expansion anchors. If two frame system is used, both inner and outer frames shall be supplied by one manufacturer.
- B. Unit Anchorages: Fabricate metal anchorage system/devices as shown, and as required to achieve performance requirements.
- C. Unit Glazing: Install glazing sheets in frames at fabrication plant prior to delivery to project. See section 08 80 00 for laminated glass assemblies that meet the requirements of UFC4-010-01.

### **2.4 FINISHES**

- A. General Finishing: Provide the following factory-applied finishes on the fabricated units of metal window framing and sub-framing, including hardware and accessories. Comply with NAAMM Metal Finishes Manual AMP 500-505-88 as applicable:
  1. Stainless steel: Finish exposed stainless steel components of the work with AISI No. 4 directional polish, except retain manufacturer's standard mill finish on exposed fasteners and similar devices.



2. Fabricated aluminum: Provide Class I clear anodized coating of 0.018 mm thickness; comply with Aluminum Association designation AA-M12C22A41.
3. Fabricated aluminum: Provide Class I, black, color anodized coating of 0.008 inch (0.018 mm) thickness; comply with Aluminum Association designation AAM12C22A42/A44.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine prepared substrate openings to receive framed fenestration units of this Section. Check anchorages for location and coordination of face plans between walls and fenestration units. Check dimensions and clearances for sealant applications.
- B. Coat substrate surfaces of concrete, masonry, or steel where they will be in contact or close proximity with aluminum or stainless steel framing of fenestration units. Apply 1/32 inch (0.76 mm) coating of bituminous paint, confined to surfaces which will be concealed.

#### **3.2 INSTALLATION**

- A. Coordinate installation of window units in sub-frames with installation of expansion joint materials, isolators, joint fillers, spacer strips, tapes, gaskets, sealants, removable sub-frame stops, and other elements as indicated. Tighten bolts for maximum shear and tensile strength, for resisting forces indicated. Comply with Fabricator's instructions and recommendations.
- B. Place installation accessory items as shown and as required for unit installations, including flashings, shims, fillers, bedding materials, and anchorage accessories. Prepare openings for unit interfaces with other work.
- C. Install window units uniformly to lines and elevations indicated, plumb and level, true to plane of optical reflection. Comply with Fabricator's instructions for final assembly and installation. Install anchor bolts and devices as indicated, exercising care to shim and tighten against substrates without distorting or deflecting frames from intended lines. Provide uniform spaces around units for subsequent installation of joint sealer materials, which are not work of this Section, see Division 7 section for sealants.
- D. Anchorage: The window manufacturer is responsible to provide anchors appropriate for substrate to which window assembly is to be fastened.

1. New Building window assembly installation: The window frame system shall consist of inner and outer frame. The outer frame shall be embedded in concrete wall as concrete is placed with sufficient anchorage (embedded studs) to meet performance requirements of this Section. The inner frame shall be anchored to outer frame with ½ inch (13 mm) bolts having the following minimum requirements:
    - a. Yield strength: 130,000 psi (900 MPa)
    - b. Tensile strength: 150,000 psi (1033 MPa)
  2. Existing building window assembly installation: Structural frames shall have pre-drilled bolt holes at 12 inches (300 mm) o.c. maximum. The manufacturer shall verify substrates involved and supply fastening tools (e.g., drill, bit) required by their anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during life of building. The anchor shall also meet the following requirements:
    - a. Anchor diameter: 3/8 inch (10 mm) minimum.
    - b. Embedment and edge distances shall be as certified for window, but not less than the following:
      - i. Embedment in concrete: 3½ inch (90 mm).
      - ii. Embedment in solid masonry: 6 inches (150 mm).
      - iii. Edge distance: 3 inches (75 mm).
    - c. The minimum anchor strengths shall be as certified for window, but not less than:
      - i. Yield strength: 130,000 psi (900 MPa)
      - ii. Tensile strength: 180,000 psi (1240 MPa)
  3. Avoid cutting of rebar during concrete anchor installation.
- E. Remove protective covering from finished metal surfaces, and from exposed glass and plastic glazing sheets.
- F. Overcoat Painting: Refer to Division 9 section on painting for final overcoating on metal framing and trim members of fenestrations units; not work of this section.

### **3.3 CLEANING AND PROTECTION**

- A. General: Upon completion of installation of metal windows, clean exposed surfaces of window units and sub-frames; comply with Fabricator's instructions. Remove excess and migrating joint sealing compounds, dirt, and foreign substances. Repair damaged areas of factory-applied finishes in accordance with Fabricator's instructions;

comply with Project Director's requests. Continue maintenance of exposed finishes through remainder of construction period.

- B. Protection: Provide breakage protection promptly upon completion of fenestration installation. Install crossed streamers of cloth/plastic, adhered to unit framing exterior faces. Maintain through construction completion.
- C. Repair and Replacement: Touch up minor finish damage on metal surfaces where handling and installation have produced marred or abraded areas which can be readily corrected. Replace or refinish units where damage is of greater substance, as directed by Project Director.
- D. Glazing: Clean glazing in accordance with Section 08 80 00, GLAZING.

---END---



**SECTION 08 63 00**  
**METAL-FRAMED CANOPY SKYLIGHTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies field erected aluminum framed standing seam monolithic polycarbonate skylights.
- B. Undivided responsibility for design, fabrication, finishing, and installation of extruded aluminum framed skylights including glass, glazing, sealants, and related metal flashing.
- C. Reference Alternates No. NO. 3 and 5 in Section 01 00 00 - GENERAL REQUIREMENTS.

**1.2 RELATED WORK**

- A. Alternates: section 01 00 00 - GENERAL REQUIREMENTS
- B. Field installed joint sealants in connection with metal-framed skylights: Section 07 92 00, JOINT SEALANTS.
- C. Plastic glazing: Section 08 80 00, GLAZING.

**1.3 QUALITY ASSURANCE:**

- A. Qualifications:
  - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
    - a. Manufacturers Qualifications: Manufacturer with five years continuous documented experience in design, fabrication, and installation of metal-framed skylights of type and size required for that project.
    - b. Manufacturer's product submitted has been in satisfactory and efficient use on minimum of three installations similar and equivalent to this project for past three years.
    - c. Testing Agency Qualifications: ISO 9000 Refer to Performance Requirements and Field Quality Control articles for testing requirements.
    - d. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of metal-framed skylights. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more

methods including preconstruction testing, field testing, or in-service performance:

- 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- e. Welding: Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials and equipment of the type required for this work.
- f. All work shall be in accord with seismic requirements.

B. Pre-Installation Conference:

1. Prior to starting installation of skylight system schedule conference with Contracting Officer to ensure (1) a clear understanding of drawings and specifications; (2) onsite inspection and acceptance of structural and pertinent structural details relating to skylight system; and (3) coordination of work of various trades involved in providing related work. Conference shall be attended by Contractor; personnel directly responsible for installation of skylight system, flashing and sheet metal work and skylight manufacturer. Conflicts shall be resolved and confirmed in writing.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
  1. Manufacturers standard details and fabrication methods.
  2. Data on finishing, components, and accessories.
  3. Instructions: Submit detail specifications and instructions for installation, and adjustments.
  4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Certified test reports by an independent organization:
  1. Self Ignition Temperature (ASTM D-1929-3)
  2. Smoke Density (ASTM D-2843)
  3. Burnimng Extent (ASTM D-635)
- D. Shop Drawings: Show elevations of skylights at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.

- B. Inspect materials delivered to site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on non-absorptive strips or wood platforms. Do not cover frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

#### 1.6 PROJECT CONDITIONS

Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

#### 1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- 501-05.....Methods of Test for Exterior Walls
  - 503-08.....Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems
  - 2605-11.....Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels
  - CW 10-04.....Curtain Wall Manual No. 10 Care and Handling of Architectural Aluminum from Shop to Site
  - CW 13-85.....Curtain Wall Manual #13 Structural Sealant Glazing Systems
- C. American Society for Testing and Materials (ASTM):
- A36/A36M-08.....Carbon Structural Steel
  - A123/A123M-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A193/A193M-10.....Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
  - A307-10.....Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

- B211/B211M-03.....Aluminum-Alloy Bar, Rod and Wire
- B221/B221M-08.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B316/B316M-10.....Specification for Aluminum and Aluminum-Alloy  
Rivet and Cold-Heading Wire and Rods
- C864-05.....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks and Spacers
- C920-11.....Elastomeric Joint Sealants
- D 635-10.....Rate of Burning and/or Extent and Time of  
Burning of Plastics in a Horizontal Position
- D1929-11.....Determining Ignition Temperaturof Plastics
- D2843-10.....Density of smoke from the Burning of  
Decomposition of Plastics
- E283-04.....Determining Rate of Air Leakage Through  
Exterior Windows, Curtain Walls, and Doors  
Under Specified Pressure Differences Across the  
Specimen
- E330-02(R2010).....Structural Performance of Exterior Windows,  
Curtain Walls and Doors by Uniform Static Air  
Pressure Difference
- E331-00(R2009).....Water Penetration of Exterior Windows, Curtain  
Walls, and Doors by Uniform Static Air Pressure  
Difference
- E1105-00(R2008).....Field Determination of Water Penetration of  
Installed Exterior Windows, Curtain Walls, and  
Doors by Uniform or Cyclic Static Air Pressure  
Differences
- D. American Welding Society (AWS):
- D1.2/D1.2M-08.....Structural Welding Code-Aluminum
- E. Glass Association of North America (GANA):
- 2010 Edition.....GANA Glazing Manual
- 2008 Edition.....GANA Sealant Manual
- F. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06.....Metal Finishes Manual
- G. International Organization for Standardization ISO:
- ISO 9000.....International Quality Management System  
Standards and Guidelines



## **1.8 WARRANTY**

Warranty metal skylight against leaks, and structural failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to five years.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

#### **A. Design Requirements:**

1. System shall meet or exceed all performance requirements specified.
2. Extruded aluminum members with a system of alternate serrations for attachment of exterior caps and glass supports.
3. Self-flashing frame.
4. Integral guttering system within skylight framing members for positive drainage of condensation. Integral weeping system to drain to exterior.
5. Flush glazed exterior joints as indicated on contract drawings.
6. All structural silicone shall be factory applied.
7. Glazing shall be standing seam monolithic polycarbonate
8. Glazing Requirement: Refer to Section 08 80 00, GLAZING for glazing requirements.

#### **B. Manufacturer's Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.

#### **C. Performance Requirements:**

1. Structural Members: Of sizes to support design loads as indicated on structural Contract Drawings and as outlined below.
2. Deflection of framing member in a direction normal to plane of glass when subjected to a uniform load deflection test in accordance with ASTM E330, Procedure B, and per above specified structural design loads as indicated on structural contract drawings, shall not exceed 1/175 nor 25 mm (1 inch) of its clear span for clear spans less than 6000 mm (20 feet) or 1/240 of clear spans greater than 6000 mm (20 feet).

3. Air Infiltration: When tested in accordance with ASTM E283, shall not exceed 0.03 L/S per sqm (0.06 cfm per square foot) of fixed skylight surface.
4. Water Penetration: No uncontrolled water shall penetrate when skylight is tested in accordance with ASTM E331 at a differential static pressure of 20 percent of inward acting design wind load pressure, with a minimum of 300Pa (6.24 psf).

## **2.2 MATERIALS**

### **A. Framework:**

1. Principle Supporting Members: 3 mm (0.125 inch) minimum thickness extruded aluminum, alloy 6063-T5, 6063-T6, or 6061-T6 per ASTM B221M. Profiles as indicated on Contract Drawings.
2. Snap-on Covers and Miscellaneous Non-supporting Trim: 1.5 mm (0.062 inch) minimum thickness extruded aluminum, alloy 6063-T5 per ASTM B221M.
3. Principle Formed Metal Members: 3 mm (0.125 inch) minimum thickness aluminum, alloy 5052, 5005, or 6061-T6 per ASTM B209M.
4. Internal Reinforcement: ASTM A36M, steel shapes as required for strength and mullion size limitations, hot-dip galvanized after fabrication in accordance with ASTM A123.
5. Fasteners:
  - a. For exterior cap retainers: ASTM A193 B8 300 series stainless steel screws
  - b. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series stainless steel, and ASTM B316 aluminum rivets, as required by connection.
  - c. For anchoring skylight to support structure: ASTM A307 zinc plated steel fasteners.

## **2.3 PANEL PERFORMANCE**

- A. Panel assembly thickness shall be a minimum 0.15 single panel with exposed interlocking U battens.
- B. Panel width shall not exceed two feet.
- C. Panel Joint System
  1. Panel shall be extruded in one single formable length. Transverse connections are not acceptable.
  2. Panels shall be manufactured with upstands that are integral to the unit. The upstands shall be 90 degrees to the panel face (standing

seam dry glazed concept). Welding or gluing of upstands or standing seam is not acceptable.

3. The aluminum U battens shall have a screw down clamping mechanism to ensure the designed uplift capability.
  4. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.
- D. Flammability: Panel shall be an approved light transmitting plastic with a CC1 fire rating classification per ASTM D635. Smoke density no greater than 75 per ASTM D2843 and a minimum self-ignition temperature of 1000 degrees F per ASTM D1929. The panel shall be self-extinguishing.
- E. OSHA Life Safety Standards 29 CFR 1926.502 (i)(2) and CFR 1910.23 (e)(8). Panel assembly shall withstand impact loading by blunt object of 500 Ft. Lbs. per ASTM E695.
- F. Weatherability: Panels shall consist of a polycarbonate resin with a permanent, co-extruded, ultra-violet protective layer. Post-applied coating or films of dissimilar materials are unacceptable.

#### **2.4 FABRICATIO**

- A. Skylight components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.
- B. Construct skylight(s) using a continuous aluminum curb with expansion joints as required.
- C. Insofar as practicable, fit and assemble work in manufacturer's shop. Work that cannot be permanently assembled shall be shop-assembled, marked and disassembled before shipment to job site.
- D. Design rafter bars for snap-in type glazing strips.
- E. Attach snap-on cap retainers using stainless steel fasteners into a system of alternate serrations, at a maximum spacing of 300 mm (12 inches) on center.
- F. Design snap-on cap retainer fasteners to provide not more than 187 g/mm (10 pounds per linear inch) of compression on glazing strips and glass edge.
- G. Use snap-on type caps to conceal snap-on cap retainer fasteners.

