

# PROJECT MANUAL

## VOLUME ONE

### Establish Sunnyvale R&D Campus

Contract No. 640-397

Electrical

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5 Third Street, Suite 716  
San Francisco, CA 94103  
Phone: 415-546-0490

Mechanical

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PO Box 2586  
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Architect – Engineer

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Fire Protection

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Geotechnical:

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### Department of Veterans Affairs

Palo Alto Health Care System  
3801 Miranda Avenue  
Palo Alto, California

2017.04.30 – Fully Sprinklered



# PROJECT MANUAL

## VOLUME ONE STAMPS & SIGNATURES



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**DEPARTMENT OF VETERANS AFFAIRS  
SPECIFICATIONS**

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23 36 00	Air Terminal Units
23 37 00	Air Outlets and Inlets
23 40 00	HVAC Air Cleaning Devices
23 50 11	Boiler Plant Mechanical Equipment
23 51 00	Breechings, chimneys and stacks
23 52 25	Low pressure water heating boilers
23 52 33.19	Package Water - Tube Boiler
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23 74 13	Packaged, Outdoor, Central Station Air-Handling Units
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26 22 00	Low-Voltage Transformers
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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 construction operations, and furnish all labor, equipment and materials and perform work for the expansion and modification of the Sunnyvale New Office and Labs, Sunnyvale, CA as required by the drawings and specifications.
- B. Visits to the VA Sunnyvale Campus site by Bidders may be made only at pre-bid meeting.
- C. Offices of The KPA Group, 6700 Koll Center Parkway, Pleasanton, CA 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.
- D. Before placement and installation of work subject to tests by a testing laboratory approved by the COR and retained by the contractor, the Contractor shall notify the Contracting Officer's Representative and the testing laboratory in sufficient time to enable the COR and the 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 Contracting Officer's Representative.
- E. All employees of the Contractor and subcontractors shall comply with the VA security management program and obtain permission for site entry from the VA police, be identified by project and employer, and be restricted from unauthorized access.
- F. The Contractor will continually clean-up any dust, dirt or debris caused by their jobsite Ingress/egress. The contractor will not be allowed to use the existing lobby, stairwells, and elevators for construction activities. Contractor at his own expense shall install temporary measures as required for construction office space, pathways, and transportation of personnel, materials, and equipment.
- G. Dust and fume control will be exercised during all construction operations. Workers will be careful not to operate any vehicles, gas or diesel engines, or to perform any fume or dust generating process near a building air intake system. Construction noise shall be held to a minimum - the city of Sunnyvale's Construction noise ordinance shall be adhered to at all times - Construction activity noise shall only be permitted between the hours of seven a.m. and six p.m. daily Monday

through Friday. Saturday hours shall be between eight a.m. and five p.m. There shall be no construction activity on Sunday or federal holidays when city offices are closed. See contractor normal working hours section 1.5 paragraph 3.

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

- A. ITEM I, GENERAL: Work includes general demolition of structures and site construction.
- B. SCOPE OF WORK: This two-story office addition to Building 1002 at the VA Palo Alto Health Care System (project located in Sunnyvale, CA) shall accommodate office and lab facilities. The intent of the project will provide a complete and functional office building addition as shown on the Contract Documents.

The Scope of Work includes construction of approximately 12,900 square feet of new office spaces on two levels; connection to a recently constructed lobby that is connected to an older two story office building. Contractor shall be required to operate concurrently with separate contractor(s) for other VA Sunnyvale Campus renovation project(s) separate from this contract. Site access & utilities for other VA construction projects shall not be disturbed by this project.

Selective demolition will include removal of existing topsoil and unsuitable soil materials, removal of portions of existing pavements, removal of existing building finishes and other building elements necessary for new construction.

The new addition will be a combination of concrete foundation, steel framing, metal deck with concrete fill, and metal stud partitions, and curtain wall framing. Site work will include Storm, Sewer, Domestic & Fire water, and site lighting & other misc. features.

A new fire protection sprinkler system will be extended into the new addition. New roof drains and overflow will be provided. New light fixtures will be provided. New HVAC, plumbing, electrical, data and communication outlets, and security systems will be incorporated into the work and interconnected into new and existing systems.

- i) Period of Performance (POP): the period of performance includes all preconstruction activities from date of 'Notice to Proceed' (NTP) through all construction activities till project acceptance

by the Contracting Officer, but does not include days for contracting administrative close out, contractor submittal of close-out documents, LEED requirements, and other misc. activities not directly related to construction all of which are at the contractor's own expense if not completed by the date of contractor demobilization / construction site turn over to the VA.

I. Total Period of Performance: (546 days)

a. Pre-Construction POP (126 Days) from NTP to Mobilization

1. From NTP to approval by the COR to mobilize contractor shall prepare, submit for review, make corrections as necessary till accepted by the COR in writing all product data, design, shop drawings for the following specifications:

01 00 00	General Requirements
01 32 16.15	Project Schedules
01 45 29	Testing Laboratory Services
01 52 50	Safety Requirements
01 57 19	Temporary Environmental Controls
01 74 19	Construction Waste Management
02 41 00	Demolition
03 30 00	Cast-in-Place Concrete
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21 08 00	Commissioning of Fire Suppression Systems
21 13 13	Wet-Pipe Sprinkler Systems
22 05 11	Common Work Results for Plumbing
22 05 23	General-Duty Valves for Plumbing Piping
22 07 11	Plumbing Insulation
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23 05 11	Common Work Results for HVAC
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27 05 33	Raceways and Boxes for Communications Systems
27 10 00	Structured Cabling
27 11 00	Communications Equipment Room Fittings
27 15 00	Telecommunications Horizontal Cabling
27 51 16	Public Address System
28 31 00	Fire Detection and Alarm
31 20 00	Earthwork
33 10 00	Water Utilities
33 30 00	Sanitary Sewer Utilities
33 40 00	Storm Sewer Utilities

2. Contractor shall not be authorized to mobilize for construction activities till all the listed specifications submittals in this section have been accepted in writing by the COR. Contractor may mobilize sooner than the specified 126 days dependent on COR approval of all submittals listed in this section.

3. Failure of contractor to provide & receive COR acceptance for the submittals in the specified POP timeframe will be considered by the CO a contractor delay to the project and

will be enforced per the liquidated damages clause of the contract if the project extends beyond the total project period of performance specified. Contractor shall allow for 15 calendar days for each submittal & resubmittal reviewed by the VA / AE team.

- II. Construction POP (420 days)- from date of Mobilization till project acceptance by the Contracting Officer. (420 days) includes (42 working days) lost due to inclement weather where work on the critical path is not possible. Critical Path shall be determined by the COR approved base line schedule required in specification 01 32 16.15. (42 working days) are not subject to request for equitable adjustment - project schedule shall use the 42 working days as float during the inclement weather months of October 1 through March 31 during the Construction project duration.

C. DEDUCTIVE ALTERNATE NO.1 - Site Miscellaneous - Same as Base Bid Item #1 except delete the following:

1. Delete New Fire Hydrant extensions - Delete all labor, materials and equipment to Fire Hydrant extensions as identified on the Drawings.
2. Delete Security Cameras - Delete all labor, materials and equipment to Security Cameras as identified on the Drawings.
3. Delete Sounded Paging - Delete all labor, materials and equipment to Sounded Paging as identified on the Drawings.

D. DEDUCTIVE ALTERNATE NO. 2 - Interior Office - Same as Deductive Alternate #1 except delete the following:

1. Delete Core Office Area and Millwork - Delete all labor, materials and equipment to omit room 144, 145, 146, 147, 148, 244, 245, 246, 247, 248as identified on the Drawings and Millwork (cabinetry and wood wall panels. Including lights, data, telecom, low voltage and extension of duct work).
2. Delete Room 123, 137, 223, 237 and Millwork - Delete all labor, materials and equipment to omit Team Rooms & Conference Rooms as identified on the Drawings and Millwork (cabinetry and wood wall panels. Including lights, data, telecom, low voltage and extension of duct work).
3. Delete Room 128, 228 and Millwork - Delete all labor, materials and equipment to omit Reprographic Rooms as identified on the Drawings and Millwork (cabinetry and wood wall panels. Including lights, data, telecom, low voltage and extension of duct work).

E. DEDUCTIVE ALTERNATE NO. 3 - Exterior - Same as Deductive Alternate 2 except delete the following:

1. Delete Mechanical Equipment Screen on the Roof. Delete all labor, materials and equipment to omit Mechanical Equipment Screen as identified on the Drawings.
2. Delete Roof Walkway Pads. Delete all labor, materials and equipment to omit Roof Walkway pads as identified on the Drawings.
3. Delete Utility Fence at utility yard. Delete all labor, materials and equipment to omit Utility Fence at utility yard as identified on the Drawings.
4. Delete Roof Ladders. Delete all labor, materials and equipment to omit Roof Ladders as identified on the Drawings.

F. DEDUCTIVE ALTERNATE NO. 4 - Finishes - Same as Deductive Alternate #3 except delete the following:

1. Delete Whisper Clouds. Delete all labor, materials and equipment to omit Whisper Clouds as identified on the Drawings.
2. Delete Tile (CT-4 & CT-5). Delete all labor, materials and equipment to omit Tiles as identified on the Drawings.
3. Delete Light Boxes. Delete all labor, materials and equipment to omit Light Boxes as identified on the Drawings.
4. Delete Carpet. Delete all labor, materials and equipment to omit Carpet as identified on the Drawings.
5. Delete Blinds & Shades. Delete all labor, materials and equipment to omit Blinds & Shades as identified on the Drawings.
6. Delete Computer Millwork. Delete all labor, materials and equipment to omit Computer Millwork as identified on the Drawings.
7. Delete Wood Wall Panel at Hallways. Delete all labor, materials and equipment to omit Wood Wall Panel at Hallways as identified on the Drawings.
8. Delete Terrazzo at Hallway at First Floor. Delete all labor, materials and equipment to omit Terrazzo at Hallway as identified on the Drawings.
9. Delete Acoustical Perforated ceiling panels. Delete all labor, materials and equipment to omit Acoustical Perforated ceiling panels as identified on the Drawings.

### **1.3 SPECIFICATIONS AND DRAWINGS**

A. After award of contract, specifications and drawings will be available for download from a link provided by the Contracting Officer's Representative

- B. The Contractor shall maintain on the job site one (1) printed set of specifications, one (1) printed set of drawings, one (1) printed copy of all RFI's and any documents that modify the original specifications and drawings.

#### **1.4 ACCIDENT PREVENTION**

- A. The Contractor shall provide and maintain work environments and procedures which will:
  - 1. Safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;
  - 2. Avoid interruptions of Government operations and delays in project completion dates;
  - 3. Control costs in the performance of this contract; and
  - 4. Maintain a safe and healthy worksite to prevent adverse impacts to Contractor and subcontractor employees.
- B. The Contractor shall:
  - 1. Before commencing the work, submit a written Safety Plan for implementing actions to prevent accidents. The plan shall include an analysis of significant hazards to life, limb and property inherent in contract work performance and measures for controlling these hazards and avoiding personnel exposure. Meet with the Contracting Officer's Representative to discuss and develop a mutual understanding relative to administration of the overall safety program and obtain approval for the Contractor's Safety Plan from the Contracting Officer's Representative before work start.
  - 2. Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910 (OSHA); and Title 8, California Administrative Code - Construction Standards (CAL OSHA)
  - 3. Prior to commencing work, provide proof that an OSHA designated competent person (CP) per 29 CFR 1926.20(b)/ 1926.32(f)(2) will maintain a presence at the work site whenever the Contractor or subcontractors are present.
  - 4. Provide appropriate safety barricades, signs, signal lights and personal protective equipment (hard hats, goggles, protective shoes, gloves, masks or breathing apparatus, etc.).
  - 5. Ensure all Contractor and subcontractor employees have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by Contracting Officer's Representative. General Contractor shall maintain at least one person on site at all times who has completed the 30 hours OSHA Construction Safety Course (submittal of 30-hour training certificate required prior to start of

- work), and shall represent the contractor as the competent person / safety officer. Submit training records of all such employees for approval before the start of work.
6. Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for accident protection and safety of personnel are taken.
- C. Whenever the Contracting Officer becomes aware of any noncompliance with safety requirements or any condition which poses a serious or imminent danger to the health or safety of personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.
- D. The Contractor shall insert the above clause with appropriate changes in the designation of the parties in subcontracts.