- H. Where applicable, shop rivet or weld aluminum clips to framing members or field bolt at installation.
- I. Set glass with exterior EDPM glazing strips.
- J. Dissimilar Metals: Separate dissimilar metals with bituminous paint or other separator that will prevent galvanic action.
- K. Fasteners: Conceal fasteners wherever possible. Countersink heads of exposed fasteners.

## **2.5 METAL FINISHES**

- A. In accordance with NAAMM AMP 500-505 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 - Chemically etched medium matte, with clear anodic coating, Class 1 Architectural, 0.7-mil thick.
- C. Sealants:
  - 1. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
  - 2. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
  - 3. Structural silicone shall not be used to support dead weight of vertical glass or panels.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

Prior to installation of skylight system, arrange for representative(s) of skylight manufacturer to examine structure and substrate to determine that they are properly prepared, sized and ready to receive skylight work included herein.

### **3.2 INSPECTION AND PREPARATION**

Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.

### **3.3 INSTALLATION**

- A. Install skylight frame, plastic glazing and accessory items as needed in accordance with manufacturer's instructions.
- B. Install skylight system by factory trained mechanics.
- C. Erect system plumb and true in proper alignment and relation to established lines and grades as shown on approved shop drawings.
- D. Anchor skylight to structure in strict accordance with approved Shop Drawings.

- E. Use high-performance silicone sealants to seal horizontal joints between glass panels and silicone sealant to wet seal joints between snap-on cap retainers and glass.
- F. Apply sealing materials in strict accordance with sealant manufacturer's instructions. Before application, remove mortar dirt, dust, moisture and other foreign matter from surfaces it will contact. Mask adjoining surfaces to maintain a clean, neat appearance. Tool sealing compounds to fill joint and provide a smooth finish.

### **3.4 TOLERANCES**

- A. All parts of work, when completed, shall be within the following tolerances:
  - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length, or 10 mm (3/8 inch) in total length.
  - 2. Maximum offset from true alignment between two members abutting end-to-end, edge-to-edge in line: .75 mm (1/32 inch).

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field quality-control tests and to prepare test reports.
- B. Sealant Adhesion Tests: Test installed sealant in a minimum of two areas and as follows:
- C. Repair or replace Work that does not meet requirements or that is damaged by testing; repair or replace to comply with specifications.

### **3.6 CLEANING**

- A. Install skylight frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of skylight manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Clean glass just prior to time of final acceptance of building, subsequent to completion of installation.

### 3.7 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

- - - E N D - - -

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: Section 08 14 00, WOOD DOORS; Section 08 11 13, HOLLOW METAL DOORS AND FRAMES; and Section 08 71 13, AUTOMATIC DOOR OPERATORS.
- C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- E. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Electrical: Division 26, ELECTRICAL.
- G. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

**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, if possible, except as otherwise specified:
  - 1. Mortise locksets.
  - 2. Hinges for hollow metal and wood doors.
  - 3. Surface applied overhead door closers.

4. Exit devices.
5. Floor closers.

#### 1.4 WARRANTY

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.24-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
1. Locks, latchsets, and panic hardware: 5 years.
  2. Door closers and continuous hinges: 10 years.

#### 1.5 MAINTENANCE MANUALS

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

#### 1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23 plus 2 copies to the VAMC Locksmith (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 PREINSTALLATION MEETING**

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

#### **1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mates, 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. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers which are considered equivalent to those specified may be used. Manufacturers whose products are specified are identified by abbreviations as follows:

|                 |                                         |                   |
|-----------------|-----------------------------------------|-------------------|
| Adams-Rite      | Adams Rite Mfg. Co.                     | Pomona, CA        |
| Best            | Best Access Systems                     | Indianapolis, IN  |
| Don-Jo          | Don-Jo Manufacturing                    | Sterling, MA      |
| G.E. Security   | GE Security, Inc.                       | Bradentown, FL    |
| Markar          | Markar Architectural Products           | Pomona, CA        |
| Pemko           | Pemko Manufacturing Co.                 | Ventura, CA       |
| Rixson          | Rixson                                  | Franklin Park, IL |
| Rockwood        | Rockwood Manufacturing Co.              | Rockwood, PA      |
| Securitron      | Securitron Magnalock Corp.              | Sparks, NV        |
| Southern Folger | Southern Folger Detention Equipment Co. | San Antonio, TX   |
| Stanley         | The Stanley Works                       | New Britain, CT   |
| Tice            | Tice Industries                         | Portland, OR      |
| Trimco          | Triangle Brass Mfg. Co.                 | Los Angeles, CA   |
| Zero            | Zero Weather Stripping Co.              | New York, NY      |

- C. Keying: All cylinders shall be keyed into existing Great 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 6 pin type. Keying information shall be furnished at a later date by the Resident Engineer.
- D. Keying: A new Great Grandmaster key shall be established for this project. The key system shall be small format (Best size and profile) removable core type as previously described. The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced

by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.

1. Keying information will be furnished to the Contractor by the Resident Engineer.
2. 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):
- F883-04.....Padlocks
- E2180-07.....Standard Test Method for Determining the  
Activity of Incorporated Antimicrobial Agent(s)  
In Polymeric or Hydrophobic Materials
- C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
- A156.1-06.....Butts and Hinges
- A156.2-03.....Bored and Pre-assembled Locks and Latches
- A156.3-08.....Exit Devices, Coordinators, and Auto Flush  
Bolts
- A156.4-08.....Door Controls (Closers)
- A156.5-01.....Auxiliary Locks and Associated Products
- A156.6-05.....Architectural Door Trim
- A156.8-05.....Door Controls-Overhead Stops and Holders
- A156.12-05 .....Interconnected Locks and Latches
- A156.13-05.....Mortise Locks and Latches Series 1000
- A156.14-07 .....Sliding and Folding Door Hardware

- A156.15-06.....Release Devices-Closer Holder, Electromagnetic  
and Electromechanical
- A156.16-08.....Auxiliary Hardware
- A156.17-04 .....Self-Closing Hinges and Pivots
- A156.18-06.....Materials and Finishes
- A156.20-06 .....Strap and Tee Hinges, and Hasps
- A156.21-09.....Thresholds
- A156.22-05.....Door Gasketing and Edge Seal Systems
- A156.23-04.....Electromagnetic Locks
- A156.24-03.....Delayed Egress Locking Systems
- A156.25-07 .....Electrified Locking Devices
- A156.26-06.....Continuous Hinges
- A156.28-07 .....Master Keying Systems
- A156.29-07 .....Exit Locks and Alarms
- A156.30-03 .....High Security Cylinders
- A156.31-07 .....Electric Strikes and Frame Mounted Actuators
- 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 (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

## **2.2 CONTINUOUS HINGES**

A. ANSI/BHMA A156.26, Grade 1-600.

1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.

1. Base Metal for Exterior Hinges: Stainless steel.
2. Base Metal for Interior Hinges: Steel
3. Base Metal for Hinges for Fire-Rated Assemblies: Steel.
4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.

5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

### **2.3 DOOR CLOSING DEVICES**

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

### **2.4 OVERHEAD CLOSERS**

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
  1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
  2. Where specified, closer shall have hold-open feature.
  3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
  4. Material of closer body shall be forged or cast.
  5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
  6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
  7. Closers shall have full size metal cover; plastic covers will not be accepted.
  8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.

9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1-1/2" (38mm) minimum piston diameter.

## **2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS**

- A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements for concealed type floor closers for classes of fire doors indicated on drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single acting floor closers shall also have built in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer

case, provide closer without floor plate and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.

B. Where floor closer appears in hardware set provide the following as applicable.

1. Double Acting Floor Closers: Type C06012.
2. Single Acting Floor Closer: Type C06021 (center pivoted).  
(Intermediate pivot is not required).
3. Single Acting Floor Closers: Type C06041 (offset pivoted).
4. Single Acting Floor Closer for Labeled Fire Doors: Type C06051  
(offset pivoted).
5. Single Acting Floor Closers For Lead Lined Doors: Type C06071  
(offset pivoted).

## **2.6 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. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.



- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
- L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

## **2.7 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.

## **2.8 FLOOR DOOR HOLDERS**

- A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

## **2.9 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than six 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 following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching Sargent "LNJ. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. 3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware.

## **2.10 PUSH-BUTTON COMBINATION LOCKS**

- A. ANSI/BHMA A156.13, Grade 1. Battery operated pushbutton entry.
- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.

- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

## **2.11 ELECTROMAGNETIC LOCKS**

- A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."
1. Type: Full exterior or full interior, as required by application indicated.
  2. Strength Ranking: 1500 lbf (6672 N)
  3. Inductive Kickback Peak Voltage: Not more than 53.
  4. Residual Magnetism: Not more than 4 lbf (18 N) to separate door from magnet.
- B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory".
1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds, as required by NFPA 101.
  2. Security Grade: Activated from secure side of door by initiating device.
  3. Movement Grade: Activated by door movement as initiating device.
  4. The lock housing shall not project more than 4-inches (101mm) from the underside of the frame head stop.

## **2.12 ELECTRIC STRIKES**

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-secure electric strikes at fire-rated doors.

## **2.13 KEYS**

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

| <b>Locks/Keys</b>               | <b>Quantity</b>            |
|---------------------------------|----------------------------|
| Cylinder locks                  | 2 keys each                |
| Cylinder lock change key blanks | 100 each different key way |
| Master-keyed sets               | 6 keys each                |
| Grand Master sets               | 6 keys each                |

|                        |        |
|------------------------|--------|
| Great Grand Master set | 5 keys |
| Control key            | 2 keys |

- B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

#### **2.14 KEY CABINET**

- A. ANSI Standard A156.5. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.
- B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."
- C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.
- D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the Resident Engineer.

## **2.15 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING**

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates and door edging as specified below:
  - 1. Kick plates, mop plates and armor plates of metal, Type J100 series.
  - 2. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
  - 3. Kick plates and/or mop plates are not required on following door sides:
    - a. Armor plate side of doors;
    - b. Exterior side of exterior doors;
    - c. Closet side of closet doors;
    - d. Both sides of aluminum entrance doors.
  - 4. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
  - 5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
  - 6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge

guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

## **2.16 EXIT DEVICES**

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

## **2.17 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).

#### **2.18 FLUSH BOLTS (AUTOMATIC)**

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).
- B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

#### **2.19 DOOR PULLS**

- A. Conform to ANSI A156.6. Pull plate 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Cut plates of door pulls for cylinders, or turn pieces where required.

#### **2.20 PUSH PLATES**

- A. Conform to ANSI A156.6. Metal, Type J302, 200 mm (8 inches) wide by 350 mm (14 inches) high. Provide metal Type J300 plates 100 mm (4 inches wide by 350 mm (14 inches) high) where push plates are specified for doors with stiles less than 200 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

#### **2.21 COMBINATION PUSH AND PULL PLATES**

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

#### **2.22 COORDINATORS**

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of

doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

## **2.23 THRESHOLDS**

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

## **2.24 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS**

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

## **2.25 WEATHERSTRIPS (FOR EXTERIOR DOORS)**

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

## **2.26 MISCELLANEOUS HARDWARE**

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.



- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:
1. Folding doors and partitions.
  2. Wicket door (in roll-up door assemblies).
  3. Slide-up doors.
  4. Swing-up doors.
  5. Fire-rated access doors-Engineer's key set.
  6. Doors from corridor to electromagnetic shielded room.
  7. Day gate on vault door.
- C. 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.

## **2.27 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES**

- A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.
- B. Key padlocks as follows:
1. Constant Temperature and Cold Rooms in Research Departments:  
Research Laboratory Set.
  2. Cold Room in Morgue Department: Autopsy Set.
  3. Refrigerators in Canteen Department: Canteen Storage Set.
  4. All Refrigerator Rooms in Main Kitchen Department: Kitchen Storage Set.
  5. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
  6. Chain Link Fence Gates for Oxygen Storage Buildings: Maintenance supply set.
  7. Roof Access and Scuttles: Engineer's set.
  8. Hinged Wicket in Post Office Partitions: Post Office set.

C. Omit padlocks on communicating refrigerator doors.

## **2.28 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS**

- A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.5. Key locks in Key Sets approved by Contracting Officer. See mechanical drawings and specifications for location of cabinets.
- B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

## **2.29 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS**

- A. Butt hinges, type A8133 (special swaging) 100 mm by 90 mm (4 inches by 3-1/2 inches), Finish US2C.
  - 1. 3 hinges for guards over 1060 mm (3-1/2 feet) high.
  - 2. 2 hinges for guards less than 1060 mm (3-1/2 feet) high.
- B. Conform to ANSI A156.5. Lock Type E06081 for guards and Type E06061 for partitions.
  - 1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.
  - 2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed drawings for number of locks and butt hinges required for each guard).

## **2.30 FINISHES**

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

6. Cover plates for floor hinges and pivots: 630.
7. Other primed steel hardware: 600.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.
- E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.
- F. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag<sup>+</sup>). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

## **2.31 BASE METALS**

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

| <b>Finish</b> | <b>Base Metal</b> |
|---------------|-------------------|
| 652           | Steel             |
| 626           | Brass or bronze   |
| 630           | Stainless steel   |

## **PART 3 - EXECUTION**

### **3.1 HARDWARE HEIGHTS**

- A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA Resident Engineer for approval.
- B. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- C. Hardware Heights from Finished Floor:
- Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  - Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  - 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 except security bedroom, bathroom and anteroom doors 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)<br>(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. 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.

#### **ELECTRIC HARDWARE ABBREVIATIONS LEGEND:**

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

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HW-1

Each Door to Have:

NON-RATED

|                           |                                                |
|---------------------------|------------------------------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED                    |
|                           | X HOSPITAL TIPS @ INSWING DOORS                |
| 1 Latchset                | Sargent 8215 x BHL (Antiligature), or<br>equal |
| 1 Floor Stop              | L02121 x 3 FASTENERS                           |
| 1 Set Self-Adhesive Seals | R0E154                                         |
| 1 Automatic Door Bottom   | R0Y346 - HEAVY DUTY                            |

HW-2

Each Door to Have:

RATED/NON-RATED

|                                |                                 |
|--------------------------------|---------------------------------|
| Hinges                         | QUANTITY & TYPE AS REQUIRED     |
|                                | X HOSPITAL TIPS @ INSWING DOORS |
| 1 Keyed Privacy Indicator Lock | F13 x OCCUPANCY INDICATOR       |
| 1 Closer                       | C02011/C02021                   |
| 1 Kick Plate                   | J102                            |
| 1 Mop Plate (@ Inswing Doors)  | J102                            |
| 1 Floor Stop                   | L02121 x 3 FASTENERS            |
| 1 Set Self-Adhesive Seals      | R0E154                          |

HW-3

Each Door to Have:

NON-RATED

|                                  |                                                         |
|----------------------------------|---------------------------------------------------------|
| 1 Center Pivot Set               | C07042                                                  |
| 1 Privacy Lock                   | F02-MOD x THUMBTURN BOTH SIDES X<br>OCCUPANCY INDICATOR |
| 1 Rescue Stop                    | ES-1 (STANLEY), OR EQUAL                                |
| 1 Custom Rescue Strike           | CUSTOM DOUBLE-LIPPED (TICE), OR EQUAL                   |
| 1 Kick Plate                     | J102                                                    |
| 1 Mop Plate                      | J102                                                    |
| 1 Wall Stop                      | L52101 CONVEX                                           |
| STONE THRESHOLD BY OTHER TRADES. |                                                         |

HW-4

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Each Door to Have:

RATED/NON-RATED

|                           |                                    |
|---------------------------|------------------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED        |
| 1 Storeroom Lock          | F07 x Modified - LESS TRIM OUTSIDE |
| 1 Flush Pull              | Rockwood 95A, or equal             |
| 1 Closer                  | C02011/C02021                      |
| 1 Kick Plate              | J102                               |
| 1 Set Self-Adhesive Seals | R0E154                             |

HW-5

Each Door to Have:

NON-RATED

|                               |                                 |
|-------------------------------|---------------------------------|
| Hinges                        | QUANTITY & TYPE AS REQUIRED     |
|                               | X HOSPITAL TIPS @ INSWING DOORS |
| 1 Push Plate                  | J304 8" x 16"                   |
| 1 Hospital Grip               | J401                            |
| 1 Kick Plate                  | J102                            |
| 1 Mop Plate (@ Inswing Doors) | J102                            |
| 1 Closer                      | C02011/C02021                   |
| 1 Floor Stop                  | L02121 x 3 FASTENERS            |
| 3 Silencers                   | L03011                          |

HW-6

Each Door to Have:

RATED

|                           |                                 |
|---------------------------|---------------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED     |
|                           | X HOSPITAL TIPS @ INSWING DOORS |
| 1 Classroom Lock          | F05                             |
| 1 Floor Stop              | L02121 x 3 FASTENERS            |
| 1 Set Self-Adhesive Seals | R0E154                          |



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HW-7

Each Door to Have:

RATED

|                               |                                 |
|-------------------------------|---------------------------------|
| Hinges                        | QUANTITY & TYPE AS REQUIRED     |
|                               | X HOSPITAL TIPS @ INSWING DOORS |
| 1 Classroom Lock              | F05                             |
| 1 Closer                      | C02011/C02021 x Hold Open       |
| 1 Kick Plate                  | J102                            |
| 1 Mop Plate (@ Inswing Doors) | J102                            |
| 1 Floor Stop                  | L02121 x 3 FASTENERS            |
| 1 Set Self-Adhesive Seals     | R0E154                          |

HW-7a

Each Door to Have:

RATED

|                               |                                 |
|-------------------------------|---------------------------------|
| Hinges                        | QUANTITY & HEAVY WEIGHT         |
|                               | X HOSPITAL TIPS @ INSWING DOORS |
| 1 Storeroom Lock              | F07                             |
| 1 Deadbolt                    | EO6081                          |
| 1 Electric Strike             | HES 8000 x Fail Secure          |
| 1 Closer                      | C02011/C02021                   |
| 1 Kick Plate                  | J102                            |
| 1 Mop Plate (@ Inswing Doors) | J102                            |
| 1 Floor Stop                  | L02121 x 3 FASTENERS            |
| 1 Set Self-Adhesive Seals     | R0E154                          |
| Card Reader and Door Contact  | By Division 28 Contractor       |

HW-8

Each Door to Have:

RATED/NON-RATED

|                               |                             |
|-------------------------------|-----------------------------|
| Hinges                        | QUANTITY & TYPE AS REQUIRED |
| 1 Storeroom Lock              | F07 x Tactile               |
| 1 Closer                      | C02011/C02021               |
| 1 Kick Plate                  | J102                        |
| 1 Mop Plate (@ Inswing Doors) | J102                        |
| 1 Floor Stop                  | L02121 x 3 FASTENERS        |
| 1 Auto Door Bottoms           | R0Y346 - HEAVY DUTY         |
| 1 Set Self-Adhesive Seals     | R0E154                      |

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HW-9

| <u>Each Door to Have:</u>     | <u>RATED/NON-RATED</u>      |
|-------------------------------|-----------------------------|
| Hinges                        | QUANTITY & TYPE AS REQUIRED |
| 1 Storeroom Lock              | F07                         |
| 1 Closer                      | C02011/C02021               |
| 1 Kick Plate                  | J102                        |
| 1 Mop Plate (@ Inswing Doors) | J102                        |
| 1 Floor Stop                  | L02121 x 3 FASTENERS        |
| 1 Auto Door Bottoms           | R0Y346 - HEAVY DUTY         |
| 1 Set Self-Adhesive Seals     | R0E154                      |

HW-10

| <u>Each Door to Have:</u> | <u>RATED/NON-RATED</u>               |
|---------------------------|--------------------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED          |
|                           | X HOSPITAL TIPS @ INSWING DOORS      |
| 1 Classroom Lock          | F05                                  |
| 1 Closer                  | C02011/C02021 x Spring Stop & Holder |
| 1 Kick Plate              | J102                                 |
| 1 Mop Plate               | J102                                 |
| 1 Set Self-Adhesive Seals | R0E154                               |

HW-11

| <u>Each Pair to Have:</u>                 | <u>RATED/NON-RATED</u>       |
|-------------------------------------------|------------------------------|
| Hinges                                    | QUANTITY & TYPE AS REQUIRED  |
| 2 Exit Devices                            | TYPE 2 x 01 LESS BOTTOM BOLT |
| 2 Magnetic Closer/holders                 | EMCH                         |
| 2 Kick Plates                             | J102                         |
| 2 Floor Stops                             | L02121 x 3 FASTENERS         |
| 1 Set Self-Adhesive Seals                 | R0E154                       |
| Interface with Building Fire Alarm System |                              |

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HW-12

| <u>Each Door to Have:</u>  | <u>RATED/NON-RATED</u>                              |
|----------------------------|-----------------------------------------------------|
| Hinges                     | QUANTITY & TYPE AS REQUIRED                         |
| 1 Transfer Hinge           | 4-WIRE TYPE AS REQUIRED                             |
| 1 Electrified Exit Device  | Type 3 x 12 x Fail Secure w/REX 24VDC               |
| 1 Power Supply             | REGULATED, FILTERED, 24VDC, AMPERAGE<br>AS REQUIRED |
| 1 Closer                   | C02011/C02021                                       |
| 1 Kick Plate               | J102                                                |
| 1 Mop Plate                | J102                                                |
| 1 Floor Stop               | L02121 x 3 FASTENERS                                |
| 1 Set Self-Adhesive Seals  | R0E154                                              |
| Card Reader & Door Contact | By Division 28 Contractor                           |

HW-13

| <u>Each Door to Have:</u> | <u>RATED/NON-RATED</u>      |
|---------------------------|-----------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED |
| 1 Exit Device             | TYPE 3 x 08                 |
| 1 Closer                  | C02011/C02021               |
| 1 Kick Plate              | J102                        |
| 1 Mop Plate               | J102                        |
| 1 Floor Stop              | L02121 x 3 FASTENERS        |
| 1 Set Self-Adhesive Seals | R0E154                      |

HW-13a

| <u>Each Door to Have:</u> | <u>RATED/NON-RATED</u>           |
|---------------------------|----------------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED      |
| 1 Exit Device             | TYPE 3 x 08                      |
| 1 Electric Strike         | HES 9600 x Fail Secure, or equal |
| 1 Closer                  | C02011/C02021                    |
| 1 Kick Plate              | J102                             |
| 1 Mop Plate               | J102                             |
| 1 Floor Stop              | L02121 x 3 FASTENERS             |
| 1 Set Self-Adhesive Seals | R0E154                           |

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR  
OPERATORS.

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HW-14

| <u>Each Door to Have:</u>     | <u>RATED/NON-RATED</u>      |
|-------------------------------|-----------------------------|
| Hinges                        | QUANTITY & TYPE AS REQUIRED |
| 1 Storeroom Lock              | F07                         |
| 1 Closer                      | C02011/C02021               |
| 1 Kick Plate                  | J102                        |
| 1 Mop Plate (@ Inswing Doors) | J102                        |
| 1 Floor Stop                  | L02121 x 3 FASTENERS        |
| 1 Set Self-Adhesive Seals     | R0E154                      |

HW-15

| <u>Each Door to Have:</u> | <u>RATED/NON-RATED</u>      |
|---------------------------|-----------------------------|
| Hinges                    | QUANTITY & TYPE AS REQUIRED |
| 1 Exit Device             | TYPE 3 x 12 LESS LEVER      |
| 1 Flush Pull              | Rockwood 95A, or equal      |
| 1 Closer                  | C02011/C02021               |
| 1 Kick Plate              | J102                        |
| 1 Mop Plate               | J102                        |
| 1 Set Self-Adhesive Seals | R0E154                      |

HW-16

| <u>Each Door to Have:</u>   | <u>NON-RATED</u>                      |
|-----------------------------|---------------------------------------|
| 1 Continuous Hinge          | A51031B                               |
| 1 Exit Device               | Von Duprin 98EO, or equal             |
| 1 Closer                    | C02011/C02021                         |
| 1 Kick Plate                | J102                                  |
| 1 Door Sweep                | 90100CNB (PEMKO), OR EQUAL            |
| 1 Set Frame Seals           | 2891AS X CSK SCREWS (PEMKO), OR EQUAL |
| 1 Drip                      | R0Y976                                |
| 1 Threshold (outswing door) | J35130 x SILICONE GASKET              |

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HW-17

Each Pair to Have:

NON-RATED

|   |                              |                                                       |
|---|------------------------------|-------------------------------------------------------|
| 2 | Continuous Hinges            | A51031B x Power Transfer                              |
| 2 | Electric Exit Devices        | Von Duprin RX-EL-9847TL/NL x 370 Control,<br>or equal |
| 2 | Power Transfers              | Manufacturer Standard                                 |
| 1 | Power Supply                 | Manufacturer Standard                                 |
| 2 | Pulls                        | Rockwood BF158, or equal                              |
| 2 | Door Sweeps                  | 90100CNB (PEMKO), OR EQUAL                            |
|   | Gasketing                    | By Door/Frame Manufacturer                            |
| 2 | Drips                        | R0Y976                                                |
| 1 | Threshold (outswing door)    | J35130 x SILICONE GASKET                              |
|   | Card Reader and Door Contact | By Division 28 Contractor                             |

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

HW-18

Each Pair to Have:

NON-RATED

|   |                           |                                                       |
|---|---------------------------|-------------------------------------------------------|
| 2 | Continuous Hinges         | A51031B x Power Transfer                              |
| 2 | Electric Exit Devices     | Von Duprin RX-EL-9847TL/NL x 370 Control,<br>or equal |
| 2 | Power Transfers           | Manufacturer Standard                                 |
| 1 | Power Supply              | Manufacturer Standard                                 |
| 2 | Door Sweeps               | 90100CNB (PEMKO), OR EQUAL                            |
|   | Gasketing                 | By Door/Frame Manufacturer                            |
| 2 | Drips                     | R0Y976                                                |
| 1 | Threshold (outswing door) | J35130 x SILICONE GASKET                              |

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

VA Medical Center, Manchester Campus  
Bldgs 1 & 18, 781 Smyth Road, Manchester, NH 03104  
Mental Health Addition/Improvements, Project 608-313

HW-19

Each Pair to Have:

NON-RATED

|                     |                            |
|---------------------|----------------------------|
| 2 Continuous Hinges | A51031B                    |
| 2 Push Bars         | Rockwood 47, or equal      |
| 2 Pulls             | Rockwood BF158, or equal   |
| Gasketing           | By Door/Frame Manufacturer |

AUTOMATIC DOOR OPERATORS AND CONTROLS BY SECTION 08 71 13, AUTOMATIC DOOR OPERATORS.

HW-20

Each Door to Have:

RATED/NON-RATED

|                            |                                                     |
|----------------------------|-----------------------------------------------------|
| Hinges                     | QUANTITY & TYPE AS REQUIRED                         |
| 1 Transfer Hinge           | 4-WIRE TYPE AS REQUIRED                             |
| 1 Electrified Lock         | F07 x Fail Secure w/REX 24VDC                       |
| 1 Power Supply             | REGULATED, FILTERED, 24VDC, AMPERAGE<br>AS REQUIRED |
| 1 Closer                   | C02011/C02021                                       |
| 1 Kick Plate               | J102                                                |
| 1 Mop Plate                | J102                                                |
| 1 Floor Stop               | L02121 x 3 FASTENERS                                |
| 1 Set Self-Adhesive Seals  | R0E154                                              |
| Card Reader & Door Contact | By Division 28 Contractor                           |

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**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies equipment, controls and accessories for automatic operation of swing doors.