#### **1.5 CONSTRUCTION SECURITY REQUIREMENTS**

- A. Security Plan (Submittal of Security Plan is required prior to mobilization):
1. The Security Plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
  2. The Contractor is responsible for assuring that all sub-Contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
1. Contractor and subcontractor employees shall not enter the project site without an appropriate badge (where badge is required). They will be subject to inspection of their personal effects when entering or leaving the project site.
  2. The Contractor shall create an Employee Daily Log of all personnel working on the site. The Employee Daily Log shall contain the employee's (a) Full Name, (b) Employer/Company Name and (c) Occupation/Trade. The Employee Daily Log shall be submitted with the Contractor's Daily Work Report.
3. Contractor's normal working hours shall be 7am to 4pm Monday through Friday excluding federally observed holidays.

- I. Contractor must observe Federal Holidays with no work allowed on such days. Refer to the OPM website [www.opm.gov](http://www.opm.gov) for the observed Federal Holidays and their dates for the applicable year.
- a. Contractor must obtain written prior approval by the COR to work outside of normal working hours and Saturdays. This notice is separate from any notices required for utility shutdown described later in this specification.
  4. No photography of VA premises is allowed without written permission of the VA Public Affairs Officer.
  5. The VA Police are Federal Police Officers with full authority to make arrests, investigate crimes and issue traffic citations. Citations issued require an appearance in the Federal District Court and/or payment of a fine. Speed limits and other driving and parking codes are strictly enforced. Any vehicle left unattended for more than a few minutes may be cited by the VA Police.
  6. Sexual harassment is strictly prohibited. This includes deliberate or unsolicited verbal comments or gestures of a sexual nature, unwelcome sexual advances, requests for sexual favors and/or other unwelcome verbal or physical conduct of a sexual nature.
  7. Possession or use of non-prescription drugs or alcohol, including beer and wine, on the Health Care System grounds is strictly prohibited. Possession of firearms, knives with blades over 4", ammunition, explosive devices and any item that may be considered an offensive weapon is strictly prohibited. This includes carrying such items in vehicles.
  8. The Health Care System does not have the equipment, facilities, or personnel trained to handle serious injuries. Call 911 for emergency medical assistance and notify the Contracting Officer's Representative and the VA Police.
  9. Vehicle authorization requests shall be required for any contractor vehicle entering the site and such requests shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
  10. VA reserves the right to shut down the project site and order Contractor's employees and subcontractors off the premises in the event of a national emergency or local disaster. The Contractor may return to the site only with the written approval of the Contracting Officer's Representative.

C. Guards: NOT USED

D. Key Control:

1. The Contractor shall provide duplicate keys and lock combinations to the Contracting Officer's Representative for the purpose of security inspections and emergency actions for every area of the project site including tool boxes and parked machines.
2. The Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation.

E. Document Control:

1. Before mobilization, the Contractor shall submit to and receive acceptance by the COR, an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "Sensitive Information".
2. The Contractor is responsible for safekeeping of all drawings, project manuals and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit access to only those who will need it for the project. Return the information to the Contracting Officer's Representative upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer's Representative.
5. All paper waste or electronic media shall be shredded, destroyed or erased in a manner acceptable to the VA.
6. Notify Contracting Officer's Representative and Site Security Officer immediately when there is a loss or compromise of "Sensitive Information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive Information" including drawings and other documents may be attached to e-mails provided all VA encryption procedures are followed.

**1.5 FIRE SAFETY**

- A. Applicable Publications: Publications listed below form part of this Article.

1. American Society for Testing and Materials (ASTM):  
E84-13a.....Surface Burning Characteristics of Building  
Materials
  2. National Fire Protection Association (NFPA):  
NFPA 10.....Standard for Portable Fire Extinguishers  
NFPA 30.....Flammable and Combustible Liquids Code  
NFPA 51.....Standard for Fire Prevention During Welding,  
Cutting and Other Hot Work  
NFPA 70/NEC.....National Electrical Code  
NFPA 241.....Standard for Safeguarding Construction,  
Alteration, and Demolition Operations
  3. Occupational Safety and Health Administration (OSHA):  
29 CFR 1910/1926.....Safety and Health Regulations for Construction
- B. Fire Safety Plan (Submittal acceptance by COR of Fire Safety Plan is required prior to mobilization):
- 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 Contracting Officer's Representative for review for compliance with contract requirements. Prior to any worker for the Contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the Contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VA safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VA equipment, etc. Documentation shall be provided to the Contracting Officer's Representative that individuals have undergone Contractor's safety briefings.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and fire, police and other emergency response forces in accordance with NFPA 241. In the event of a fire or during a fire drill, the Contractor must vacate the construction site if within the zone affected.
- D. Separate temporary facilities such as trailers, storage sheds and dumpsters from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 20 feet exposed overall length, separate by 10 feet.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer's Representative.



- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily and report findings and corrective actions weekly to Contracting Officer's Representative.
- H. Fire Extinguishers: Provide, maintain and show proof of extinguisher maintenance in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10. Provide minimum of (2) 10 pound fire extinguishers at all times.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Standpipes: Maintain standpipes at each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection and fire alarm systems except for portions immediately under construction or temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. If a Fire Alarm system or sprinkler system is out of service for more than 4 hours, then the Contractor shall implement Interim Life Safety Measures in accordance with VA Palo Alto Health Care System Memorandum SAFE 13-23. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer's Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the Contracting Officer's Representative.
- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer's Representative.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51. Any welding, cutting metal or other burning or spark producing operations require a hot work permit. Welding and/or burning operations are allowed only during normal working hours. Coordinate with Contracting Officer's Representative to obtain permits from the Facility Safety Officer at least 24 hours in advance. Evidence of training of all personnel assigned to be a fire watch shall be provided before Hot Work Permits will be issued. A fire watch is required for all hot work unless specified differently on the permit. The fire watch shall have fire extinguishing equipment readily available and be trained in its use and be familiar with facilities for sounding an alarm in the event of a fire. They shall watch for fires in all

exposed areas, try to extinguish then otherwise sound the alarm. A fire watch shall be maintained for at least 30 minutes after completion of hot work.

- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with and report findings and corrective actions weekly to Contracting Officer's Representative.
- P. Smoking: Smoking is prohibited in all buildings and adjacent construction areas. Smoking is prohibited except in designated smoking areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily. Waste and debris will not be disposed of on station or in VA trash containers or dumpsters. The Contractor shall provide their own bin or dumpster; however, the use and location of such must be approved in writing by the Contracting Officer's Representative. Construction waste and debris will not be accumulated in corridors or other building areas where it might cause a fire or safety hazard. Contractor shall provide a monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling per SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- R. Smoke/fire Barrier Penetrations: Any penetrations to smoke or fire barrier walls, ceilings or floor slabs shall be properly sealed immediately with Hilti Fire Stop 601 or 635 for walls and ceilings and Hilti Fire Stop 657 for floor penetrations or approved equal.
- S. Install one-hour temporary construction partitions as shown on drawings or as required to separate the work site from the occupied portion of the building and maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures. 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.
- S. If required, submit documentation to the Contracting Officer's Representative that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

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

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer's Representative. 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's Representative 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 their expense upon completion of the work. With the written consent of the Contracting Officer's Representative, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, as prescribed by the Contracting Officer's Representative, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer's Representative. 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, code 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 Contracting Officer's Representative.
- E. Workmen are subject to rules of the VA Campus applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of the VA Campus as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by the VA in quantities sufficient for not more than two work days. Provide unobstructed access to VA Campus areas required to remain in operation.
- G. Utilities Services: Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems, they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by

Contracting Officer's Representative. All such actions shall be coordinated with any Utility Company involved:

- H. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, six-foot minimum height, around the construction area, material storage areas and dumpsters/waste locations. Contractor shall provide and maintain visual screening fabric for all fencing. Contractor shall provide gates as required for access with necessary hardware including hasps and locks. All gates shall be kept closed at all times, and locked when no workers are present. Contractor shall coordinate with the COR to assure VA access at any time. Contractor shall remove the fence when directed by Contracting Officer's Representative.

Contractor shall place all applicable safety signs as required by 29 CFR 1926, securely attached to fence or approved surface. Contractor shall also place construction area signs on the exterior of the construction fence alerting campus and contractor personnel that the fence is enclosing a construction area. Sign shall indicate Construction Area, Authorized Personnel Only, Hard Hats and safety shoes required - Spacing of signs shall not exceed 50' on center, with a minimum of one safety sign on each direction of fence.

- I. Work areas will be vacated by Government and turned over to Contractor after date of Notice to Proceed and all pre-construction activities and submittals have been accepted by the COR.

- J. When a building/ area are turned over to Contractor, Contractor shall accept entire responsibility therefore.

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

- K. Utilities Services: Maintain existing utility services for the VA Campus at all times.

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 Contracting Officer's Representative. 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 Contracting Officer's Representative 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 Contracting Officer's Representative, in writing, 5 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 the VA. Interruption time approved by Contracting Officer's Representative may occur at other than Contractor's normal working hours at the contractor's own expense.
  4. Major interruptions of any system must be requested, in writing, at least 45 calendar days prior to the desired time and shall be performed as directed by the Contracting Officer's Representative. Contractor shall make provisions that all major utility interruptions shall occur during off hours and / or Saturdays at the contractor's own expense.
  5. In case of a contract construction emergency, service will be interrupted on approval of Contracting Officer's Representative. 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 Contractor.
- L. 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.
- M. To minimize interference of construction activities with flow of VA Campus traffic, comply with the following:
1. The Contractor shall not block any road or street, walkway or building egress without requesting in writing for approval from the Contracting Officer's Representative. Written requests shall be made at least (21) days prior to proposed interruption. 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 work crosses 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 Contracting Officer's Representative.

N. Coordinate this contract with other construction operations as directed by Contracting Officer's Representative. This includes the scheduling of traffic and the use of roadways.

#### **1.7 ALTERATIONS**

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the Contracting Officer's Representative, of buildings areas in which alterations occur and areas which are anticipated routes of access, and furnish a signed report, to the Contracting Officer's Representative. 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 the building.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contracting Officer's Representative.