**1.2 RELATED WORK**

- A. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- B. Door hardware; Section 08 71 00, DOOR HARDWARE.
- C. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- D. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.
- E. Section 28 31 00, FIRE DETECTION AND ALARM.

**1.3 QUALITY ASSURANCE**

- A. Automatic door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years and shall be the same manufacturer of operators in the existing facility.
- B. One type of automatic door equipment shall be used throughout the building.
- C. Equipment installer shall have specialized experience and shall be approved by the manufacturer.

**1.4 WARRANTY**

- A. Automatic door operators shall be subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that the Warranty period shall be two years in lieu of one year.

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on automatic door operators.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.

C. Shop Drawings:

1. Showing location of controls and safety devices in relationship to each automatically operated door.
2. Showing layout, profiles, product components, including anchorage, accessories, as applicable.
3. Submit templates, wiring diagrams, fabrication details and other information to coordinate the proper installation of the automatic door operators.

D. Submit in writing to Resident Engineer that items listed in Article 1.3 are in compliance.

**1.7 DESIGN CRITERIA**

- A. As a minimum automatic door equipment shall comply with the requirements of BHMA 156.10. Except as otherwise noted on drawings, provide operators which can be adjusted to move the doors from the fully closed to fully opened position in three to seven seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Provide all motor, starter, controls, associated devices, and interconnecting wiring required for the installation. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

**1.8 APPLICABLE PUBLICATIONS**

- . The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Builders Hardware Manufacturers Association, Inc. (BHMA):  
A156.10-05.....Power Operated Pedestrian Doors (BHMA 1601)
- C. National Fire Protection Association (NFPA):  
101-09.....Life Safety Code
- D. Underwriters Laboratory (UL):  
325-10.....Door, Drapery, Gate, Louver, and Window  
Operators and Systems

**1.9 DELIVERY AND STORAGE**

- A. Delivery shall be in factory's original, unopened, undamaged container with identification labels attached.



## **PART 2 - PRODUCTS**

### **2.1 SWING DOOR OPERATORS**

- A. General: Swing door operators shall be of institutional type, door panel size 600 mm to 1250 mm (2'-0" to 5'-0") width, weight not to exceed 300 kg (600 pounds), electric operated for overhead mounting within the header or transom. Furnish metal mounting supports, brackets and other accessories necessary for the installation of operators at the head of the door frames. The motor on automatic door operator shall be provided with an interlock so that the motor will not operate when doors are electrically locked from opening. Operators shall be manufactured by the same company that manufactured the operators in the existing building.
- B. Operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall be capable of recycling doors instantaneously to full open position from any point in the closing cycle when control switch is activated. Operators shall, when automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.
- C. Operator, enclosed in housing, shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power, or controlled by hydraulic closer in electro-hydraulic operators. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:
1. Operator Housing: Housing shall be a minimum of 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems. All structural sections shall have a minimum thickness of 3.2 mm (0.125 inch) and be fabricated of a minimum of 6063-T5 aluminum alloy.
  2. Power Operator: Completely assembled and sealed unit which shall include gear drive transmission, mechanical spring and bearings, all located in aluminum case and filled with special lubricant for extreme temperature conditions. Complete unit shall be rubber

- mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
3. Connecting hardware shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing. Door shall not pivot on shaft of operator.
  4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. All connecting harnesses shall have interlocking plugs.

## **2.2 MICROPROCESSOR CONTROLS**

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1-30 seconds), LED indications for sensor input signals and operator status and power assist close options. Control shall be capable of receiving activation signals from any device with normally open dry contact output. All activation modes shall provide fully adjustable opening speed:
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and stops the opening direction of the door if an obstruction is sensed. The motor shall include a recycle feature that reopens the door if an obstruction is sensed at any point during the closing cycle. The control shall include a standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated in the architectural drawings.

## **2.3 POWER UNITS**

Each power unit shall be self-contained, electric operated and independent of the door operator. Capacity and size of power circuits shall be in accordance with automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

## **2.4 DOOR CONTROLS**

- A. Opening and closing actions of doors shall be actuated by controls and safety devices specified, and conform to ANSI 156.10. Controls shall cause doors to open instantly when control device is actuated; hold doors in open positions; then, cause doors to close, unless safety device or reactivated control interrupts operation.
- B. Manual Controls:

1. Push Plate Wall Switch: Recess type, stainless steel push plate minimum 100 mm by 100 mm (four-inch by four-inch), with 13 mm (1/2-inch) high letters "To Operate Door--Push" engraved on face of plate.

C. Motion Detector: The motion detector may be surface mounted or concealed, to provide a signal to actuate the door operator, and monitor the immediate zone, to detect intrusion by persons, carts or similar objects. The zone which the detector monitors shall be 1500 mm (five feet) deep and 1500 mm (five feet) across, plus or minus 150 mm (six inches) on all dimensions. The maximum response time shall be no less than 25 milliseconds. Unit shall be designed to operate on 24 volts AC. The control shall not be affected by cleaning material, solvents, dust, dirt and outdoor weather conditions.

## **2.5 SAFETY DEVICES**

- A. General: Area over which doors swing or slide shall be a safety section and anyone standing in path of door's movement shall be protected by a safety device.
- B. Each swing door shall have installed on the pull side a presence sensor to detect any person standing in the door swing path and prevent the door from opening.
- C. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.
- D. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment, in finish work.
- B. Install power units in locations shown. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and must function properly for the type of traffic (pedestrians, carts, stretchers and wheelchairs) expected to

pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.

- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the Resident Engineer.

### **3.2 INSTRUCTIONS**

- A. Following the installation and final adjustments of the door operators, the installer shall fully instruct VA personnel for 4 hours on the operating, servicing and safety requirements for the swing and sliding automatic door operators.
- B. Coordinate instruction to VA personnel with VA Resident Engineer.

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**SECTION 08 80 00**  
**GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

**1.2 RELATED WORK**

- A. Factory glazed by manufacturer in following units:
1. Wood doors: Section 08 14 00, INTERIOR WOOD DOORS
  2. Storefront/entrance: Section 08 41 13, ALUMINUM FRAMED ENTRANCES AND STOREFRONT WALL SYSTEM
  3. Strip windows: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS
  4. Ballistic Resistant glazing: Section 08 56 53, BLAST RESISTANT GLAZED SYSTEMS FOR MISSION CRITICAL RATED BUILDINGS
  5. Glazing blast requirements: Section 08 80 50, BLAST REQUIREMENTS FOR GLAZED SYSTEMS.
  6. Mirrors: Section 10 28 00, TOILET ACCESSORIES.
  7. Plastic glazing: Section 08 63 00, METAL-FRAMED CANOPY SKYLIGHTS.
  8. Seismic: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**1.3 LABELS**

- A. Temporary labels:
1. Provide temporary label on each light of glass and plastic 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 glass and plastic 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.
    - a. Tempered glass.
    - b. Laminated glass or have certificate for panes without permanent label.
  3. Plastic Assemblies:

- a. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.
- b. The "attack (threat) side" shall be identified in bold lettering on each side of glazing with removable label.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Building Enclosure Vapor Retarder and Air Barrier:
  1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
  2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Glass Thickness:
  1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with applicable code.
  2. Test in accordance with ASTM E 1300.
  3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
  4. All glazing shall be installed in accordance with seismic requirements.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Certificates:
  1. Certificate on "R" value when value is specified.
  2. Certificate that blast resistant glass meets the requirements of UFC4-010-01.
- 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. Insulating glass units.
  3. Fire rated glass.
  4. Elastic compound for metal sash glazing.
  5. Glazing cushion.
  6. Sealing compound.

7. Plastic glazing material, each type required.

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.

#### 1.7 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

#### 1.8 WARRANTY

- 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.
  3. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
  4. Insulating plastic to not have more than 6 percent decrease in light transmission and be ultraviolet light stabilized for 10 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):  
Z97.1-04.....Safety Glazing Material Used in Building -  
Safety Performance Specifications and Methods  
of Test.
- C. American Society for Testing and Materials (ASTM):  
C1363-05.....Thermal Performance of Building Assemblies, by  
Means of A Hot Box Apparatus  
C542-05.....Lock-Strip Gaskets.  
C716-06.....Installing Lock-Strip Gaskets and Infill  
Glazing Materials.  
C794-06.....Adhesion-in-Peel of Elastomeric Joint Sealants.



- C864-05.....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks, and Spacers.
- C920-08.....Elastomeric Joint Sealants.
- C964-07.....Standard Guide for Lock-Strip Gasket Glazing.
- C1036-06.....Flat Glass.
- C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass.
- C1172-09.....Laminated Architectural Flat Glass.
- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on  
Flat Glass.
- D635-06.....Rate of Burning and/or Extent and Time of  
Burning of Self-Supporting Plastic in a  
Horizontal Position.
- D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic  
Sheet.
- E84-09.....Surface Burning Characteristics of Building  
Materials.
- E1300-09.....Determining Load Resistance of Glass in  
Buildings.
- E2190-08.....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;  
1977, with 1984 Revision.
- F. National Fire Protection Association (NFPA):  
80-08.....Fire Doors and Windows.
- G. National Fenestration Rating Council (NFRC)
- H. Safety Glazing Certification Council (SGCC)2009:  
Certified Products Directory (Issued Semi-Annually).
- I. Underwriters Laboratories, Inc. (UL):  
752-06.....Bullet-Resisting Equipment.
- J. Unified Facilities Criteria (UFC):  
4-010-01-2007.....DOD Minimum Antiterrorism Standards for  
Buildings
- K. Glass Association of North America (GANA):  
Glazing Manual (Latest Edition)  
Sealant Manual (2008)

- L. American Society of Civil Engineers (ASCE):  
ASCE 7-10.....Wind Load Provisions

## **PART 2 - PRODUCT**

### **2.1 GLASS**

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
1. ASTM C1036, Type I, Class 1, Quality q3 or as indicated.
  2. Thickness, 6 mm (1/4 inch) or as indicated .
- C. Patterned Glass:
1. ASTM C1036, Type II, Class 1, Form 3, Pattern P1, Finish F1, Quality Q5, Mesh m3 .
  2. Thickness, 6 mm (1/4 inch) or as indicated .

### **2.2 HEAT-TREATED GLASS**

- A. Clear Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
  2. Thickness, 6 mm (1/4 inch) or as indicated //.
- B. Clear Tempered Glass:
1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
  2. Thickness, 6 mm (1/4 inch).

### **2.3 COATED GLASS**

- A. Low-E Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating having an E of 0.15.
  2. Apply coating to second surface of insulating glass units.
  3. Thickness, 4.8 mm (3/16 inch).

### **2.4 PLASTIC**

- A. Clear Polycarbonate Sheet, Abrasion Resistant:
1. Fed. Spec. A-A-59502, Type III, coated mar resistant, Class 1, ultraviolet light stabilized, Grade A, High abrasion resistance. Flame spread of 10 or less when tested per ASTM E84.
  2. Thickness, as indicated.

### **2.5 LAMINATED GLASS**

- A. Two lites of glass bonded with an interlayer material for use in building glazing
- B. Use 1.5 mm (0.060 inch) thick interlayer for:

## **2.6 LAMINATED GLAZING ASSEMBLIES**

### **A. Clear Glazing:**

1. Both panes clear glass ASTM C1036, Type I or II, Class 1, Quality q3.
2. Thickness: Each pane (3/16 inch) thick or as indicated.

## **2.7 INSULATING GLASS UNITS**

### **A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.**

### **B. Assemble units using glass types specified:**

### **C. Sealed Edge Units (SEU):**

#### **1. Insulating Glass Unit Makeup:**

##### **a. Outboard Lite:**

1. Glass type: Heat-strengthened.
2. Glass Tint: Clear.
3. Nominal Thickness: 6 mm (1/4 inch).
4. Glass Strength: Heat-Strengthened.
5. Coating Orientation: Low-E PPG Solarban 60 or approved equal Surface #2

##### **b. Spacer:**

1. Nominal Thickness: 12 mm (1/2 inch).
2. Gas Fill: Air.

##### **c. Inboard Lite:**

1. Glass Type: Laminated.
2. Glass Tint: Clear.
3. Nominal Thickness: Two layers 4.8 mm (3/16 inch) each.
4. Glass Strength: Annealed

#### **2. Performance Characteristics (Center of Glass)**

- a. Visible Transmittance: 70%
- b. Visible Reflectance: 11%
- c. Winter U-factor (U-value): 0.29
- d. Shading Coefficient (SC): 0.44
- e. Solar heat Gain Coefficient (SHGC): 0.38

#### **3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.**

4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

## **2.8 FIRE RESISTANT GLASS WITHOUT WIRE MESH**

- A. Fire resistant glass or glass assembly classified by UL in Building Materials Directory or other approved testing laboratory bearing permanent mark of classification.
- B. Firelite.
  1. UL listing R13377-1, 4.8 mm (3/16 inch) thick, unpolished.
  2. Distributed by Technical Glass Products; Kirkland, WA 98033.
- C. Pyrovue Commercial.
  1. UL listing R10178(N), 41 mm (1-5/8 inch) thick.
  2. Represented by Advanced Glass Systems Corporation, Trumbauersville, PA 18970-0051
- D. Rating
  1. Provide rating as required.

## **2.9 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 Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.
- G. Glazing Gaskets: ASTM C864:
1. Firm dense wedge shape for locking in sash.
  2. Soft, closed cell with locking key for sash key.
  3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- H. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- I. 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.
- J. 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.
- K. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
  2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.
- L. 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.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

#### **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. Glaze in accordance with seismic requirements.
- D. Set glazing without bending, twisting, or forcing of units.
- E. Do not allow glass to rest on or contact any framing member.
- F. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F2. Install units in interior partitions with pattern in same direction in all openings.

G. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

H. Plastic:

1. Use dry glazing method.
2. Use only neoprene or EPDM gaskets.

I. Laminated Glass:

1. Tape edges to seal interlayer and protect from glazing sealants.
2. Do not use putty or glazing compounds.

J. Insulating Glass Units:

1. Glaze in compliance with glass manufacturer's written instructions.
2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
3. Do not use putty or glazing compounds.
4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
5. Install with tape or gunnable sealant in wood sash.
6. Other fire resistant glass: Glaze in accordance with UL design requirements.

### **3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing tape and spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- 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 fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

### **3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with acrylic type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of acrylic type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.6 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.

### **3.7 PROTECTION**

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### **3.8 GLAZING SCHEDULE**

- A. Fire Resistant Glass:
  - 1. Use Fire Resistant Glass without wire mesh in 90 minute rated fire doors
- B. Tempered Glass:
  - 1. Install in full and half glazed doors unless indicated otherwise.
  - 2. Install in storefront, windows, and door sidelights adjacent to doors.



3. Use clear tempered glass on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.
4. Use SEU clear tempered insulating glass on storefronts and sidelights.
5. Use clear tempered glass in exterior and interior panes unless specified otherwise at insulating glass units adjacent to door.

C. Insulating Glass:

1. Install SEU clear tempered glass in exterior pane of dual glazed , storefronts, curtain walls adjacent to entrances or walks.
2. Install SEU heat strengthened clear glass in exterior pane of dual glazed windows, storefronts, curtain walls, not adjacent to entrances or walks.

D. Laminated Glass: Install as specified in doors, observation windows and interior pane of dual glazed windows where indicated.

1. Laminated glass shall be 7/16-in thick .(min. 1.5 mm interlayer).
2. Where laminated glass is required for blast-resistant windows, follow UFC4-010-01, DOD Minimum Antiterrorism Standards for Buildings.

E. Pattern Glass (obscure):

2. Pattern Glass (obscure), etched unless specified otherwise.

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**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies steel studs wall systems, shaft wall systems, soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

**1.2 RELATED WORK**

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Pull down tabs in steel decking: Section 05 36 00, COMPOSITE METAL DECKING.
- D. Ceiling suspension systems for acoustical panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS and Section 09 29 00, GYPSUM BOARD.
- E. Seismic requirements: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

**1.3 TERMINOLOGY**

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Studs, runners and accessories.
  - 2. Hanger inserts.
  - 3. Channels (Rolled steel).
  - 4. Furring channels.
  - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
  - 1. Typical ceiling suspension system.

2. Typical metal stud and furring construction system including details around openings and corner details.
  3. Typical shaft wall assembly
  4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.
- D. Test Results: Fire rating test designation, each fire rating required for each assembly.

#### **1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C754.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
- A123-09.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
  - A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
  - C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems
  - C635-07.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
  - C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - C645-09.....Non-Structural Steel Framing Members
  - C754-09.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - C841-03(R2008).....Installation of Interior Lathing and Furring
  - C954-07.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
  - C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

E580-09.....Application of Ceiling Suspension Systems for  
Acoustical Tile and Lay-in Panels in Areas  
Requiring Moderate Seismic Restraint.

## **PART 2 - PRODUCTS**

### **2.1 PROTECTIVE COATING**

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM A123.

### **2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified and sizes as shown.
  - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
  - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Top track shall have 2 ½ inch extended legs to allow for deflection of overhead construction
- F. Shaft Wall Framing:
  - 1. Conform to rated wall construction.
  - 2. C-H Studs.
  - 3. E Studs.
  - 4. J Runners.
  - 5. Steel Jamb-Strut.

### **2.3 FURRING CHANNELS**

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient Furring Channels:
  - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
  - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
  - 1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
  - 2. Web furring depth to suit thickness of insulation with slotted perforations.

- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

## **2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
  - 1. ASTM A641, soft temper, Class 1 coating.
  - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
  - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
  - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION CRITERIA**

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.
- C. All work shall be installed in accordance with seismic requirements.

### 3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Deflection relief: Cut studs 13 mm (1/2 inch) less than floor to underside of structure overhead when extended to underside of structure overhead. At partitions built to underside of roof deck, attach runner to beam or deck construction, do not attach studs to runner; allow 1/2 inch deflection space between studs and underside of construction
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.
- F. Openings:
  - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- G. Fastening Studs:
  - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
  - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- H. Chase Wall Partitions:
  - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
  - 2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
- I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
- J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

### **3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
- B. Wall furring-Stud System:
  - 1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
  - 2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
  - 3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.
- C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
  - 1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
  - 2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
  - 3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
  - 4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
  - 5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
  - 6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.
- D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

### **3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.



### **3.5 INSTALLING SHAFT WALL SYSTEM**

- A. Conform to UL Design No. U438 for two-hour fire rating.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
  - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
  - 2. Frame openings cut within a liner panel with E studs around perimeter.
  - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

### **3.6 INSTALLING FURRED AND SUSPENDED SOFFITS**

- A. Install furred and suspended soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board soffits.
  - 1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
  - 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. Concrete slabs on steel decking composite construction:
  - 1. Use pull down tabs when available.
  - 2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- C. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- D. Existing concrete construction exposed or concrete on steel decking:
  - 1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
  - 2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- E. Steel decking without concrete topping:
  - 1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.

2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
- F. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
1. Install only for ceilings to receive screw attached gypsum board.
  2. Install in accordance with ASTM C636.
    - a. Install main runners spaced 1200 mm (48 inches) on center.
    - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
    - c. Install wall track channel at perimeter.
- G. Installing Ceiling Bracing System:
1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
  2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.

### 3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

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**SECTION 09 29 00**  
**GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.
- C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- D. Seismic: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**1.3 TERMINOLOGY**

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Corner bead and edge trim.
  - 2. Finishing materials.
  - 3. Laminating adhesive.
  - 4. Gypsum board, each type.
- C. Shop Drawings:
  - 1. Typical gypsum board installation, showing corner details, edge trim details and the like.
  - 2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
  - 3. Typical shaft wall assembly.
  - 4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
- D. Samples:
  - 1. Corner bead.
  - 2. Edge trim.
  - 3. Control joints.
- E. Test Results:
  - 1. Fire rating test, each fire rating required for each assembly.

2. Sound rating test.

#### **1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C840.

#### **1.6 ENVIRONMENTAL CONDITIONS**

In accordance with the requirements of ASTM C840.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
- C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-08.....Application and Finishing of Gypsum Board
  - C919-08.....Sealants in Acoustical Applications
  - C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
  - C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing
  - C1396-06.....Gypsum Board
  - C1658-06.....Glass Mat Gypsum Panels
  - E84-08.....Surface Burning Characteristics of Building Materials
- C. Underwriters Laboratories Inc. (UL):
- Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
- Latest Editions.....Certification Listings
- E. United States Green Building Council (USGBC)
- LEED Version 3.0, 2009..

## **PART 2 - PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009.

## **2.2 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Coreboard or Shaft Wall Liner Panels.
  - 1. ASTM C1396, Type X.
  - 2. ASTM C1658: Glass Mat Gypsum Panels,
  - 3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.
- D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

## **2.3 GYPSUM SHEATHING BOARD**

- A. ASTM C1177, Type X.

## **2.4 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

## **2.5 JOINT MATERIAL AND REINFORCING TAPE**

Products selected shall be as recommended by the gypsum board manufacturer for the specific application conditions.

## **2.6 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

## **2.7 FINISHING MATERIALS AND LAMINATING ADHESIVE**

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

### **PART 3 - EXECUTION**

#### **3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead,

#### **3.2 INSTALLING GYPSUM BOARD**

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Install gypsum board in accordance with seismic requirements.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.
  - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
  - 5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
  - 6. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
  - 7. Control Joints ASTM C840 and as follows:

- a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
  - b. Not required for wall lengths less than 9000 mm (30 feet).
  - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- G. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
  2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
  3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.
- H. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- I. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
  2. Install in one piece, without the limits of the longest commercially available lengths.
  3. Corner Beads:
    - a. Install at all vertical and horizontal external corners and where shown.
    - b. Use screws only. Do not use crimping tool.
  4. Edge Trim (casings Beads):
    - a. At both sides of expansion and control joints unless shown otherwise.
    - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
    - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
    - d. Where shown.

### 3.3 INSTALLING GYPSUM SHEATHING

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.

- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
- D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
- E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.
- F. Deflection relief: At partitions built to underside of roof deck, do not attach gypsum board to runner, allow ½ inch deflection space between gypsum board and underside of construction.

### **3.4 CAVITY SHAFT WALL**

- A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR Nonbearing for two-hour fire rating.
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
  - 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
  - 2. Stagger joints top and bottom in adjacent panels.
  - 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
- D. Gypsum Board:
  - 1. Two Hour Wall:
    - a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
    - b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
    - c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
  - 2. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.
- E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.



### 3.5 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
  - 1. Gypsum board is fastened and held close to framing or furring.
  - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of nondecorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated and sound rated construction. Sanding is not required of nondecorated surfaces.

### 3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in nondecorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction, and STC equivalent to the sound rated construction.

### 3.7 UNACCESSIBLE CEILINGS

At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

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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.

**1.2 RELATED WORK**

- A. Seismic requirements: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

**1.3 SUBMITTAL**

- 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, including suspension system specified to match existing.
  - 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
- C. United States Green Building Council (USGBC)

## **PART 2- PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009.

### **2.2 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..
- 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.

### **2.3 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.

### **2.4 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).

### **2.5 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.

## 2.6 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<br>Kg | Pound | Hot-rolled<br>Kg | Pound |
|---------|-------------|-------------------|-------|------------------|-------|
| 38      | 1 1/2       | 215.4             | 475   | 508              | 1120  |
| 50      | 2           | 267.6             | 590   | 571.5            | 1260  |

## 2.7 ACOUSTICAL UNITS

- A. General:
  - 1. Ceiling Panel 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.
  - 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.
  - 7. Lay-in panels: Sizes as shown, with square edges.
- 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.

## 2.8 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 panels 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 lay-in panels in accordance with ASTM C636, except as specified otherwise.
  - 2. Install in accordance with seismic requirements.
  - 3. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
  - 4. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
  - 5. Prevent deflection in excess of 1/360 of span of cross runner and main runner.

6. 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.
7. 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,
8. Use main runners not less than 1200 mm (48 inches) in length.
9. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

1. Concrete:

- a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
- b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

2. Steel:

- a. 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 insure 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.

C. 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.

D. 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) on center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

E. 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 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. 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.
- D. All ceilings shall be installed in accordance with seismic requirements

### 3.4 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 65 13**  
**RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of vinyl base.

**1.2 RELATED WORK**

- A. Resilient sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.
- B. Resilient tile flooring: Section 09 65 19, RESILIENT TILE FLOORING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Base material manufacturer's recommendations for adhesives.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Base: 150 mm (6 inches) long, each type and color.
  - 2. Adhesive: Literature indicating each type.

**1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

**1.5 STORAGE**

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):  
F1861-02.....Resilient Wall Base
- C. United States Green Building Council (USGBC)

**PART 2 - PRODUCTS**

**2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0,

2009.

## **2.2 GENERAL**

Use only products by the same manufacturer and from the same production run.

## **2.3 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, 150 mm (6 inches) high, Type TV Vinyl, Thermoplastics, Group 2-layered with molded top. Style B-cove.
- B. Where carpet occurs, use Style A-straight.

## **2.4 ADHESIVES**

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

# **PART 3 - EXECUTION**

## **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 21 degrees C (70 degrees F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21 degrees C and 27 degrees C (70 degrees F and 80 degrees F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

## **3.2 INSTALLATION REQUIREMENTS**

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

## **3.3 PREPARATION**

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.

- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
  - 1. Remove existing base including adhesive.
  - 2. Do not use solvents to remove adhesives.
  - 3. Prepare substrate as specified.

### **3.4 BASE INSTALLATION**

- A. Location:
  - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework and where other equipment occurs.
  - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Set base with joints aligned and butted to touch for entire height.
  - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
    - a. Short pieces to save material will not be permitted.
    - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
  - 1. Score back of outside corner.
  - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

### **3.5 CLEANING AND PROTECTION**

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
  - 1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
  - 2. Do not polish tread and sheet rubber materials.

- D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section specifies the installation of sheet flooring without backing
- B. Installation of sheet flooring including following:
  - 1. Heat welded seams.

**1.2 RELATED WORK**

- A. Resilient base over base of equipment and casework and on walls: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- B. Resilient Tile: Section 09 65 19, RSILIENT TILE FLOORING

**1.3 QUALITY CONTROL-QUALIFICATIONS**

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
  - 1. Heat welded seaming is manufacturer's prescribed method of installation.
  - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
  - 3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
  - 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
  - 1. Description of resilient material and accessories to be provided.

2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
3. Application and installation instructions.

C. Samples:

1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod.
2. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
3. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
4. Edge strips: 150 mm (6 inches) long each type.
5. Adhesive, underlayment and primer: Pint container, each type.

- D. Shop Drawings: Show seaming diagrams, dimensions, run of sheet pattern, junctions with other work, and details of unusual conditions.

**1.5 PROJECT CONDITIONS**

- A. Maintain temperature of floor materials and room, where work occurs, above 18 degrees C (65 degrees F) and below 38 degrees C (100 degrees F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 degrees C (55 degrees F).
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation.
- D. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.



- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
- E648-09.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.
  - E662-09.....Specific Optical Density of Smoke Generated by Solid Materials.
  - F710-08.....Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
  - F970-07.....Static Load Limit
  - F1869-04.....Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
  - F1913-04.....Vinyl Sheet Flooring without Backing
  - F2170-09.....Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
- Recommended Work Practices for Removal of Resilient Floor Coverings.
- D. United States Green Building Council (USGBC)

#### **1.8 SCHEDULING**

Interior finish work such as drywall finishing, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

#### **1.9 WARRANTY**

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

### **PART 2 - PRODUCTS**

#### **2.1 VOC'S**

VOC's shall be in compliance with VOC requirements of LEED version 3.0, 2009

## **2.2 SHEET VINYL FLOOR COVERINGS**

- A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to material requirements specified in ASTM F1913.
- B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1800 mm (6 feet).
- C. Each color and pattern of sheet flooring shall be of same production run.