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 Contracting Officer's Representative to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and Contracting Officer's Representative 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. 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 VA's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Contracting Officer's Representative and Facility ICRA team for review for compliance with contract requirements.
  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. VA Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the Contracting Officer's Representative prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition in patient-care areas:

1. The Contractor, Contracting Officer's Representative and VA Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in patient-care areas 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. The contractor shall install negative air machines as directed by the Contracting Officer's Representative and shall be required to add machines as directed.
  2. In case of a problem - the VA, 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 Contracting Officer's Representative. Blank off ducts and diffusers to prevent circulation of dust into adjacent areas during construction.
  2. Do not perform dust producing tasks within adjacent areas without the approval of the Contracting Officer's Representative. 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 temporary drywall construction barriers to separate construction from the operational areas of the facility to contain dirt debris and dust. Construct the dust proof barrier with a one hour fire rating. Barriers shall be sealed and made presentable on facility occupied side. Install a self-closing rated door and metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. For special cases a fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used in certain circumstances where hard walls cannot be constructed and an agreement is reached with the Contracting Officer's Representative and VA Fire Protection Specialist.
    - b. HEPA filtration is required. Contractor shall verify that construction exhaust to exterior is not reintroduced to the adjacent facility 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. The contractor shall install a state of the art air pressure differential monitor. The monitor shall be placed at such a location that anyone entering or leaving the work site shall be able to determine if negative air pressure is being maintained.
- d. Adhesive Walk-off/Carpet Walk-off Mats, minimum 24" x 36", shall be used at all interior transitions from the construction area to occupied medical center area. A shop vacuum with HEPA filtration shall be placed at any exit from the work site. These shop vacuums shall be used to remove dust that has accumulated on workers clothing while working whenever they leave the work site. The mats shall be changed as directed by the Contracting Officer's Representative to maintain clean work areas directly outside construction area at all times.
- e. Vacuum and wet mop all transition areas from construction to the adjacent facility at the end of each workday. Shop vacuums and vacuum cleaners 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.
- f. The contractor shall not haul debris through adjacent areas without prior approval of the Contracting Officer's Representative. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with tape. No sharp objects should be allowed to cut through the plastic. Wipe down the wheel treads and 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. Wheels and tires shall not track debris on floors outside the work zone.
- g. 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.
- h. 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 4 hours. Remove and dispose of porous materials that remain damp for more than 24 hours.

- i. 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 and existing air ducts shall be cleaned prior to final inspection.

**1.9 DISPOSAL AND RETENTION**

A. Materials and equipment accruing from work removed 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 from present locations in such a manner as to prevent damage. Store such items where directed by Contracting Officer's Representative.
2. Items not reserved shall become property of the Contractor and be removed by Contractor.
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 VA 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.
4. The Contractor is required to alert the VA immediately in the event any known or suspected hazardous materials are disturbed or will need to be disturbed before proceeding with work. Hazardous materials, such as PCB's, asbestos, lead paint, cleaning solutions and other harmful chemicals shall be disposed of in accordance with federal, state and local laws and regulations. In case of an accidental spill of hazardous materials, the Contractor shall take immediate action to contain the spill and notify the Contracting Officer's

Representative. Washing cement, plaster, paint, oil or grease, solvents, etc. into any drains is strictly prohibited. **REPORT ANY ACCIDENTAL SPILLS THAT MAY RUN INTO STORM DRAINS IMMEDIATELY TO ENGINEERING SERVICE AT 650-493-5000 EXTENSION 62468.**

**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 as directed by the Contracting Officer's Representative.
- B. Contractor shall protect all irrigation equipment designated to remain within the limit of work and ensure the continued irrigation of all existing planting areas to remain in place.
- C. *The project construction may affect irrigation operations beyond the limit of work.* It shall be the responsibility of the Contractor to ensure the irrigation operations beyond the limit of work, affected by the project construction, remain operational at all times during construction. Contractor shall make all repairs to restore operations within 24 hours of the disruption. If the Contractor fails or refuses to repair the damage within 24 hours of the disruption, the Contracting Officer's Representative may have the necessary work performed and charge the cost to the Contractor.
- D. The Contractor shall protect existing trees to remain by placing temporary fencing completely around the perimeter of the drip line of the trees. Provide 6' high tree protection fencing completely enclosing the tree(s). Avoid driving major fence posts or stakes into major roots.
  - 1. Treatment of roots exposed during construction. For roots over 1 inch in diameter damaged during construction, make a clean straight cut to remove damaged portion of the root. All exposed roots should be temporary covered with damp burlap and covered with soil or mulch as soon as possible to prevent drying.
  - 2. No equipment or machinery shall be used within the tree protection zone. Work within the protection zone shall be done manually.

3. No stockpiling of materials, vehicular traffic, or storage is allowed within the tree protection zone.
- E. 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's Representative may have the necessary work performed and charge the cost to the Contractor.

#### **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 Contracting Officer's Representative. Existing work to be altered or extended and that which is found to be defective in any way, shall be reported to the Contracting Officer's Representative 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 the same or better condition as existed before contractor commencing work at Contractor's own expense.
- C. 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, computer network, etc.) which are indicated on drawings or reasonably discovered during execution of the work and which are not scheduled for discontinuance or abandonment at Contractor's own expense.
- D. Expense of repairs to such utilities and systems not shown on drawings for which locations are unknown and not reasonably discovered will be considered for 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 PHYSICAL DATA**

- A. Data and information (test borings, hydrographic data, test pits, weather conditions, etc.) furnished or referred to is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor. (FAR 52.236-4)

**1.13 LAYOUT OF WORK**

- A. The Contractor shall lay out the work and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all templates, 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 that may be established or indicated by the Contracting Officer's Representative. The Contractor shall also be responsible for maintaining and preserving all marks established by the Contracting Officer's Representative 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's Representative 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)

**1.14 AS-BUILT DRAWINGS**

- A. The Contractor shall maintain one full size set of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Contracting Officer's Representative's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Contracting Officer's Representative within 15 calendar days after each completed phase and after the acceptance of the project by the Contracting Officer's Representative.  
Contractor shall provide all final as-built drawings prepared in CAD software. An electronic copy shall be delivered to the COR in both DWG format and PDF along with the two hard copy sets. Drawing size, style, and fonts shall match construction drawings provided to the contractor by the contracting officer. Coordinate with COR for allowable version of DWG files.

#### **1.15 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on the VA Campus and, when authorized by the Contracting Officer's Representative, such temporary roads which are necessary in the performance of contract work. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed transitions. Temporary roads and protection measures shall be constructed by the Contractor at Contractor's own expense.

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

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
1. Permission to use each unit or system must be given by Contracting Officer's Representative. If the equipment is not installed and maintained in accordance with the following provisions, the Contracting Officer's Representative 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 use 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.

**1.17 USE OF EXISTING ELEVATORS**

- A. Use of existing elevators for handling building materials and Contractor's personnel shall not be permitted under any circumstance.

**1.18 TEMPORARY TOILETS**

- A. Provide where directed, (for use of all Contractor and subcontractor employees) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by Contracting Officer's Representative, provide suitable dry closets where directed. Keep such places clean and free from odor or flying insects, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

**1.19 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. If applicable, the amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer's Representative, shall install and maintain all necessary temporary connections and distribution lines, transformers and electrical panels, and all meters required to measure the amount of electricity used for the purpose of determining contractor usage and charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated equipment at contractor's own expense.
- C. Contractor shall install electrical load meters at Contractor's expense and furnish the Contracting Officer's Representative a monthly record of the Contractor's usage of electricity.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any

temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the VA Campus electrical distribution system where practical. The Contractor shall separately meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
  - 2. Where Campus power is not practical or available for project power requirements, contractor shall provide portable power generators at contractor's own expense.
- F. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the VA Campus 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 Contracting Officer's Representative's discretion) of use of water from VA Campus system at no cost.
  - 3. Provide drinking water for construction personnel at all times.
- 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 or reimbursed by the Contractor at Contractor's expense.

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

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

#### **1.21 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of the Contracting Officer's Representative. Contractor shall



furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests, and re-tests as required.

- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

#### **1.22 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating Manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and Operating Manuals (two copies each plus pdf file) for each separate piece of equipment shall be delivered to the Contracting Officer's Representative 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 manufacturer representatives to give detailed instructions to assigned VA 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 Contracting Officer's Representative and shall be considered concluded only when the Contracting Officer's Representative is satisfied in regard to complete and thorough coverage. The VA reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Contracting Officer's Representative, does not demonstrate sufficient qualifications in accordance with requirements for the above.

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

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the building.
- 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 building.
- D. Notify Contracting Officer's Representative 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 the Contracting Officer's Representative. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Contracting Officer's 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 Contracting Officer's Representative.
- 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.

#### **1.24 RELOCATED EQUIPMENT 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 Contracting Officer's Representative.
- C. 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.

#### **1.25 CONSTRUCTION SIGN**

- A. Provide a Construction Sign where directed by the Contracting Officer's Representative. All wood members shall be of framing lumber. Face of sign shall be 3/4 inch thick exterior grade plywood. Provide three equally spaced 4x4 pressure treated framing posts extending full height of sign and four feet into ground. Set bottom of sign level at three feet above ground and secure to posts with through bolts. Brace posts with 2x4 framing material. Minimum sign size shall be 96" wide x 72" tall.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.

- C. Maintain sign and remove it when directed by the Contracting Officer's Representative.
- D. Submit to COR for approval prior to fabrication detailed drawing of proposed construction sign showing required legend and other characteristics of sign - if requested by Contractor COR may provide examples of previously approved signs.

#### **1.26 SAFETY SIGN**

- A. Provide a Safety Sign where directed by Contracting Officer's Representative. Face of sign shall be 3/4 inch thick exterior grade plywood. Provide two 4x4 pressure treated framing posts extending full height of sign and three feet into ground. Set bottom of sign level at four feet above ground. Minimum sign size shall be 48"x48".
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted and approved by Contracting Officer's Representative.
- C. Post on sign the number of accident free days on a daily basis.
- D. Maintain sign and remove it when directed by Contracting Officer's Representative.
- E. Submit to COR for approval prior to fabrication detailed drawing of proposed safety sign showing required legend and other characteristics of sign - if requested by Contractor COR may provide examples of previously approved signs.

#### **1.27 PHOTOGRAPHIC DOCUMENTATION**

- A. Contractor to provide digital photographic exhibit of existing site and work performed. Digital color photos shall be taken from a digital camera with a minimum of 7.0 megapixels. Photos shall be transmitted to the COR by DVD in jpeg or tiff, and PDF formats. Each photo's electronic file size shall be a minimum of 300k with a maximum file size of 1.5meg.
- B. Photos shall document all phases of construction and shall be updated weekly until the project has been completed. Photos shall be submitted each month along with the project invoice for monthly payment.

#### **1.28 FINAL ELEVATION DIGITAL IMAGES - NOT USED**

#### **1.29 HISTORIC PRESERVATION**

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

Establish Sunnyvale R&D Campus; 640-397

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**SECTION 01 32 16.15**

**PROJECT SCHEDULES**

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 CONTRACTOR'S REPRESENTATIVE:**

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

**1.3 CONTRACTOR'S CONSULTANT:**

- A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:
  - 1. The name and address of the proposed consultant.
  - 2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
  - 3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.
- B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall

have their scheduling consultant approved prior to submitting any schedule for approval.

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

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

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

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



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

- D. 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.
- E. 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.
- F. The Complete Project Schedule shall contain approximately 40 work activities/events.

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

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 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 COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
  4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.

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

**1.8 PAYMENT TO THE CONTRACTOR:**

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

**1.9 PAYMENT AND PROGRESS REPORTING**

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

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

slippage as well as ways to improve the project schedule status, when appropriate.

**1.10 RESPONSIBILITY FOR COMPLETION**

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

**1.11 CHANGES TO THE SCHEDULE**

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

any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

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

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

**PART 2 - PRODUCTS**

Not Used

**PART 3 - EXECUTION**

Not Used

- - - E N D - - -



**SECTION 01 33 23**

**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

**PART1 - GENERAL**

**1.1 RELATED WORK**

- A. 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 DEFINITIONS**

- B. For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the referenced requirements. The following text refers to all items collectively as SUBMITTALS.