## **2.3 WELDING ROD**

Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

## **2.4 APPLICATION MATERIALS AND ACCESSORIES**

- A. Floor Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.

## **2.5 SHEET FLOORING**

- A. ASTM F1913.
- B. Minimum nominal thickness 2 mm (0.08 inch); 1800 mm (6 ft) minimum width.
- C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke density: less than 450 per ASTM E662.
- E. ASTM F970 static load: 750 psi
- F. Color and pattern of sheet flooring of the same production run.

## **2.6 ADHESIVES**

Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L

## **2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

## **2.8 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive or sheet flooring manufacturer.

## **2.9 EDGE STRIPS**

- A. Resilient Edge or Reducer Strips: Flooring manufacturer's standard profile, sized for condition.
- B. Color as scheduled on Drawings.

## **2.10 SEALANT**

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

## **PART 3 - EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of sheet flooring above 36 degrees C (65 degrees F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 degrees C (65 degrees F), for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 36 degrees C (65 degrees F.)
- D. Building is permanently enclosed.
- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

### **3.2 SUBFLOOR PREPARATION**

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
  - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
  - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.

1. Do not use adhesive for filling or leveling purposes.
  2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3lb of water/1000 sq. ft.) in 24 hours.
  2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.
- H. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Solvents shall not be used.

### **3.3 INSTALLATION OF FLOORING**

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

- G. Inform the Resident Engineer of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
  - 1. Air pockets or loose edges will not be accepted.
  - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
  - 1. Locate edge strips under center lines of doors unless otherwise indicated.
  - 2. Set resilient strips in adhesive.

### **3.4 WELDING**

- A. Heat weld all joints of flooring and integral base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

### **3.5 CLEANING**

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- D. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.

- F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

### **3.6 PROTECTION**

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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**SECTION 09 65 19**  
**RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of bio based tile flooring and accessories.

**1.2 RELATED WORK**

- A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- B. Sheet Flooring: Section 09 65 16, RESILIENT SHEET FLOORING

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Resilient material manufacturer's recommendations for adhesives, underlayment, primers and polish.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Tile: 300 mm by 600 mm (12 inches by 24 inches) for each type, pattern and color.
  - 2. Edge Strips: 150 mm (6 inches) long, each type.
- D. Shop Drawings:
  - 1. Layout of patterns shown and scheduled on the drawings.
  - 2. Edge strip locations showing types and detail cross sections.
- E. Test Reports:
  - 1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
  - 2. Tested per ASTM F510.

**1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

**1.5 STORAGE**

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

## 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - D4078-02 (2008).....Water Emulsion Floor Finish
  - E648-10.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
  - E662-09.....Specific Optical Density of Smoke Generated by Solid Materials
  - E1155-96 (R2008).....Determining Floor Flatness and Floor Levelness Numbers
  - F510-93 (R 2008).....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
  - F710-08.....Preparing Concrete Floors to Receive Resilient Flooring
  - F970-07.....Static Load Limit
  - F1066-04 (R2010).....Vinyl Composition Floor Tile
- C. Resilient Floor Covering Institute (RFCI):
  - IP #2.....Installation Practice for Vinyl Composition Tile (VCT)
- D. Federal Specifications (Fed. Spec.):
  - SS-T-312.....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition
- E. United State Green Building Council (USGBC)

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
- D. Smoke density: Less than 450 per ASTM E662.
- E. Environmental requirements
  - 1. VOC's shall be in compliance with VOC requirements of LEED 3.0, 2009.
  - 2. Minimum 10% pre-consumer recycled content.
  - 3. Minimum 2% rapidly renewable content.



## **2.2 BIO BASED TILE**

- A. ASTM F1066, Class 2 (through pattern), 300 mm by 600 mm (12 inches by 24 inches), 3 mm (1/8 inch) thick.
- B. ASTM F970, Static load limit: 250 psi.
- C. Color and pattern uniformly distributed throughout thickness.

## **2.3 ADHESIVES**

- A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.
- B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

## **2.4 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive and tile manufacturer.

## **2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

## **2.6 POLISH AND CLEANERS**

- A. Cleaners RFCI CL-1.
- B. Polish: ASTM D4078.

## **2.7 EDGE STRIPS**

- A. 28 mm (1-1/8 inch) wide unless shown otherwise.
- B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.
- C. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

# **PART 3 - EXECUTION**

## **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 degrees C (70 degrees F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 degrees C and 27 degrees C (70 degrees F and 80 degrees F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

### 3.2 SUBFLOOR PREPARATION

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:  
FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints and other irregularities in concrete with leveling compound:
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.
- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- E. Concrete Subfloor Testing: Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.
- H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
  - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
  - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
  - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
  - 1. Apply adhesive uniformly with no bare spots.

- a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
  - b. More than 5 percent of the joints not touching will not be accepted.
2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
  3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.
- F. Installation of Edge Strips:
1. Locate edge strips under center line of doors unless otherwise shown.
  2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
  3. Where tile edge is exposed, butt edge strip to touch along tile edge.
  4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

### **3.4 CLEANING AND PROTECTION**

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean and polish materials in the following order:
  1. For the first two weeks sweep and damp mopped only.
  2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.
  3. Apply polish to the floors in accordance with the polish manufacturer's instructions.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.
- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

### 3.5 LOCATION

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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**SECTION 09 68 00**  
**CARPETING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Section specifies carpet tile, edge strips, adhesives, and other items required for complete installation.

**1.2 RELATED WORK**

A. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 QUALITY ASSURANCE**

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
  - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
  - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
  - 1. Carpet: "Production Quality" samples 300 x 300 mm (12 x 12 inches) of each carpet, showing quality, pattern and color as scheduled on Drawings.
  - 2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
  - 3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.
- D. Shop Drawings: Installers layout plan showing joints, pattern and cuts for carpet module.
- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

#### **1.5 DELIVERY AND STORAGE**

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

#### **1.6 ENVIRONMENTAL REQUIREMENTS**

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

#### **1.7 WARRANTY**

Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

#### **1.8 APPLICABLE PUBLICATIONS**

- A. Publication listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):  
ANSI/NSF 140-07.....Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):  
AATCC 16-04.....Colorfastness to Light  
AATCC 129-05.....Colorfastness to Ozone in the Atmosphere under High Humidities  
AATCC 134-06.....Electric Static Propensity of Carpets  
AATCC 165-99.....Colorfastness to Crocking: Textile Floor Conerings-AATCC Crockmeter Method
- D. American Society for Testing and Materials (ASTM):  
ASTM D1335-05.....Tuft Bind of Pile Yarn Floor Coverings  
ASTM D3278-96 (R2004)...Flash Point of Liquids by Small Scale Closed-Cup Apparatus

ASTM D5116-06.....Determinations of Organic Emissions from Indoor  
Materials/Products

ASTM D5252-05.....Operation of the Hexapod Tumble Drum Tester

ASTM D5417-05.....Operation of the Vettermann Drum Tester

ASTM E648-06.....Critical Radiant Flux of Floor-Covering Systems  
Using a Radiant Heat Energy Source

E. The Carpet and Rug Institute (CRI):

CRI 104-02.....Installation of Commercial Carpet

F. United States Green Building Council (USGBC)

G. Executive Order 13423 and 13514

## **PART 2 - PRODUCTS**

### **2.1 CARPET**

A. Environmental Requirements

1. VOC's shall be in compliance with VOC requirements of LEED Version  
3.0, 2009.

2. Sustainability shall be in compliance with Executive Orders 13423 and  
13514.

3. Third Party Certifications (except CPT-2):

a. MBDC Cradle to cradle: Silver Certificate

b. NSF 140: Platinum Certificate

c. CRI Green Label Plus: Certified

d. USGBC: Contributes

4. Total Recycled Content (by weight): minimum 44% (30% for CPT-2)  
Post-consumer: minimum 10%

5. Packaging (except CPT-1): 100% recyclable

6. Country of origin: USA

7. End of Life (except CPT-2)

a. Recyclability: 100% recyclable

b. Manufacturer closed loop recycling

B. General Requirements:

1. Carpet shall be carpet tile.

2. 75% of tile shall be from the same manufacturer's collection.

3. 75% of tile shall be available under the GSA Contract.

4. All tile shall meet the recycled content goals of Executive Order  
Nos. 13423 and 13514.

5. Tile shall be available in a series of muted, or neutral colors, to  
coordinate with the VISN color palette.

6. Tile shall be available as a series - with one pattern geometric, one  
organic/floral, one textured to meet the requirements of the VISN  
standards for a healing environment for a diverse Veteran population.

C. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
2. Manufacturers standard construction commercial carpet:
  - a. Modular Tile: 660 mm (24 inches) square tile.
3. Provide static control to permanently control static buildup to less than 2.0 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
4. Pile Height: Maximum 4.76 mm/0.187 inch(3.94 mm/.155 inch for CPT-2)
5. Yarn Weight: 19 oz (30 oz for CPT-6 and CPT-7) (38 oz for CPT-2)
6. Gauge: 1/10 or 1/12 (5/32 for CPT-2)
7. Stitches per inch: 11 to 11.5 ( for CPT-2)
8. Pile Fiber: Nylon
9. Construction Type:
  - a. Multi level pattern loop or level Loop.
  - b. Tip-Sheared Loop for CPT-2.
10. Backing materials: Manufacturer's unitary backing designed for glue-down installation using recovered materials.
11. Appearance Retention Rating (ARR): Carpet shall be tested and have the minimum 3.5-4.0 Severe ARR when tested in accordance with either the ASTM D5252 (Hexapod) or ASTM D5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
12. Tuft Bind: Minimum force of 40 N (10 lb) required to pull a tuft or loop free from carpet backing. Test per ASTM D1335.
13. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
14. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
15. Delamination Strength: Minimum of 440 N/m (2.5 lb/inch) between secondary backing.
16. Flammability and Critical Radiant Flux Requirements:
  - a. Test Carpet in accordance with ASTM E648.
  - b. Class I: Not less than 0.45 watts per square centimeter.
17. Density: Average Pile Yarn Density (APYD): Minimum APYD 7000 (8500 for CPT-2)
18. VOC Limits: Use carpet and carpet adhesive that comply with the following limits for VOC content when tested according to ASTM D5116:
  - a. Carpet, Total VOCs: 0.5 mg/sq.m x hr.



- b. Carpet, 4-PC (4-Phenylcyclohexene): 0.05 mg/sq.m x hr.
  - c. Carpet, Formaldehyde: 0.05 mg/sq.m x hr.
  - d. Carpet, Styrene: 0.4 mg/sq.m x hr.
  - e. Adhesive, Total VOCs: 10.00 mg/sq.m x hr.
  - f. Adhesive, Formaldehyde: 0.05 mg/sq.m x hr.
  - g. Adhesive, 2-Ethyl-1-Hexanol: 3.00 mg/sq.m x hr.
- D. Color, Texture, and Pattern: As scheduled on Drawings.

## **2.2 ADHESIVE AND CONCRETE PRIMER**

- A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D3278.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining.

## **2.3 EDGE STRIPS (MOLDING)**

- A. Vinyl Edge Strip:
- 1. Beveled floor flange minimum 50 mm (2 inches) wide.
  - 2. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
  - 3. Color as scheduled on Drawings.

## **2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected.

# **PART 3 - EXECUTION**

## **3.1 SURFACE PREPARATION**

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents and existing carpet materials.
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
- 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.

- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

### **3.2 CARPET INSTALLTION**

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 direct glue down installation.
  - 1. Relax carpet in accordance with Section 6.4.
  - 2. Comply with indoor air quality recommendations noted in Section 6.5.
  - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
  - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
  - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.
- F. Carpet Modules:
  - 1. Install per CRI 104, Section 13, Adhesive Application.
  - 2. Lay carpet modules with pile in same direction unless indicated otherwise on Drawings.
  - 3. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
  - 4. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

### **3.3 EDGE STRIPS INSTALLATION**

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

### **3.4 PROTECTION AND CLEANING**

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

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**SECTION 09 91 00**  
**PAINTING**

**PART 1-GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies field painting and prime coats which may be applied in shop under other sections. Painting includes stains, coatings specified, and identity markings.
- B. Work to be Painted:
  - 1. Painting and finishing of interior and exterior work, and painting of mechanical and electrical systems, except as specified under Article, WORK NOT TO BE PAINTED.
  - 2. Painting and finishing of work as scheduled on Drawings.
  - 3. Painting and finishing of existing work as specified under Article, REFINISHING.
- C. Work Not to be Painted:
  - 1. Prefinished Items: Casework, equipment, and similar items specified under other sections.
  - 2. Concealed Surfaces: Inside duct shafts, pipe basements, crawl spaces, pipe tunnels, above ceilings.
  - 3. Finished Surfaces: Anodized aluminum, stainless steel, chromium plating, copper, brass.
  - 4. Moving and Operating Parts: Shafts, chains, gears, mechanical and electrical parts such as valve stems, operators, linkages, sprinkler heads, sensing devices.
  - 5. Exterior galvanized railings, stairs and grating platforms, other than touch up welds.
  - 6. Labels: Any code required label such as Underwriters Laboratories Inc., or Factory Mutual Research Corporation, identification plates, instruction plates, performance rating, nomenclature.

**1.2 RELATED WORK**

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- B. Fireproofing: Section 07 81 23, INTUMESCENT FIREPROOFING.
- C. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

**1.3 QUALITY ASSURANCE**

- A. Paint Color and Texture:

1. In general, color and texture of finish coats, as scheduled on Drawings.
2. For additional requirements regarding color, see Articles REFINISHING AND FIELD PAINTING OF MECHANICAL AND ELECTRICAL SYSTEM.

B. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

C. Painting, Caulking, Closures, 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 plastic laminate or stainless steel.

D. Before starting any application of water paint mixtures apply paint as specified to an area not to exceed 100 SF selected by Resident Engineer. Finish and texture approved by Resident Engineer shall be used as a standard of quality for remainder of work.

**1.4 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 the following:

1. Manufacturer's literature, indicating brand names, kind, color, texture, composition of vehicle and pigment.
2. Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award. Each coating system shall 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.
3. Federal Specification Number where applicable and certificates as specified.
4. Description for each type of product and application to be used.
5. Installation instructions for each type of product and application to be used.
6. Manufacturers' Certificates indicating compliance with specified requirements.

C. Samples:

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), show each color as scheduled on Drawings.
  3. Panels to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
  4. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Veterans Administration Master Paint Color Code Number (for paint).
    - c. Specification code number.
    - d. Product type, color, and finish texture.
    - e. Name of project.
  5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
  6. Sample of identity markers.
- D. Submit one complete set of applicable American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Booklet and Document publications for use by the Resident Engineer.

#### **1.5 DELIVERY AND STORAGE**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
1. Name of manufacturer.
  2. Product type.
  3. Batch number.
  4. Instructions for use.
  5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
1. Federal Specification Number, where applicable, and name of material.
  2. Surface upon which material is to be applied.
  3. If paint or other coating, state coat types; prime, body or finish.
  4. Master Paint Institute (MPI) Code Number, where applicable.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition. 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).

- E. Safety: Observe all required safety regulations and the manufacturer's warning and instructions during the storage, handling and application of painting materials.
1. Necessary precautions shall be taken 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 the end of each days work.
- F. Lead-Base Paint: The responsibility of compliance with Section 401 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with the implementing regulations promulgated by the Secretary of Housing and Urban Development is placed upon the Contractor. Regulations concerning the prohibition against the 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.

#### **1.6 MOCK-UP PANEL**

- A. Before starting application of water paint mixtures, apply paint as specified to an area, not to exceed 9 m<sup>2</sup> (100 ft<sup>2</sup>), selected by Resident Engineer.
- B. Finish and texture approved by Resident Engineer will be used as a standard of quality for remainder of work.

#### **1.7 ENVIRONMENTAL REQUIREMENTS**

- A. Do no exterior painting during rain or snow, or when relative humidity is above 50 percent.
- B. Do no interior painting in foggy, damp or rainy weather.
- C. Paint interior surfaces when the ambient temperature is between 45 and 90 degrees F, except when water thinned paints are used, the ambient temperature shall be between 50 and 90 degrees F, unless otherwise designated in the manufacturer's printed instructions. Maintain these temperatures until the paint dries hard.
- D. Apply only on clean and dry surfaces. Apply water thinned acrylic paints to damp (not wet) surfaces where allowed by the manufacturer's printed instructions.
- E. Do no painting in direct sunlight or on surfaces which will soon be warmed by the sun.
- F. All painting shall be in compliance with LEED VOC requirements

## 1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):  
ACGIH TLV-BKLT-2008.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)  
ACGIH TLV-DOC-2008.....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):  
E84.....Surface Burning Characteristics of Building Materials  
E119.....Fire Tests of Building Construction and Materials
- E. Federal Specifications (Fed Spec):  
TT-F-322D (1).....Filler, Two Component Type, for Dents, Cracks, Small-Holes and Blow-Holes  
TT-P-641G (1).....Primer Coating, Zinc Dust Zinc Oxide (For Galvanized Surfaces)  
TT-P-650C (1).....Primer Coating, Latex Base, Interior, White (For Gypsum Wallboard)  
TT-T-801C.....Turpentine, Gum Spirits, Steam Distilled, Sulfate Wood and Destructively Distilled
- F. Master Painters Institute (MPI):  
Paints shall be in accordance with LEED requirements. Substitute as required to meet LEED requirements with approval of COTR.  
No. 4-07.....Interior/ Exterior Latex Block Filler  
No. 11-07.....Exterior Latex, Semi-Gloss (AE)  
No. 18-07.....Organic Zinc Rich Primer  
No. 26-07.....Cementitious Galvanized Metal Primer  
No. 31-07.....Polyurethane, Moisture Cured, Clear Gloss (PV)  
No. 36-07.....Knot Sealer  
No. 50-07.....Interior Latex Primer Sealer  
No. 52-07.....Interior Latex, MPI Gloss Level 3 (LE)  
No. 53-07.....Interior Latex, Flat, MPI Gloss Level 1 (LE)  
No. 54-07.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE) Approved) (FR)  
No. 77-07.....Epoxy Cold Cured, Gloss (EC)

No. 101-07.....Epoxy Anti-Corrosive Metal Primer

No. 134.....Waterborne Galvanized Primer

G. 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

H. United States Green Building Council (USGBC)

## **PART 2 - PRODUCTS**

### **2.1 VOC'S**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0, 2009.

### **2.2 MATERIALS**

A. Wood Sealer: MPI 31 (or equivalent to meet LEED)(gloss) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.

B. Plastic Tape:

1. Pigmented vinyl plastic film in colors as scheduled on Drawings.

2. Pressure sensitive adhesive back.

3. Widths as shown.

C. Identity markers options:

1. Pressure sensitive vinyl markers.

2. Snap-on coil plastic markers.

D. Exterior Latex, Semi-Gloss (AE): MPI 11.

E. Organic Zinc rich Coating (HR): MPI 18 or equivalent to meet LEED.

F. Knot Sealer: MPI 36 or equivalent to meet LEED.

G. Interior Latex Primer Sealer: MPI 50.

H. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

I. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

J. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

K. Epoxy Cold Cured, Gloss (EC): MPI 77 or equivalent to meet LEED

L. Epoxy Anti-Corrosive Metal Primer: MPI 101 or equivalent to meet LEED.

M. Interior Latex, Gloss (LE) and (LG): MPI 114.

N. Waterborne Galvanized Primer: MPI 134 or equivalent to meet LEED

### **2.3 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. Materials shall be finely ground, uniform in consistency and readily dispersed to form a smooth and homogeneous fluid.



- C. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

## **2.4 REGULATORY REQUIREMENTS**

- 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 days 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. Fill holes, cracks, depressions with patching compound. Finish flush with adjacent surface with texture to match surrounding surface.
4. Surfaces to be finished shall be cleaned, washed, dried, smooth and prepared as specified. 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.
5. Materials and methods used for cleaning shall be compatible with the substrate and specified finish. Remove any residue remaining from cleaning agents used.
6. See other sections of the specifications for requirements for surface conditions and prime coat.

C. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
  - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
  - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.

D. 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, 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.

E. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich

Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer).

**F. 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. Before application of body and finish coats, surfaces shall be primed, except as otherwise specified.
- D. Additional field applied prime coats over shop or factory applied prime coats are not required, except for exterior steel which shall have a field applied prime coat in addition to the shop prime coat.
- E. Retouch damaged and abraded painted surfaces before applying succeeding coats.
- F. Apply each coat evenly and cover substrate completely.

- G. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- H. Finish painted surfaces shall have solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- I. Apply by brush, roller or spray, except as otherwise specified.
- J. 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.
- K. 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. Wood and Wood Particleboard:
  - 1. Use same kind of primer specified for exposed face surface.
    - a. Interior wood except for transparent finish: Interior Latex Primer Sealer, thinned if recommended by manufacturer.
    - b. Transparent finishes as specified under Transparent Finishes on Wood.
  - 2. Apply two coats of sealer Interior Latex Primer Sealer to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
  - 3. Apply one coat of sealer Interior Latex Primer Sealer as soon as delivered to site to surfaces of unfinished woodwork, except concealed

surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: Fast Drying Latex Metal Primer.
2. Zinc-coated steel and iron: Waterborne Galvanized Primer.
6. Metal over 94 degrees C (200 degrees F): High Heat Resistant Latex Coating .

G. Gypsum Board :

1. Surfaces scheduled to have MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)), MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) (Interior
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use appropriate primer in shower and bathrooms.
4. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss (EC)) finish.

**3.6 EXTERIOR FINISHES**

A. Apply following finish coats as scheduled on Drawings.

B. Steel and Ferrous Metal:

1. Two coats of MPI 10 Exterior Latex, Semi-Gloss on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

**3.7 INTERIOR FINISHES**

A. Apply following finish coats over prime coats in spaces or on surfaces as scheduled on Drawings.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
  - a. Apply two coats of MPI 54 (Interior Latex, Semi-Gloss unless specified otherwise.
  - e. Ferrous Metal over 94 degrees K (200 degrees F): One coat MPI 22 (High Heat Resistant Coating (HR)).

C. Gypsum Board:

1. One coat of MPI 50 (Interior Primer Sealer) plus one coat of MPI 52 (Interior Latex, Semi-Gloss, MPI Gloss Level 3 )

D. Wood:

1. Sanding:
  - a. Use 220-grit sandpaper.
  - b. Sand sealers between coats.

- c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer, and to knock off "whiskers" of any raised grain as well as dust particles.
- 2. Sealers:
  - a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
  - b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
  - c. Sand as specified.
- 3. Paint Finish:
  - a. One coat of interior primer sealer) or interior enamel undercoat plus one coat of MPI 54 (Interior Latex, Semi-Gloss).
- 4. Transparent Finishes on Wood.
  - a. Natural Finish:
    - 1) One coat of sealer.
    - 2) Two coats of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss (PV)).
- E. Miscellaneous:
  - 1. Apply as scheduled on Drawings.
  - 2. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:
    - a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.
    - b. Mineral fiber units: One coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)).

### **3.8 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. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).

- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

### **3.9 PAINT COLOR**

- A. Color and gloss of finish coats as scheduled on Drawings.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
  - 1. Color of priming coat: Lighter than body coat.
  - 2. Color of body coat: Lighter than finish coat.
  - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  - 1. Paint to match color of casework where casework has a paint finish.
  - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

### **3.10 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, paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located above suspended ceilings, in concealed areas such as pipe and electric closets, 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 scheduled on Drawings shall match surrounding surfaces.
2. Paint colors as scheduled on Drawings except for following:
  - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
  - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:
  - a. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:  
Galvanized and zinc-copper alloy metal.
2. Interior Locations:
  - a. Apply two coats of MPI 54 (Interior Latex, Semi- Gloss 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 one coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) on finish of insulation on piping.
  - c. Apply two coats of MPI 22 (High Heat Resistant Coating (HR)) to ferrous metal surface over 94 degrees K (200 degrees F).

### 3.11 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 as scheduled on Drawings.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Identity painting and safety painting.
- B. Building and Structural Work **NOT** Painted:
  - 1. Prefinished items:
    - a. Casework, doors, wall covering, and similar items specified factory finished under other sections.
    - b. Factory finished equipment and pre-engineered metal building components such as metal 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 duct shafts, above ceilings, 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.
  - 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. Except where specifically specified to be painted.
  - 7. Metal safety treads and nosings.
  - 8. Gaskets.
  - 9. Concrete curbs, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.

10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.

### 3.12 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 pressure sensitive vinyl markers or by stencil applied (painted on) 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:

#### COLOR OF LEGEND PIPING

| EXPOSED PIPING             | BACKGROUND | LETTERS | ABBREVIATIONS    |
|----------------------------|------------|---------|------------------|
| 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. _____*      |

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|                                   |       |        |       |                      |
|-----------------------------------|-------|--------|-------|----------------------|
| 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                  |       | Green  | White | Fuel Oil-Grade ____* |
| 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)              |       |        |       |                      |
| 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      |

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 semigloss paint of color that contrasts with color of substrate.

**3.13 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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**SECTION 10 21 13**  
**TOILET COMPARTMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies metal toilet partitions and urinal screens.

**1.2 RELATED WORK**

- A. Overhead structural steel supports for ceiling hung pilasters: Section 05 50 00, METAL FABRICATIONS.
- B. Grab bars and toilet tissue holders: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Prime coat of paint on 150 mm (six-inch) square of metal panel showing panel and top and side edge with baked enamel finish coat over half of panel.
- C. Manufacturer's Literature and Data: Specified items indicating all hardware and fittings, material, finish, and latching.
- D. Shop Drawings: Construction details at 1/2 scale, showing installation details, anchoring and leveling devices.
- E. Manufacturer's certificate, attesting that zinc-coatings conform to specified requirements.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):  
FF-B-575C.....Bolt, Hexagon and Square
- C. Code of Federal Regulations (CFR):  
40 CFR 247.....Comprehensive Procurement Guidelines for  
Products Containing Recovered Materials
- D. Commercial Item Descriptions (CID):  
A-A-1925.....Shield, Expansion (Nail Anchors)  
A-A-60003.....Partitions, Toilet, Complete

**PART 2 - PRODUCTS**

**2.1 FABRICATION**

- A. Sheet Steel: galvanize to ASTM A653, G90.
  - 1. Panels and Doors: 22 gauge minimum
  - 2. Pilasters: 18 gauge

3. Reinforcement: 12 gauge B. Conform to Fed. CID A-A-60003, except as modified herein.
- B. Fabricate to dimensions shown or specified.
- C. Toilet Enclosures:
  1. Type 1, Style B (Ceiling hung).
  2. Reinforce panels shown to receive toilet tissue holders or grab bars.
  3. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
  4. Latching devices and hinges for handicap compartments shall comply with ADA requirements.
  5. Keeper:
    - a. U-slot to engage bar of throw latch.
    - b. Combined with rubber bumper stop.
  6. Wheelchair Toilets:
    - a. Upper pivots and lower hinges to hold out swinging doors in closed position.
    - b. Provide U-type doors pulls, approximately 100 mm (four inches) long on pull side.
  7. Finish:
    - a. Finish 1 powder coat baked enamel.
- D. Urinal Screens:
  1. Type III, Style D (wall hung), finish same as enclosures. .
    - a. With integral flanges and continuous, full height wall anchor plate.
    - b. Option: Full height U-Type bracket.
    - c. Wall anchor plate drilled for 4 anchors on both sides of screen.
  2. Screen 600 mm (24 inches) wide and 1060 mm (42 inches high).

## **2.2 FASTENERS**

- A. Partition Fasteners: CID A-A-60003.
- B. Use expansion bolts, CID A-A-60003, for anchoring to solid masonry or concrete.
- C. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.
- D. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.