**1.3 SUBMITTAL PROCEDURES**

- A. 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:
  - 1. Satisfactory written evidence is presented to, and approved by Contracting Officer's Representative, that manufacturer cannot make scheduled delivery of approved item or;
  - 2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - 3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- B. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- C. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Contracting Officer's Representative on behalf of the Contracting Officer.
- D. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

- E. 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 therefore by Contracting Officer's Representative, 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.
- F. 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's Representative and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- G. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer's Representative assumes no responsibility for checking quantities or exact numbers included in such submittals.
1. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  2. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
    - a. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
    - b. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

- c. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- H. In addition to complying with the applicable requirements specified in preceding Paragraph G, 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's Representative.
  - 1. Laboratory shall furnish Contracting Officer's Representative 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 Contracting Officer's Representative and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  - 5. Laboratory test reports shall be sent directly to Contracting Officer's Representative 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.
- I. 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.
- J. Approved samples will be kept on file by the Contracting Officer's Representative 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.

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

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

- L. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to:

The KPA Group  
1 Kaiser Plaza, Suite 445  
Oakland, California 94612

- M. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Contracting Officer's Representative.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

Not Used

- - - E N D - - -

**SECTION 01 40 50**  
**CONTRACTOR COORDINATION DRAWINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies specific requirements for the Contractor's coordination of the work of trades. Coordination will include all portions of the work.
- B. The Contractor is required to prepare coordination drawings for work that will occur above the finish ceiling of each floor, the roof deck(s), below grade both under the building(s), existing service and utility yards, general site, penetration through roof deck, floor deck, existing utility trench, and into adjacent existing buildings. These coordination drawings are in addition to those specified in particular in specific technical specification sections or required by notations on the drawings.
- C. Included:
  - 1. Required Drawings
  - 2. Schedule of sequence of each trade/subcontractor.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SCOPE OF COORDINATION DRAWINGS**

- A. Work above finish ceiling for each building and/or structure:
  - 1. Prior to the start of construction the contractor shall show on reproducible paper, the work of each trade including, but not limited to, pipe runs, mechanical ductwork, cable trays, conduit runs.
  - 2. Indicate locations of all dampers, valves, cleanouts and other devices requiring human access for maintenance and repair.
  - 3. Show the height above finish floor each item, demonstrating sufficient space for installation and maintenance.
  - 4. Layout of work shall be done in such a manner that avoids conflicts between the work of different trades, does not conflict finish ceiling heights, soffits, light fixtures or other finish work at ceilings and soffits.
  - 5. Should conflicts occur that affect finish ceiling and soffit heights, methods of installations, methods of construction or means

of accessibility, the contractor shall clearly identify each location(s) for review by the Architect.

B. Work below grade for each building, structure and general site.

1. Prior to the start of construction the contractor shall show on reproducible paper the work for each trade that will be placed underground, including existing utility lines scheduled to remain.
2. Show the below finish floor elevation of each item of work, indicate the horizontal distance between work of each trade.
3. Where utility lines cross the contractor shall indicate the elevations of each utility line. Should conflicts occur between required elevations or minimum horizontal separations of work, including the sleeving of footings, pads, grade beams, footings for fences, walls, raised planters, etc. the contractor shall clearly identify each location(s) for review by the Architect.

C. Existing Service & Utility Yards, Utility Trench, General Site and Buildings:

1. Prior to the start of construction the contractor shall show on reproducible paper the work of each trade both overhead and underground that will be installed, and existing work scheduled to remain.
2. Show the finish elevations of all work, indicate the horizontal distances between work of each trade, show locations of all shut-off and isolation valves, cleanouts, filters and other devices requiring human access for maintenance and repair.
3. Should conflicts occur between required elevations, horizontal clearances, sleeving requirements of concrete work the contractor shall clearly identify each location(s) for review by the Architect/Engineer.

D. Roof:

1. Prior to the start of construction the contractor shall show on reproducible paper the work for each trade that will be placed on the roof. Show horizontal distance between all roof mounted equipment. Show the locations of roof penetrations indicate the horizontal distance between penetrations and roof mounted equipment.
2. Identify the means and methods of supports being used for pipe and conduit runs.
3. Show all pipe and conduit runs for each trade.
4. Show the relationship between all roof mounted equipment and all

roof crickets, drains and cant strips.

5. Show all penetrations through the roof. Show size of penetrations.

**1.4 SUBMITTAL REQUIREMENTS**

A. Submit one reproducible and two prints of each coordination plan.

B. Submit coordination drawings 30 days prior to the start of work for that area.

1. The Architect/Engineer will review the coordination drawings and return a review copy within 10 working days after receipt.

2. If required, resubmit within 7 working days after return of review copy.

C. At completion of the project submit a record copy of these documents both in printed format and as electronic drawing file.

**PART 2 -PRODUCTS**

Not Used

**PART 3 - EXECUTION**

Not Used

- - - END - - -





**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)  
425 Eye Street N.W, (sixth floor)  
Washington, DC 20001  
Telephone Numbers: (202) 632-5249 or (202) 632-5178  
Between 9:00 AM - 3:00 PM

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

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

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.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>
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>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</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>

NWWDA	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  
<http://www.tema.org>

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>

**PART 2 - PRODUCTS**

**Not Used**

**PART 3 - EXECUTION**

**Not Used**

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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 by the Contractor and approved by the Government.

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
  - T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
  - T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
  - T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
  - T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
  - 318.....Building Code Requirements for Reinforced Concrete
  - 211.....Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
  - 212.....Chemical Admixtures for Concrete
  - 214.....Recommended Practice for Evaluation of Strength Test Results of Concrete
  - 226.....Use of Fly Ash in Concrete

- 301.....Specifications for Structural Concrete for  
Buildings
- D. American Society for Testing and Materials (ASTM):
- A325-10.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum Tensile  
Strength
- A370-12.....Standard Test Methods and Definitions for  
Mechanical Testing of Steel Products
- A490-12.....Standard Specification for Heat Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength
- C31/C31M-10.....Standard Practice for Making and Curing Concrete  
Test Specimens in the Field
- C33/C33M-11a.....Standard Specification for Concrete Aggregates
- C39/C39M-12.....Standard Test Method for Compressive Strength of  
Cylindrical Concrete Specimens
- C109/C109M-11b.....Standard Test Method for Compressive Strength of  
Hydraulic Cement Mortars
- C136-06.....Standard Test Method for Sieve Analysis of Fine  
and Coarse Aggregates
- C138/C138M-10b.....Standard Test Method for Density (Unit Weight),  
Yield, and Air Content (Gravimetric) of Concrete
- C140-12.....Standard Test Methods for Sampling and Testing  
Concrete Masonry Units and Related Units
- C143/C143M-10a.....Standard Test Method for Slump of Hydraulic  
Cement Concrete
- C172/C172M-10.....Standard Practice for Sampling Freshly Mixed  
Concrete
- C173/C173M-10b.....Standard Test Method for Air Content of freshly  
Mixed Concrete by the Volumetric Method
- C780-11.....Standard Test Method for Pre-construction and  
Construction Evaluation of Mortars for Plain and  
Reinforced Unit Masonry
- C1019-11.....Standard Test Method for Sampling and Testing  
Grout
- C1064/C1064M-11.....Standard Test Method for Temperature of Freshly  
Mixed Portland Cement Concrete
- C1077-11c.....Standard Practice for Agencies Testing Concrete  
and Concrete Aggregates for Use in Construction  
and Criteria for Testing Agency Evaluation

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

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

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

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

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

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

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

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

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

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

D2974-07a.....Standard Test Methods for Moisture, Ash, and  
Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements  
for Agencies Testing and Inspecting Road and  
Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for  
Agencies Engaged in Testing and/or Inspection  
of Soil and Rock as used in Engineering Design  
and Construction

D6938-10.....Standard Test Method for In-Place Density and  
Water Content of Soil and Soil-Aggregate by  
Nuclear Methods (Shallow Depth)

E94-04(2010).....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing  
of Weldments

E329-11c.....Standard Specification for Agencies Engaged in  
Construction Inspection, Testing, or Special  
Inspection

E543-09.....Standard Specification for Agencies Performing  
Non-Destructive Testing  
E605-93(R2011).....Standard Test Methods for Thickness and Density  
of Sprayed Fire Resistive Material (SFRM)  
Applied to Structural Members  
E709-08.....Standard Guide for Magnetic Particle Examination  
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor  
Levelness Numbers

E. American Welding Society (AWS):

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

### 1.3 REQUIREMENTS:

A. Accreditation Requirements: Testing Laboratory retained by Contractor, must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the Contracting Officer's Representative a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the Contracting Officer's Representative for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.

1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
3. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D3666.
4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.
5. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
6. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
7. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.

- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Contracting Officer's Representative. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Contracting Officer's Representative to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Contracting Officer's Representative, Contractor, unless other arrangements are agreed to in writing by the Contracting Officer's Representative. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Contracting Officer's Representative 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 Contracting Officer's Representative regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Contracting Officer's Representative extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
  - 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
  - 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Contracting Officer's Representative 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 Contracting Officer's Representative. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Fill and Backfill Material Gradation: One test of stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136, ASTM D422 or ASTM D1140.
- D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- E. Testing Materials: Test suitability of on-site and off-site borrow as directed by Contracting Officer's Representative.

### **3.2 LANDSCAPE**

- A. Not required.

### **3.3 ASPHALT CONCRETE PAVING**

- A. Aggregate Base Course:

1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, Method D, ASTM D1557, Method D.
2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191, ASTM D1556, AASHTO T238, ASTM D6938.
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. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m<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 Contracting Officer's Representative 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. Contracting Officer's Representative may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
  5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m<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.
  6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
  7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
  8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
  9. Verify that specified mixing has been accomplished.
  10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.



11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
  12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
  13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
  14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
  15. Observe preparations for placement of concrete:
    - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    - b. Inspect preparation of construction, expansion, and isolation joints.
  16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
  17. Observe concrete mixing:
    - a. Monitor and record amount of water added at project site.
    - b. Observe minimum and maximum mixing times.
  18. Measure concrete flatwork for levelness and flatness as follows:
    - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    - c. Provide the Contractor and the Contracting Officer's Representative with the results of all profile tests, including a running tabulation of the overall  $F_F$  and  $F_L$  values for all slabs installed to date, within 72 hours after each slab installation.
  19. Other inspections:
    - a. Grouting under base plates.
    - b. Epoxy grouting of anchor bolts and reinforcing steel in hardened concrete.
- B. 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 Contracting Officer's Representative. 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 Contracting Officer's Representative. 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 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 welder qualifications by certification or retesting.
  3. Approve procedure for control of distortion and shrinkage stresses.
  4. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:

1. Weld Inspection:

- a. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
- b. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
- c. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
- d. Measure 25 percent of fillet welds.
- e. 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.
- f. 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.
- g. Verify that correction of rejected welds are made in accordance with AWS D1.1.
- h. 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 Contracting Officer's Representative.

### **3.8 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 Contracting Officer's Representative.

### **3.9 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 Contracting Officer's Representative.

- - - E N D - - -

**SECTION 01 52 50**

**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 in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.14 (1991) Construction and Demolition Operations -  
Requirements for Safety Belts, Harnesses,  
Lanyards and Lifelines for Construction and  
Demolition Use

ANSI Z359.1 (1992) Safety Requirements for Personal Fall Arrest  
Systems

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.94 Ventilation

29 CFR 1910.120 Hazardous Waste Operations and Emergency  
Response

29 CFR 1926.65 Hazardous Waste Operations and Emergency  
Response

29 CFR 1926.502(f) Warning Line Systems

CORPS OF ENGINEERS (COE)

COE EM-385-1-1 (1996) Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

NFPA 241 (1996) Safeguarding Construction, Alteration, and  
Demolition Operations

CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH ASSOCIATION (CAL-OSHA)

The State of California Division of Occupational Safety and Health,  
California Code of Regulations, Division 8

**1.2 DEFINITIONS**

- A. Certified Industrial Hygienist. An industrial hygienist is an individual who is certified by the American Board of Industrial Hygiene.
- B. Certified Safety Professional. A safety manager, safety specialist, or safety engineer that has passed the CSP exam administered by the Board of Certified Safety Professionals.

- C. Confined Space. A space which by design has limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy, engulfment or any other recognized safety or health hazard. Confined spaces include, but are not limited to storage tanks, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.
- D. Multi-employer work site (MEWS). The prime contractor is the "controlling authority" for all work site safety and health of the subcontractors.
- E. Recordable Occupational Injuries or Illness. An occupational injury or illnesses which result in serious injuries, lost workday cases, non-fatal cases or significant mishaps.
- F. Serious Injuries & Fatalities. Regardless of the time between the injury and death or the length of the illness; hospitalization of three or more employees; or property damage in excess of \$200,000.
- G. Lost Workday Cases. Injuries, other than fatalities, that result in lost workdays.
- H. Non-Fatal Cases. Cases without lost workdays which result in transfer to another job or termination of employment, or require medical treatment (other than first aid) or involve property damage in excess of \$10,000 but less than \$200,000 or involve: loss of consciousness or restriction of work or motion. This category also includes any diagnosed occupational illnesses which are reported to the employer but are not classified as fatalities or lost workday cases.
- I. Health and Safety Plan (HASP). The HASP is the VA equivalent Army term of SHP or SSHP used in COE EM-385-1-1. "USACE" property and equipment specified in COE EM-385-1-1 should be interpreted as Government property and equipment.
- J. Safety Officer. The superintendent or QC Manager who is responsible, qualified and competent for the on-site safety required for the project.
- K. Significant Contractor Mishap. A contractor mishap which involves falls of 4 feet or more, electrical mishaps, confined space mishaps, diving mishaps, equipment mishaps, and fire mishaps which result in a lost time injury, or property damage of \$10,000 or more, but less than

\$200,000; or when fire department or emergency medical treatment (EMT) assistance is required.

- L. 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 provided by a physician or registered personnel.
- M. First Aid. A one-time treatment, and follow-up visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, even though provided by a physician or registered professional personnel.
- N. Lost Workdays. The number of days (consecutive or not) after, but not including, the day of injury or illness during which the employee would have worked but could not do so; that is, could not perform all or part of his normal assignment during all or any part of the workday or shift; because of the occupational injury or illness.

### **1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 23.
  - 1. Infectious Control Risk Assessment
  - 2. Health and Safety Plan (HASP)
- B. Infectious Control Risk Assessment.

The Contractor shall prepare an Infectious Control Risk Assessment for each area and phase of construction. The attached for shall be used for this assessment.
- C. Health and Safety Plan (HASP)

Allow 30 calendar days for review by the VA.

### **1.4 QUALITY ASSURANCE**

- A. Qualifications
  - 1. Qualifications of Safety Officer:
    - a. Ability to manage the on-site contractor safety program through appropriate management controls,
    - b. Ability to identify hazards and have the capability to expend resources necessary to abate the hazards.
    - c. Have worked on similar types of projects that are equal to or exceed the scope of the project assigned with the same responsibilities.
  - 2. Qualifications of Qualified Person, Confined Space Entry. The qualified person shall be capable (by education and specialized training) of anticipating, recognizing, and evaluating employee

exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and protective action to ensure worker safety.

3. Qualification of Crane Operators. Crane operators shall meet the requirements in COE EM-385-1-1, Appendix G.

B. Qualifications of Qualified Person, Confined Space Entry

The qualified person shall be capable (by education and specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and protective action to ensure worker safety.

C. Qualification of Crane Operators

Crane operators shall meet the requirements in COE EM-385-1-1, Appendix G.

D. Meetings

1. Preconstruction Conference

The Contractor's Safety Officer shall attend the preconstruction conference.

2. Meeting on Work Procedures

Meet with Contracting Officer to discuss work procedures and safety precautions required by the HASP. Ensure the participation of the Contractor's superintendent, the Quality Control, and the CSP or CIH.

3. Weekly Safety Meetings

Hold weekly. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the QC Contractor Quality Control daily report.

**1.5 INFECTIOUS CONTROL RISK ASSESSEMENT**

Prepare for each phase of the work. As a minimum, define activity being performed, sequence of work, specific hazards anticipated, control measures to eliminate or reduce each hazard to acceptable levels, training requirements for all involved, and the competent person in charge of that phase of work.

**1.6 HEALTH AND SAFETY PLAN (HASP)**

Prepare as required by 29 CFR 1910.120 and COE EM-385-1-1.

A. Qualified Personnel

Retain a Certified Industrial Hygienist (CIH) or a Certified Safety Professional (CSP) to prepare the HASP, conduct activity hazard



analyses, and prepare detailed plan for demolition, removal, and disposal of materials.

**B. Contents**

In addition to the requirements of COE EM-385-1-1, Table 28-1, the HASP must include:

1. Location, size, and details of control areas.
2. Location and details of decontamination systems.
3. Interface of trades involved in the construction.
4. Sequencing of work.
5. Disposal plan.
6. Sampling protocols.
7. Testing labs.
8. Protective equipment.
9. Pollution control.
10. Evidence of compliance with 29 CFR 1910.120 and 29 CFR 1926.65.
11. Training and certifications of CIH, CSP or other competent persons.

**1.7 DRUG PREVENTION PROGRAM**

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employees either use illegal drugs or consume alcohol during work hours. Ensure no employees under the influence of drugs or alcohol during work hours.

**1.8 DUTIES OF THE SAFETY OFFICER**

- A. Ensure construction hazards are identified and corrected.
- B. Maintain applicable safety reference material on the job site.
- C. Maintain a log of safety inspections performed.
- D. Attend the pre-construction conference.

**1.9 DISPLAY OF SAFETY INFORMATION**

Display the following information in clear view of the on-site construction personnel:

- A. Map denoting the route to the nearest emergency care facility with emergency phone numbers.
- B. Confined space entry permit.
- C. Sign with number of hours worked since last lost workday accident.

**1.10 SITE SAFETY REFERENCE MATERIALS**

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

#### **1.11 HIGH HAZARD WORK AND LONG DURATION**

Work under this contract is potentially hazardous. Pursuant to contract clause "FAR 52.236-13, Accident Prevention, Alternate I," submit in writing additional proposals for effecting accident prevention under hazardous conditions. Meet in conference with Contracting Officer to discuss and develop mutual understanding relative to the administration of the overall safety program.

#### **1.12 EMERGENCY MEDICAL TREATMENT**

Contractors shall arrange for their own emergency medical treatment. Government has no responsibility to provide. However, if emergency medical care is rendered by VA medical services, charges will be billed to Contractor's workmen's compensation insurance company at prevailing rates.

#### **1.13 SITE CONDITIONS**

##### **A. Noise**

Enforce hearing protection protecting Contractor's site personnel from Government or Contractor produced noise.

#### **1.14 REPORTS**

##### **A. Reporting Reports**

For OSHA recordable accidents, the prime contractor shall conduct a suitable investigation, and provide a written report to the Contracting Officer within 5 calendar days of the accident.

##### **B. Notification**

Notify Contracting Officer, within 4 hours, of any accident meeting the definition of OSHA recordable occupational injury or illness.

Information shall include Contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of mishap; names of personnel injured; extent of property damage, if any; and brief description of mishap (to include type of construction equipment used, PPE used, etc.) In addition to OSHA reporting requirements, initial notification shall be made of any accident involving significant mishaps.

##### **C. OSHA Citations and Violations**

Provide the Contracting Officer with a copy of each OSHA citation, OSHA report and Contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

## **PART 2 - PRODUCTS**

### **2.1 FALL PROTECTION ANCHORAGE**

Fall protection anchorages, used by contractors to protect their people, shall be left in place and so identified for continued customer use.

### **2.2 CONFINED SPACE SIGNAGE**

Provide permanent signs integral to or securely attached to access covers for new confined spaces. Signs wording: "DANGER--PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER -" on bold letters a minimum of one inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" and shall be red and readable from 5 feet.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION**

Comply with COE EM-385-1-1, NFPA 241, the Infectious Control Risk Assessment and other related submittals and activity fire and safety regulations.

#### **A. Hazardous Material Exclusions**

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. Exceptions to the use of any of the above excluded materials may be considered by Contracting Officer upon written request by Contractor.

#### **B. Unforeseen Hazardous Material**

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. 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 PERSONNEL PROTECTION

#### A. Hazardous Noise

Provide hazardous noise signs, and hearing protection, wherever equipment and work procedures produce sound-pressure levels greater than 85 dBA steady state or 140 dBA impulse, regardless of the duration of the exposure.

#### B. Fall Protection

Enforce use of the fall protection device named for each activity in the AHA all times when an employee is on a surface 6 feet or more above lower levels. Personal fall arrest systems are required when working from an articulating or extendible boom, scissor lifts, swing stages, or suspended platform. Fall protection must comply with ANSI A10.14.

##### 1. Personal Fall Arrest Device

Equipment, subsystems, and components shall meet ANSI Z359.1, Personal Fall Arrest Systems. Only a full-body harness with a shock absorbing lanyard is an acceptable personal fall arrest device. Body belts may only be used as positioning devices only such as for steel reinforcing assembly. Body belts are not authorized as a personal fall arrest device. Harnesses must have upper middle back "D" rings for proper body suspension during a fall. Lanyard must be fitted with a double locking snap hook attachment. Webbing, straps, and ropes must be of synthetic fiber or wire rope.

##### 2. Fall Protection for Roofs

- a. For work within 6 feet of an edge, on low-pitched roofs, personnel shall be protected by use of personal fall arrest systems, guardrails, and safety nets. Safety monitoring system is not adequate fall protection and is not authorized.
- b. For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.502(f).
- c. Work on steep roofs requires personal fall arrest, guardrails with toe boards, or safety nets. This requirement includes residential or housing type construction.

##### 3. Safety Nets

Safety nets shall be provided in unguarded workplaces over water, machinery, dangerous operations, or more than 25 feet above surface.

#### C. Scaffolding

Employees shall be provided 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. Contractor shall ensure that employees that are qualified perform scaffold erection. 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 plan. Minimum platform size shall be based on the platform not being greater in height than four times the dimension of the smallest width dimension for rolling scaffold. Some Baker type scaffolding has been found not to meet these requirements. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. The first tie-in shall be at the height equal to 4 times the width of the scaffold base.

**D. Use of Material Handling Equipment**

1. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufactures printed operating instructions. Crane supported work platforms shall only be used in extreme conditions if the Contractor proves that using any other access to the work location would provide a greater hazard to the workers.
2. Cranes must be equipped with Load Indicating Devices, anti-two blocks devices, load, and boom angle moment indicating indicators.
3. Christmas-tree lifting (multiple rigged materials) is not allowed.

**E. Excavations**

The competent person for excavation shall be on site when work is being performed in excavation, and shall inspect excavations prior to entry by workers. Individual must evaluate for all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

**F. Conduct of Electrical Work**

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cable intended to be cut must be positively identified and de-energized prior to performing each cut. Perform all high voltage cutting remotely. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is

the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personnel protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses.

G. Work in Manholes

Contractor shall provide mechanical ventilation for all work accomplished in manholes, unless other hazards are present like friable asbestos.

H. Work in Confined Spaces

Comply with the requirements in Section 06.I of COE EM-385-1-1. Any potential for a hazard in the confined space requires a permit system to be used.