**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General:

1. Install in rigid manner, straight, plumb and with all horizontal lines level.
2. Conceal evidence of drilling, cutting and fitting in finish work.
3. Use hex-bolts for through-bolting.
4. Adjust hardware and leave in freely working order.
5. Clean finished surfaces and leave free of imperfections.

B. Panels and Pilasters:

1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.
2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.

C. Urinal Screens:

1. Anchor urinal screen flange to walls with minimum of four bolts both side of panel.
2. Space anchors at top and bottom and equally in between.

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**SECTION 10 21 23**  
**CUBICLE CURTAIN TRACKS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies cubicle curtain track (C.C.T.).

**1.2 RELATED WORK**

Metal stud for supporting track assembly: Section 09 22 16, NON-  
STRUCTURAL METAL FRAMING and Section 09 51 00, ACOUSTICAL CEILINGS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
  - 2. One clip anchor for fastening track to grid system of acoustical ceilings. One curtain carrier.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data: Cubicle curtain track.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.
- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

**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):
  - B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  - B456-03.....Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual

**PART 2 - PRODUCTS**

**2.1 CUBICLE CURTAIN TRACKS**

- A. Surface Mounted Type:

1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (one foot) of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- D. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

## **2.2 FASTENERS**

- A. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).
- B. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

## **2.3 FABRICATION**

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4800 mm (16 feet) without joints. Form corner bend on a 300 mm (12 inch) radius.
- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and hangers plumb and securely anchor to the ceiling to form a rigid installation.

- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical panels ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.
- D. Anchor surface mounted curtain tracks to gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.
- E. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- F. Remove damaged or defective components and replace with new components or repair to the original condition.

### **3.2 ACCEPTANCE**

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

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**SECTION 10 26 00**  
**WALL AND DOOR PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies, bumper rails, corner guards and high impact wall covering.

**1.2 RELATED WORK**

- A. Wood hand rails and chair rails: Section 06 20 00, FINISH CARPENTRY AND PLASTIC FABRICATIONS
- B. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

**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. Bumper Rails.
  - 2. Corner Guards.
  - 3. High Impact Wall covering.
- 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 degrees 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

G. United States Green Building Council (USGBC)

## **PART 2 - PRODUCTS**

### **2.1 VOC's**

VOC's shall be in compliance with VOC requirements of LEED Version 3.0,  
2009.

### **2.2 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.



## **2.3 CORNER GUARDS**

- A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 6 mm (1/4-inch corner) with 3 inch wings.
  - 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.

## **2.4 BUMPER RAILS**

- A. Resilient Bumper Rails:
  - 1. Bumper Rails : Vinyl/acrylic extrusions, 4 inches high. Continuous aluminum retainer with continuous vinyl cushion, fasteners with bumper cushions 16 inches OC maximum

## **2.5 HIGH IMPACT WALL COVERING**

- A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 6mm (0.06 inch) thick designed specially for interior use.
- B. If vertical joints occur provide manufacturer's standard joint cover to match wall covering finish and color.
- C. Provide adhesive as recommended by the wall covering manufacturer.

## **2.6 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.

## **2.7 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 scheduled on Drawings.

## **PART 3 - INSTALLATION**

### **3.1 RESILIENT CORNER GUARDS**

Install corner guards on walls in accordance with manufacturer's instructions.

### **3.2 BUMPER RAILS**

Secure rails to walls with mounting cushions, brackets and fasteners in accordance with manufacturer's details and instructions.

### **3.3 HIGH IMPACT WALL COVERING**

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Install wall protection starting above wall base.
- C. Apply with adhesive in controlled environment according to manufacture's recommendations.

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**SECTION 10 28 00  
TOILET ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured items usually used in dressing rooms, toilets, locker rooms and at sinks in related spaces.
- B. Items Specified Contractor furnished Contractor installed.
  - 1. Grab Bars
  - 2. Metal framed mirror
  - 3. Baby changing station
  - 4. Stainless steel shelves
- C. This section also specifies custom fabricated items used in toilets and related spaces.

**1.2 RELATED WORK**

- A. Support for accessories: Section 05 50 00, METAL FABRICATIONS

**1.3 ACCESSORIES FURNISHED AND INSTALLED BY VA**

This section does not include the following items which are furnished and installed by the VA: paper towel dispenser, waste receptacle, toilet paper dispenser, single robe hook and wall mounted liquid soap dispenser.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified as CFCI.
  - 2. Metal framed mirrors, showing shelf where required.
  - 3. Grab bars, showing design and each different type of anchorage.
- C. Samples:
  - 1. One of each type of accessory specified as CFCI.
  - 2. After approval, samples may be used in the work.
- D. Manufacturer's Literature and Data:
  - 1. All accessories specified.
  - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
  - 3. Show working operations of spindle for toilet tissue dispensers.
- E. Manufacturer's Certificates:
  - 1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, PhisoHex and solutions containing hexachlorophene.
  - 2. Anodized finish as specified.

### 1.5 QUALITY ASSURANCE

- A. Each 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 accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled 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.

### 1.6 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

### 1.7 STORAGE

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

### 1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - A176-99(R2004).....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
  - A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - A312/A312M-06.....Seamless and Welded Austenitic Stainless Steel Pipes
  - A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

- B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and Tubes
- B456-03.....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium
- C1036-06.....Flat Glass
- C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass
- D635-06.....Rate of Burning and/or Extent and Time of  
Burning of Self Supporting Plastics in a  
Horizontal Position
- F446-85 (R2004).....Consumer Safety Specification for Grab Bars and  
Accessories Installed in the Bathing Area.
- A269-07.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
- C. The National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500 Series.....Metal Finishes Manual  
AMP 500-505-88.....Metal Finishes Manual and Finishes for Stainless  
Steel
- D. American Welding Society (AWS):  
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless  
Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):  
A-A-3002.....Mirrors, Glass  
FF-S-107C (2).....Screw, Tapping and Drive  
FF-S-107C.....Screw, Tapping and Drive.  
WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail  
Specification

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
  2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.

- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass: ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.
- G. Plywood: PS1, Grade CD.

## **2.2 FASTENERS**

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized.
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
  - 1. ASME B18.6.4.
  - 2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be joined.

## **2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32 Mechanical finish, medium satin.
  - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
  - 3. Ferrous Metal:
    - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
    - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

## **2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.

- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

## **2.5 GRAB BARS**

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor and on toilet partitions.
- D. Bars:
  - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
    - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
  - 2. Fabricate in one continuous piece with ends turned toward walls, except swing up, bars may be fabricated in two sections, with concealed slip joint between.
  - 3. Continuous weld intermediate support to the grab bar.
- E. Flange for Concealed Mounting:
  - 1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
  - 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.
- G. Back Plates:
  - 1. Minimum 2.65 mm (0.1046 inch) thick metal.
  - 2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
  - 3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

## **2.6 METAL FRAMED MIRRORS**

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.
- B. Mirror Glass:
  - 1. Minimum 6 mm (1/4 inch) thick.
  - 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:
  - 1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
  - 2. Use either 0.9 mm (0.0359 inch) thick stainless steel, .
- D. Back Plate:
  - 1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
  - 2. Use set screw type theft resistant concealed fastening system for mounting mirrors.
- E. Mounting Bracket:
  - 1. Designed to support mirror tight to wall.
  - 2. Designed to retain mirror with concealed set screw fastenings.

## **2.7 STAINLESS STEEL SHELVES, TYPES 45.**

- A. Fabricate shelves and brackets to design shown of 1.2 mm (0.0478-inch) thick stainless steel.
- B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 6 mm (1/4-inch) anchor bolts.
- C. Screw or weld brackets to shelves.

## **2.8 BABY CHANGING STATION**

- A. Horizontal design
  - 1. FDA approved injection-molded polypropylene
  - 2. Concealed pneumatic cylinder providing controlled, slow opening and closing of the changing station bed.
  - 3. Reinforced full length steel on steel hinge.
  - 4. Contoured, concave and smooth 450 sq in changing surface.  
Replaceable, snap-lock, nylon protective holding straps.
  - 5. Performance - Unit shall not deflect more than 1 degree from 90 degrees with a 200 lb static load placed in the center of the changing surface.



### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Resident Engineer the exact location of accessories.

#### **3.2 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. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.
- I. Install wall mirrors in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

#### **3.3 SCHEDULE OF ACCESSORIES**

Items and locations are indicated on the Drawings.

#### **3.4 CLEANING**

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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**SECTION 10 44 13**  
**FIRE EXTINGUISHER CABINETS AND BRACKETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section covers recessed fire extinguisher cabinets and fire extinguisher brackets.

**1.2 RELATED WORK**

A. Field Painting: Section 09 91 00, PAINTING.

**1.3 QUALITY ASSURANCE**

- A. Manufacturer and Product Qualifications: Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly engaged in manufacturing items of the type specified. Additional or better features, not specifically prohibited by the specifications, but which are parts of the manufacturer's standard commercial product shall be included in the product.
- B. Source Limitations: Each product type shall be the same made by the same manufacturer.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet and bracket including installation instruction, and applicable rough opening requirements.

**1.5 APPLICATION PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):  
D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINET**

Semi-Recessed type with flat trim of size and design shown.

**2.2 FABRICATION**

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.

2. Design doors to open 180 degrees.
3. Provide continuous hinge, pull handle, and adjustable roller catch.

### **2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

### **2.4 FIRE EXTINGUISHER BRACKETS**

- A. Extinguisher cabinet manufacturer's standard bracket; select to accommodate size of required fire extinguishers.

## **PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.
- C. Install fire extinguisher brackets securely and in accordance with manufacturer's instructions.
- D. Install brackets at height above finished floor as indicated on Drawings.

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**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; cabinets; lockers; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.

**1.2 RELATED WORK**

- A. Section 08 80 00, GLAZING.
- B. Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- C. Section 09 29 00, GYPSUM BOARD.
- D. Section 09 51 00, ACOUSTICAL CEILINGS.
- E. Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.
- F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- G. Section 22 13 00, FACILITY SANITARY AND VENT PIPING.
- H. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- I. Section 23 21 13, HYDRONIC PIPING.
- J. Section 23 23 00, REFRIGERATION PIPING.
- K. Section 23 31 00, HVAC DUCTS AND CASINGS.
- L. Section 23 36 00, AIR TERMINAL UNITS.
- M. Section 23 37 00, AIR OUTLETS AND INLETS.
- N. Section 26 24 16, PANELBOARDS.

O. Section 26 51 00, INTERIOR LIGHTING.

### **1.3 QUALITY CONTROL**

#### **A. Shop-Drawing Preparation:**

1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

#### **B. Coordination:**

1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

#### **C. Seismic Certification:**

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipments and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

### **1.4 SUBMITTALS**

#### **A. Submit a coordinated set of equipment anchorage drawings prior to installation including:**

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

#### **B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:**

1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.

2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  3. Pipe contents.
  4. Structural framing.
  5. Location of all gravity load pipe supports and spacing requirements.
  6. Numerical value of gravity load reactions.
  7. Location of all seismic bracing.
  8. Numerical value of applied seismic brace loads.
  9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  3. Maximum spacing of hangers and bracing.
  4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):  
355.2-07.....Qualification for Post-Installed Mechanical  
Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC):  
Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specification for Carbon Structural  
Steel

- A53/A53M-10.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and Seamless
- A307-10.....Standard Specification for Carbon Steel Bolts  
and Studs; 60,000 PSI Tensile Strength.
- A325-10.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum Tensile  
Strength
- A325M-09.....Standard Specification for High-Strength Bolts  
for Structural Steel Joints [Metric]
- A490-10.....Standard Specification for Heat-Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength
- A490M-10.....Standard Specification for High-Strength Steel  
Bolts, Classes 10.9 and 10.9.3, for Structural  
Steel Joints [Metric]
- A500/A500M-10.....Standard Specification for Cold-Formed Welded  
and Seamless Carbon Steel Structural Tubing in  
Rounds and Shapes
- A501-07.....Specification for Hot-Formed Welded and Seamless  
Carbon Steel Structural Tubing
- A615/A615M-09.....Standard Specification for Deformed and Plain  
Billet-Steel Bars for Concrete Reinforcement
- A992/A992M-06.....Standard Specification for Steel for Structural  
Shapes for Use in Building Framing
- A996/A996M-09.....Standard Specification for Rail-Steel and Axel-  
Steel Deformed Bars for Concrete  
Reinforcement
- E488-96(R2003).....Standard Test Method for Strength of Anchors in  
Concrete and Masonry Element
- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, February 2011
- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems,  
1998 Edition and Addendum

#### 1.6 REGULATORY REQUIREMENT

- A. IBC 2012.
- B. Exceptions: The seismic restraint of the following items may be omitted:



1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
3. Gas and medical piping less than 2-1/2 inches inside diameter.
4. Piping in boiler plants and equipment rooms less than 1 1/4 inches inside diameter.
5. All other piping less than 2-1/2 inches inside diameter, except for automatic fire suppression systems.
6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
7. All electrical conduits, less than 2-1/2 inches inside diameter.
8. All rectangular air handling ducts less than six square feet in cross sectional area.
9. All round air handling ducts less than 28 inches in diameter.
10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

## **PART 2 - PRODUCTS**

### **2.1 STEEL**

- A. Structural Steel: ASTM A36/A36M, A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM A307, A325/A325M.

### **2.2 CAST-IN-PLACE CONCRETE**

- A. Concrete: 28 day strength, f'c = 25 MPa (3,000 psi).
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION, GENERAL**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:

1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

### **3.2 EQUIPMENT RESTRAINT AND BRACING**

- A. See drawings for equipment to be restrained or braced.

### **3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- D. Seismic Restraint of Piping:
  1. Design criteria:
    - a. Piping resiliently supported: Restrain to support 120 percent of the weight of the systems and components and contents.
    - b. Piping not resiliently supported: Restrain to support 60 percent of the weight of the system components and contents.
- E. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

### **3.4 PARTITIONS**

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

### **3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

### **3.6 FACADES AND GLAZING**

- A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.
- B. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

### **3.7 STORAGE RACKS, CABINETS, LOCKERS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor metal lockers to walls.
- E. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

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