1. 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 06.I.05 of COE EM-385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
2. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained.
3. Ensure the use of rescue and retrieval devices in confined spaces greater than 5 feet in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of COE EM-385-1-1.
4. Sewer wet walls require continuous atmosphere monitoring with audible alarm for toxic gas detection.
5. Include training information for employees who will be involved as entrant attendants for the work. Conform to Section 06.I.06 of COE EM-385-1-1.
6. Entry Permit. Use ENGFORM 5044-R or other form with the same minimum information for the Daily Confined Space Entry Permit, completed by the qualified person. Post the permit in a conspicuous place close to the confined space entrance.

I. Crystalline Silica

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and COE EM-385-1-1, (Appendix C). The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

**3.3 ACCIDENT SCENE PRESERVATION**

For serious accidents, ensure the accident site is secured and evidence is protected remaining undisturbed until released by the Contracting Officer.

**3.4 FIELD QUALITY CONTROL**

A. Inspections

Include safety inspection as a part of the daily Quality Control inspections required in Section 01 45 00, "Quality Control."

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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 effect human health or welfare,
  - 2. Unfavorably alter ecological balances of importance to human life,
  - 3. Effect other species of importance to humankind, or;
  - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
  - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
  - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
  - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
  - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
  - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
  - 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

**1.2 QUALITY CONTROL**

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

**1.3 REFERENCES**

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

**1.4 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Representative 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 Contracting Officer's Representative for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
    - d. Description of the Contractor's environmental protection personnel training program.
    - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
  - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
  - h. Permits, licenses, and the location of the solid waste disposal area.
  - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, 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.
- C. Submit SWPPP plan per City of Sunnyvale requirements.

#### **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 Contracting Officer's Representative. 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, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
  - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
  - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
  - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
  - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local ten design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
  - b. Reuse or conserve the collected topsoil sediment as directed by the Contracting Officer's Representative. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
  - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and

- permanent erosion and sedimentation control features. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
  7. Manage and control spoil areas.
  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 Contracting Officer's Representative.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
  3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air

resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California and State Air Pollution Statute, Rule, or Regulation 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 Contracting Officer's Representative. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the Contracting Officer's Representative. 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

- 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 Contracting Officer's Representative. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

**PART 2 - PRODUCTS**

Not Used

**PART 3 - EXECUTION**

Not Used

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

## **1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

## **1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.
  - 4. Construction error.
  - 5. Over ordering.
  - 6. Weather damage.
  - 7. Contamination.
  - 8. Mishandling.
  - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to

be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Contracting Officer's Representative a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
  - a. List of each material and quantity to be salvaged, reused, recycled.
  - b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection where applicable.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
  - c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

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

## **1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template. Contractor shall submit all record keeping forms/templates to COR no later than five (5) days prior to the start of work and 30 days prior to substantial completion. COR shall issue written approval of the forms prior to the start of work.

## **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 respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

### **3.2 DISPOSAL**

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

### **3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices.

Include the net total costs or savings for each salvaged or recycled material.

- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Quantity of materials shall be recorded and reported to COR in both volume (cubic yards) and weight (tons). Include the net total costs for each disposal.

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**SECTION 01 81 11**  
**SUSTAINABLE DESIGN REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

This Section describes general requirements and procedures to comply with the Guiding Principles for Leadership in High Performance and Sustainable Buildings Memorandum of Understanding incorporated in the Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005) and the Energy Independence and Security Act of 2007 (EISA 2007).

**1.2 OBJECTIVES**

- A. To maximize resource efficiency and reduce the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:
  - 1. Select products that minimize consumption of energy, water and non-renewable resources, while minimizing the amounts of pollution resulting from the production and employment of building technologies. It is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
    - a. Include environmental considerations as part of the normal purchasing process.
    - b. Emphasize pollution prevention early in the purchasing process.
    - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    - d. Compare relevant environmental impacts when selecting products and services.
    - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
  - 2. Control sources for potential Indoor Air Quality (IAQ) pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
  - 3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in

proposing product substitutions and/or changes to specified processes.

4. Use building practices that insure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.

### **1.3 RELATED DOCUMENTS**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

### **1.4 DEFINITIONS**

- A. Agrifiber Products: Composite panel products derived from agricultural fiber
- B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight
- D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
- E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
- F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
- G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.
- H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky
- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock

- J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
- K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims": [www.ftc.gov/bcp/grnrule/guides980427](http://www.ftc.gov/bcp/grnrule/guides980427)
- L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site
- M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured
- N. Sealant: Any material that fills and seals gaps between other materials
- O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.
- P. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas
- Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

#### **1.5 SUBMITTALS**

- A. General:
  - 1. Submittal requirements in this Article assume that required letters, calculations, and spreadsheets will be prepared by the assigned responsible party (Architects, Government, MEP, contractor etc), refer to the most current LEED® submittal status Matrix.
  - 2. Submit additional LEED submittal requirements included in other sections of the Specifications.

3. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

B. Sustainable Design Documentation Submittals:

1. Heat Island Effect:

- a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.
- b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.

3. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
4. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
5. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
6. Appliances and Equipment: Provide copies of manufacturer's product data for all Energy Star eligible equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's Energy Star program.

7. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
8. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.
9. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
  - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.
10. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:
  - a. Cost of each material or product, excluding cost of labor and equipment for installation
  - b. Location of product manufacture and distance from point of manufacture to the Project Site
  - c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
  - d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the

Project Site to the point of manufacture for each regional material

- e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB
  - f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.
11. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
12. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
- a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
13. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
14. Floor Coverings :
- a. Carpet Systems: Submittals for all carpet must include the following:
    - 1) A copy of an assessment from the Building for Environmental and Economic Sustainability (BEES) software model, either Version 3.0 or 4.0, with parameters of the model set as described by this specification section.

- 2) Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
- b. Engineered Wood Flooring: Submittals for all engineered wood flooring must include manufacturer's product data verifying certification under either the Greenguard or FloorScore indoor emissions testing program.
15. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
16. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
17. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
  - a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
  - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. See above for requirements
18. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
19. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
20. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
21. Blended Cement: It is the intent of this specification to reduce CO2 emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all

- concrete mixes, in aggregate, utilize blended cement mixes to displace portland cement as specified in Section 03 30 00, CONCRETE typically included in conventional construction. Provide the following submittals:
- a. Copies of concrete design mixes for all installed concrete
  - b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
  - c. Quantities in cubic yards of each installed concrete mix
22. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
23. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.
24. Duct Acoustical Insulation : Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.
25. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.
- C. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Contracting Officer's Representative and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
    - a. Identify each reused or salvaged material, its cost, and its replacement value.
    - b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half



- of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
- c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
  - d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
  - e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.
- 2. Provide final versions of the above spreadsheets to the Contracting Officer's Representative and Architect not more than 14 days after Substantial Completion.
- D. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.
- E. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
- 1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and Contracting Officer's Representative approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:
  - 2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling

- a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage
  - b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
  - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
  - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit
3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
- a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
  - b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
4. Not more than 14 days after Substantial Completion provide the following:
- a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
  - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
  - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance

with IAQ testing procedures and requirements defined in Section 01 81 09 "Testing for Indoor Air Quality."

- F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19 "Construction Waste Management."
  2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

#### **1.6 QUALITY ASSURANCE**

- A. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Contracting Officer's Representative, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.
- B. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

### **PART 2 - PRODUCTS**

#### **2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS**

- A. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.
- B. Landscape Irrigation: Use water-efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities).
- C. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 20% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992

fixture performance requirements. Flow and flush rates shall not exceed the following:

1. Toilets: no more than 1.3 gallons per flush, otherwise be dual flush 1.6/0.8 gallons per flush, and have documented bowl evacuation capability per MaP testing of at least 400 grams
  2. Urinals: Waterless or Water sense rated with no more than 0.5 gallons per flush.
  3. Lavatory Faucets: 0.5 gpm with automatic faucet controls
  4. Kitchen Sink Lavatories: 2.2 gpm
  5. Showerheads: no more than 1.5gpm
- D. Process Water Use: Employ strategies that in aggregate result in 20% less water use than the process water use baseline for the building after meeting the commercial equipment and HVAC performance requirements as listed in the Table below. For equipment not addressed by EPACT 2005 or the list below, additional equipment performance requirements may be proposed provided documentation supporting the proposed benchmark or industry standard is submitted.
1. Clothes Washer: 7.5 gallons/cubic foot/cycle
  2. Ice Machine: 20 gallons/100 pounds ice for machines making over 175 pounds of ice per day; 30 gallons/100 pounds ice for machines making less than 175 ice per day. Avoid water-cooled machines.
  4. Cooling Towers: 2.3 gallons/ton-hr. water loss
- E. Elimination of CFCs AND HCFCs:
1. Ozone Protection and Greenhouse Gas Reduction: Base building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
  2. Fire suppression systems may not contain ozone-depleting substances such as halon 1301 and 1211.
  3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- F. Appliances and Equipment: All materials and equipment being installed that falls under the Energy Star or FEMP programs must be Energy Star or FEMP-rated. Eligible equipment includes refrigerators, motors, laundry equipment, office equipment and more. Refer to each program's website for a complete list.
- G. HVAC Distribution Efficiency:

1. All duct systems shall be constructed of aluminum, stainless steel or galvanized sheet metal, as deemed appropriate based on the application requirements. No fiberglass duct board shall be permitted.
  2. All medium- and high-pressure ductwork systems shall be pressure-tested in accordance with the current SMACNA standards.
  3. All ductwork shall be externally insulated. No interior duct liner shall be permitted.
  4. Where possible, all air terminal connections shall be hard-connected with sheet metal ductwork. If flexible ductwork is used, no flexible duct extension shall be more than six feet in length.
  5. All HVAC equipment shall be isolated from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
  6. All supply and return air branch ducts shall include the appropriate style of volume damper. Air terminal devices such as grilles, registers, and diffusers shall be balanced at duct branch dampers, not at terminal face.
- H. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.
1. The IPMVP provides guidance on situation-appropriate application of measurement and verification strategies.
- I. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.
1. Salvaged materials: Use of salvaged materials reduces impacts of disposal and manufacturing of replacements.
- J. Recycled Content of Materials:
1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
    - a. e post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled

content by the total weight of the material and multiplying by the cost of the material.

- b. Do not include mechanical and electrical components in the calculations.
- c. Do not include labor and delivery costs in the calculations.
- d. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
- e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.
- f. The materials in the following list must contain the minimum recycled content indicated:

Category	Minimum Recycled Content
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined

K. Biobased Content:

- 1. For products designated by the USDA's Bio-Preferred program, provide products that meet or exceed USDA recommendations for biobased content, so long as products meet all other performance requirements in VA master specifications. For more information regarding the

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product categories covered by the Bio-Preferred program, visit  
<http://www.biopreferred.gov>

**PART 3 - EXECUTION**

Not Used

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**SECTION 01 81 13**

**LEED REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes general requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System for Building Design and Construction 2009 for new construction, prerequisites and credits needed for the Project to achieve at a minimum LEED® Silver certification.
1. Certain LEED prerequisites and credit requirements needed to obtain LEED certification are dependent on material selections, documentation and means and methods of the Work. Each item related to LEED may not be specifically identified as LEED requirements in this section. The Contractor should refer to the LEED Green Building Rating System for Building Design & Construction (BD&C) 2009 Edition Reference Guide, including all errata and addenda as of the project's LEED registration date, for complete credit descriptions and submittal requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests.
  2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification are dependent on the Architect's design and other aspects of the Project that are not part of the Work of the Contract. Hence, not all credits required for certification may be described as part of this section.
  3. Documentation for LEED prerequisites and credit must be submitted in the format required by the USGBC for review using LEED-Online, including all required credit audit documentation, completion of LEED calculators, and LEED templates. Refer to the Submittals part of this section for a more detailed explanation of the LEED-Online process and LEED Construction Credit Submittal.
  4. Additional information on LEED, how to purchase copies of the LEED BD&C reference guide, and how to use LEED-Online can be found at [www.gbci.org](http://www.gbci.org) and [www.leedonline.com](http://www.leedonline.com)
  5. A copy of the LEED Project checklist is attached at the end of this Section for information only.

## 1.2 RELATED SECTIONS

- A. All Sections listed in the Table of Contents are a Condition of this Section.

## 1.3 DEFINITIONS

- A. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of dust, fumes, vapors and gases.
- B. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by a Forest Stewardship Council (FSC) - accredited certification body to comply with FSC "Principles and Criteria." Certificates shall include evidence that manufacturer is certified for chain-of-custody by an FSC-accredited certification body. For more information go to [www.fscus.org](http://www.fscus.org).
- C. Chemical Waste: Includes paints, adhesives, sealants, coatings, petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
- D. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, and repair and demolition operations.
- E. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances or the environment of neighboring buildings and environmental areas; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- F. Environmental Tobacco Smoke (ETS). Secondhand smoke consists of airborne particles emitted from the burning end of cigarettes, pipe and cigars, and exhaled by smokers. The particles contain about 4,000 different compounds, up to 40 of which are known to cause cancer.
- G. Hazardous Materials: Includes pesticides, biocides, carcinogens, and "wet products" as listed by recognized authorities, such as the Environmental Protection Agency (EPA), International Agency for Research on Cancer (IARC), the State of California, and any special local requirements.
- H. Interior Final Finishes: Materials and products that will be exposed at interior occupied spaces, including flooring, wall covering, finish carpentry, and ceilings.

- I. LEED: Leadership in Energy & Environmental Design, 2009 Green Building Rating System for Design and Construction (New Construction)
- J. Mechanical Ventilation: Ventilation provided by mechanically powered equipment, such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.
- K. Municipal Solid Waste Landfill: A permitted facility that accepts solid, non-hazardous waste such as household, commercial, and industrial waste, including construction and demolition waste.
- L. Natural Ventilation: Ventilation provided by thermal, wind or diffusion effects through doors, windows, or other intentional openings in buildings.
- M. Packaged Dry Products: Materials and products that are installed in dry form and delivered to the site in the manufacturer's packaging, including carpets, resilient flooring, ceiling tiles, and insulation.
- N. Post-Consumer Material: Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of products, which can no longer be used for its intended purpose.
- O. Pre-Consumer Material: Material diverted from the waste stream during the manufacturing process (can also be considered post-industrial). Excluded is reutilization of materials such as rework, re-grind or scrap generated in a process and capable of being reclaimed within the same process that generated it.
- P. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.
- Q. Recycled Content: The percentage by weight of a material's constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).
- 1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.

2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer or post industrial recycled materials.
3. Recycled content of materials shall be defined in accordance with the International Organization for Standardization document, ISO 14021-1999 - Environmental labels and declarations - self declared environmental claims (Type II environmental labeling ). [www.iso.org](http://www.iso.org)
- R. Regionally Extracted, Processed and Manufactured Materials: Materials that are extracted, harvested, or recovered; processed; and manufactured within a radius of 500 miles (800 km) from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.
- S. Ventilation: the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space.
- T. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.

#### **1.4 MEETINGS**

- A. Prime Trade Contractor shall conduct LEED Certification meetings as required with all subcontractors, in addition to those meetings outlined in Section 01 31 19 Project Meetings.
  1. The meetings shall include, at a minimum:
    - a. Prime Trade Contractor's Project Manager
    - b. Owner's Representative
    - c. Prime Trade Contractor's LEED Representative
    - d. All other attendees designated by Owner's Representative
    - e. Sub-Contractor Representatives as appropriate to stage of work
  2. At a minimum, LEED certification goals and issues shall be discussed at the following meetings:
    - a. Preconstruction Meetings
    - b. Progress Meetings
    - c. Subcontractor Meetings

#### **1.5 SPECIAL PRODUCTS AND SUBSTITUTION PROCEDURES**

- A. In addition to the requirements of Section 01 62 00 Product Options and Substitutions, the special substitution requirements described here apply only to the LEED certification related materials and requirements and environmental products and procedures identified in this Section.

- B. Notify Owner and Architect when contractor wishes to substitute materials, equipment, or products that meet the aesthetic and programmatic intent of the Construction Documents and offer equivalent or increased environmental sensitivity to materials, equipment, or products specified to meet LEED requirements as indicated in the Construction Documents.
- C. Substitutions that may affect LEED certification must be clearly stated as such.
- D. Comply with the requirements of Section 01 62 00 Product Options and Substitutions except as follows:
  - 1. Only (1) one request for substitution for each product will be considered. When substitution is not accepted, provide specified product.
  - 2. Prior to submitting detailed information required under Section 01 62 00 Product Options and Substitutions, submit the following for initial review by the architect.
    - a. Product data including manufacturer's names, address, and phone number.
    - b. Include copy of Material Safety Data Sheet (MSDS) if applicable.
    - c. Description of the differences of the proposed substitution from specified product related to LEED requirements. Include description of environmental advantages of proposed substitution over specified product.
    - d. The contractor is responsible for re-submittal of all calculations, and documentation of products or material substitutions that affect LEED prerequisites and credits referenced in this Section, and any credits previously submitted as part of the project's LEED Design Application Submittal, and all credits included in the LEED Construction Submittal. Products that do not meet these requirements should not be submitted for substitution.
    - e. Substitutions of materials and products specified as part of the Contract documents in the following areas (but not necessarily limited to these items) will require review and potential re-submittal of LEED Design Credit Application Pre-requisites and Credits:
      - 1) Irrigation System
      - 2) Storm water System

- 3) Roofing products and materials
  - 4) Plumbing fixtures and controls
  - 5) Interior and Exterior Lighting systems and controls
  - 6) HVAC equipment, systems and controls
  - 7) CO2 monitoring system
  - f. Substituted products shall not be ordered or installed without written acceptance by the owner.
3. Requests for Substitutions
- a. Submit a separate request for each LEED related product substitution.
  - b. Identify product by Specification Section and LEED credit or credits, if applicable.
  - c. List similar projects using product, dates of installation, and names of Contractor and Owner.
  - d. Give itemized comparison of proposed substitution with specified product, listing variations, and reference Specification section and Article number.
  - e. Include copy of Material Safety Data Sheet (MSDS) if applicable.
  - f. Give cost data comparing proposed substitution with specified product and amount of net change to Contract Sum. The cost data should be based on life cycle analysis for each affected product including annual energy consumption and maintenance costs.
  - g. State effect of substitution on construction schedule and changes required in other work of products.

#### **1.6 SUBMITTALS**

- A. General: Submit additional LEED submittal requirements included in other sections of the Specifications.
- B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
- C. Project Materials Cost Data:
  - 1. Total Materials Cost: Provide statement indicating total cost for materials used for Project in Divisions 03-10 31.60.00, Foundations, 32.10.00, Paving, 32.30.00, Site Improvements and 32.90.00, Planting, excluding labor, overhead, and profit.
  - 2. Only include materials permanently installed in the project.

3. Furniture may be included; provided it is consistently included in MR credits 3-7.
  4. Consistent numbers must be applied to various LEED credits submittals requiring similar material cost data.
  5. Include breakout of costs for the following categories of items:
    - a. Furniture (if included consistently)
    - b. Wood-based construction materials.
- D. With final project submittals provide the following:
1. Final Summary of Solid Waste Disposal and Diversion.
  2. All approved Substitution Request Forms related to this section.
- E. LEED Action Plans: Provide preliminary hard copy submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met.
1. Credit MR 2: Construction Waste Management Plan complying with Section 01 74 19 "Construction Waste Management."
    - a. The project goal shall be to divert a minimum of 95% of waste from landfill.
  2. Credit MR 4: List of proposed materials with recycled content.
    - a. Include statement indicating cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
  3. Credit MR 5: List of proposed regionally extracted, processed and manufactured materials.
    - a. Identify each regionally extracted, processed and manufactured material, its source, processing/manufacturing location, and cost.
    - b. For materials with multiple constituents, list all constituents and identify percentage by weight of constituents that are regionally extracted, processed and manufactured.
  4. Credit MR 7: List of proposed FSC-certified wood products.
    - a. Include statement indicating costs for each product containing certified wood.
    - b. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
  5. Credit IEQ 3.1: Construction indoor air quality management plan.
    - a. Submit Draft hard copy of plan for review.

F. LEED Progress Reports: Concurrent with an Application for Payment once per Quarter, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Credit MR 2: Waste reduction progress reports complying with Section 01 74 19 "Construction Waste Management."
2. Credit MR 4: Recycled content.
3. Credit MR 5: Regionally extracted, processed and manufactured materials.
4. Credit MR 7: Certified wood products.
5. Credit IEQ 3.1: Construction Indoor Air Quality Management (IAQ) plan: During Construction

G. LEED Documentation Submittals

1. For all credits: LEED documentation submittals must be prepared and submitted using the LEED-Online Credit web based application ([www.leedonline.com](http://www.leedonline.com)) and minimum system requirements.
  - a. The contractor is responsible for obtaining project access to LEED-Online and joining the project using the project's project access code. Additional instructions on how to access the project can be provided by Simon & Associates, Inc upon request.
  - b. Once the Contractor has joined the project through LEED-Online, the LEED Project Administrator (Simon & Associates, Inc.) will assign the LEED credits that the contractor is responsible for completing.
    - 1) Note: To access the Credit Forms, the contractor will need to have Adobe Reader version 10.1.1 (no higher) installed on their computer. Adobe Reader is available for free download at [http://www.adobe.com/products/acrobat/readstep2\\_allversions.html](http://www.adobe.com/products/acrobat/readstep2_allversions.html)
    - 2) NOTE: Each "Credit Form" is an editable Adobe pdf document. It may be completed or updated at any time prior to the LEED Construction Submittal. After you have completed documenting the credit, use the 'Save' button at the lower right hand corner of the Form to save the data online.
  - c. Additional submittal documentation and back-up requirements should be uploaded to the "File Uploads" section of LEED-Online following the required audit documentation instructions for each credit.



2. Credit EA 4: Product Data for new HVAC equipment indicating absence of HCFC refrigerants, and for clean-agent fire-extinguishing systems indicating absence of HCFC and Halon.
3. Credit EA 5: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy and water consumption performance over time.
4. Credit MR 2: Comply with Section 01 74 19 "Construction Waste Management." Using the LEED online BD+C Credit Form:
  - a. Complete the construction waste calculation tables including:  
General description of each type/category of waste generated;  
location of receiving agent (recycler/landfill) for waste;  
quantity of waste diverted (by category) in tons or cubic yards.
  - b. Provide a narrative describing the project's construction waste management approach including a copy of the project's construction waste management plan. Please provide any additional comments or notes to describe special circumstances or considerations regarding the project's credit approach.
  - c. Required documentation:
    - 1) Copy of Construction Waste Management Plan.
    - 2) Significant sampling of the hauling/recycling tags/tickets or receipts from the project.
    - 3) Statement from the recycling facilities indicating how the materials were recycled/processed/used and documentation of the recovery rate (if comingled).
    - 4) Brief narrative explaining how and to where each waste type was diverted if not already included on the LEED Credit Template.
5. Credit MR 4: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Using the LEED online BD+C Credit Form:
  - a. Provide total project materials cost per "Project Materials Cost Data" in the Submittals section above.
  - b. Provide a tabulation of each material used on the project that is being tracked for recycled content. The tabulation must include a description of the material, the manufacturer of the material, the product cost, the pre-consumer and/or post-consumer recycled content percentage, and the source of the recycled content data.

- c. Provide an optional narrative describing any special circumstances or considerations regarding the project's credit approach
  - d. Required documentation:
    - 1) Manufacturer cut sheets, literature, or letters highlighting the overall post-consumer and/or post-industrial recycled content percentages (by weight) of each product listed on the template.
    - 2) Materials invoices (showing costs) for each product listed on the Credit Form.
6. Credit MR 5: Product Data indicating location of material sources and manufacturing/processing facilities for regionally manufactured materials. Using the LEED online BD+C Credit Form:
- a. Provide total project materials cost per "Project Materials Cost Data" in the Submittals section above.
  - b. Provide a tabulation of each material used on the project that is being tracked for regional content. The tabulation must include a description of the material; the manufacturer of the material; the product cost; the percentage of the product by weight that meets both the extraction and manufacturer location criteria; distance between the project site and extraction/harvest/recovery site; and distance between the project site and final manufacturing location.
  - c. Provide an optional narrative describing any special circumstance or considerations regarding the project's credit approach.
  - d. Required documentation:
    - 1) Manufacturer cut sheets, literature, or letters highlighting address location of each material's extraction/harvest/recovery and manufacturing / processing sites.
    - 2) Map (Yahoo Maps or equivalent) indicating distances from each location to the project site.
    - 3) Materials invoices (showing costs) for each product listed on the Credit Form.
7. Credit MR 7: Product Data and certificates of chain-of-custody for products containing FSC-certified wood. Using the LEED online BD+C Credit Form:

- a. Provide total wood-based construction materials cost per "Project Materials Cost Data" in the Submittals section above.
  - b. A list of items (and/or components of products) claimed as FSC-certified, including product type, manufacturer, and the entity's Chain of Custody (COC) certification number. (Each product name can then be cross-referenced with the manufacturer or vendor COC number during the LEED certification review.) Visit [www.fscus.org/green\\_building](http://www.fscus.org/green_building) for more information.
  - c. Provide an optional narrative describing any special circumstance or considerations regarding the project's credit approach
  - d. Required documentation:
    - 1) Official FSC chain of custody certificates (from the FSC-licensed third party inspector) for each material listed, with chain of custody number.
    - 2) Materials invoices (showing costs) for each product listed on the Credit Form. The COC number must be included on the invoice for each product for which FSC credit is claimed.
8. Credit IEQ 3.1: Construction IAQ Management Plan during Construction, Using the LEED online BD+C Credit Form:
- a. Provide a copy of the project's Indoor Air Quality (IAQ) Management Plan
  - b. Confirm if the permanently installed air handling equipment was used during construction.
  - c. Provide six photographs at each of three different times during the construction period to highlight the implemented construction IAQ practices.
  - d. List all filtration media (manufacturer, model number, MERV rating, location of installed filter) installed during construction and confirm that each unit was replaced prior to occupancy.
  - e. Provide an optional narrative describing any special circumstance or non-standard approach taken by the project.
  - f. Required documentation
    - 1) Construction IAQ Management Plan addressing the SMACNA/LEED requirements.
    - 2) Manufacturer literature, cutsheets, or letters showing the MERV values of filtration media used (during construction and immediately before occupancy).

9. Credit IEQ 4.1: Product Data and material safety data sheets (MSDS) for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Using the LEED online BD+C Credit Form:
- Provide a listing of each indoor adhesive, sealant and sealant primer product used on the project. Include the manufacture's name, product name, specific VOC data (in g/L less water) for each product, and the corresponding allowable VOC from the referenced standard (listed on pages 471-472 of the LEED BD+C Reference Guide)
  - Provide a listing of each indoor aerosol adhesive product used on the project. Include the manufacture's name, product name, specific VOC data (in g/L less water) for each product, and the corresponding allowable VOC from the referenced standard (listed on pages 3471-472 of the LEED BD+C Reference Guide)
  - Provide a narrative to describe any special circumstances or non-standard compliance path taken by the project.
  - Required documentation:
    - 1) Manufacturer cut sheets, literature, letter, or MSDS for each adhesive/sealant used on the interior, with the VOC content (g/L) circled, calculated according to the referenced standard.
10. Credit IEQ 4.2: Product data and material safety data sheets (MSDS) for paints and coatings used on the interior of the building indicating VOC content of each product used. Using the LEED online BD+C Credit Form:
- Provide a listing of each indoor paint and coating used on the project. Include the manufacture's name, product name, specific VOC data (in g/L less water) for each product, and the corresponding allowable VOC from the referenced standard. (*Note that the addenda to the LEED BD+C Reference Guide contains updated VOC threshold information. Page 483 of the Reference Guide has been superceded.*)
  - Provide a narrative to describe any special circumstances or non-standard compliance path taken by the project.
  - Required documentation:

- 1) Manufacturer cut sheets, literature, letter, or MSDS for each interior paint, with the VOC content (g/L) circled, calculated according to the referenced standard.
11. Credit IEQ 4.3: Provide product data for carpet systems indicating CRI Green Label Plus rating for each product used using the LEED online BD+C Credit Form:
- a. Provide a listing of carpet products installed in the building interior. Confirm that each product complies with CRI Green Label Plus testing program. For more information visit: [www.carpet-rug.org](http://www.carpet-rug.org)
  - b. Provide a listing of carpet cushion products installed in the building interior. Confirm that each product complies with CRI Green Label testing program. For more information visit: [www.carpet-rug.org](http://www.carpet-rug.org)
  - c. Provide a listing of hard surface flooring installed in the building interior. Confirm that each product complies with FloorScore certification program. For more information visit: [http://www.rfci.com/index.php?option=com\\_content&view=article&id=80&Itemid=79](http://www.rfci.com/index.php?option=com_content&view=article&id=80&Itemid=79).
  - d. Provide listing of tile setting adhesives and grouts. Confirm that each product meets VOC content requirements of Credit IEQ 4.1.
  - e. Provide listing of concrete, wood, bamboo, and cork floor finishes. Confirm that each product meets VOC content requirements of Credit IEQ 4.2.
  - f. Provide a narrative to describe any special circumstances or non-standard compliance path taken by the project.
  - g. Required documentation:
    - 1) Manufacturer cut sheets, literature, or letters for each flooring system product with CRI Green Label Plus (carpet), CRI Green Label (pad), FloorScore (hard surface), or VOC content (for d and e) highlighted.
9. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin. Using the LEED online BD+C Credit Form:
- a. Provide a listing of each composite wood and agrifiber product installed in the building interior, including those manufactured

off-site, such as toilet partitions, backer board, door cores and engineered wood. Confirm that the product does not contain any added urea-formaldehyde.

b. Provide a narrative to describe any special circumstances or non-standard compliance path taken by the project.

c. Required documentation

- 1) Cut sheets or manufacturer literature or letters indicating the bonding agents for each composite wood and agrifiber material used in the project, showing that no added urea-formaldehyde resins were used in these products.

#### **1.7 QUALITY ASSURANCE**

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements; serve as contact person for all LEED prerequisites and credit documentation, sub-contractor supervision, and submittal coordination; and to manage the Contractor's portions of the LEED-Online submittal process. The LEED coordinator may also serve as waste management coordinator.
- B. A copy of the LEED BD+C 2009 Reference Guide, along with all errata and addenda published to date, should be purchased by the Contractor and available on site at all times to accompany this specification.

### **PART 2 - PRODUCTS**

#### **2.1 RECYCLED CONTENT OF MATERIALS**

- A. Credits MR 4: Provide building materials with recycled content such that post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20 percent (based on cost) of the total value of materials in the Project.
  1. The recycled content fraction of a material shall be determined by weight. The recycled fraction of the material is then multiplied by the cost of the material to determine the recycled content value.
  2. Total value of materials in the Project shall be determined per "Project Materials Cost Data" in the Submittals section above.

#### **2.2 REGIONAL MATERIALS**

- A. Credit MR 5: Use building materials that have been extracted, processed and manufactured within 500 miles of the project site for a minimum of 10 percent (based on cost) of the total value of materials in the Project.

1. The regional content fraction of a material shall be determined by the proportion by weight of its constituents that are manufactured and extracted, harvested, or sourced within 500 miles of the project site. The regional fraction of the material is then multiplied by the cost of the material to determine the regional content value. If a material is processed or manufactured more than 500 miles from the project site, then no part of the material can be counted for regional content value.
2. Total value of materials in the Project shall be determined per "Project Materials Cost Data" in the Submittals section above.

### **2.3 FSC CERTIFIED WOOD**

- A. Credit MR 7: Provide a minimum of 95 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with Forest Stewardship Council Principles and Criteria. [www.fscus.org](http://www.fscus.org)

1. Wood-based materials include but are not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:
  - a. Rough carpentry.
  - b. Miscellaneous carpentry.
  - c. Heavy timber construction.
  - d. Wood decking.
  - e. Metal-plate-connected wood trusses.
  - f. Structural glued-laminated timber.
  - g. Finish carpentry.
  - h. Architectural woodwork.
  - i. Wood paneling.
  - j. Wood veneer wall covering.
  - k. Wood flooring.
  - l. Wood lockers.
  - m. Wood cabinets.
  - n. Furniture (if included consistently in total project material cost)

### **2.4 LOW-EMITTING MATERIALS**

- A. Credit IEQ 4.1: Adhesives & Sealants
  1. For interior applications, provide adhesives and sealants that comply with the limits for VOC content listed in South Coast Air

Quality Management District (SCAQMD) Rule #1168 amended January 7, 2005 and in effect July 1, 2005.

B. Credit IEQ 4.2: Paints & Coatings

1. For interior applications, provide architectural paints and coatings that comply with the limits for VOC content listed in Green Seal Standard GS-11, Paints, 3rd Edition, April 17, 2011.
2. For interior applications, provide anti-corrosive and anti-rust paints for ferrous metal substrates that comply with the limits for VOC content listed in Green Seal Standard GS-03, Anti-Corrosive Paints, 2<sup>nd</sup> Edition, January 7, 1997.
3. For interior applications, provide clear wood finishes, floor coatings, stains, primers sealers and shellacs that comply with the limits for VOC content listed in South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, in effect March 8, 2012.

C. Credit IEQ 4.3: Flooring

1. Provide carpets and carpet tiles certified to, or meeting, the Carpet and Rug Institute Green Label Plus indoor air quality standards.
2. Provide carpet cushions certified to, or meeting, the Carpet and Rug Institute Green Label indoor air quality standards. [www.carpet-rug.org](http://www.carpet-rug.org)
3. Provide carpet adhesives certified to, or meeting, the requirements of IEQ 4.1.
4. Provide hard surface flooring (resilient flooring and base, wood flooring and base) certified to, or meeting, the FloorScore standard current as of the rating system.
5. Provide concrete, wood, bamboo and cork floor sealers, stains and all other finishes certified to, or meeting, the requirements of the SCAQMD Rule 1113, in effect September 6, 2013 (IEQ 4.2).

D. Credit IEQ 4.4: Composite Wood and Agrifiber

1. Do not use composite wood and agrifiber products, including those manufactured off-site, such as toilet partitions, backer board, door cores and engineered wood, that contain added urea-formaldehyde resin or laminating adhesives.



**PART 3 - EXECUTION**

**3.1 FIELD EXECUTION OF LEED REQUIREMENTS**

- A. The contractor is responsible for ensuring proper field execution of all LEED prerequisites, credits, and submittal requirements; communication with sub-contractors of all requirements; and submission of all documentation in a timely manner.
- B. Contractor shall notify architect immediately of failure to meet any stated LEED pre-requisite or credit requirement.

**3.2 MEASUREMENT AND VERIFICATION**

- A. Credit EA 5: The owner's agent shall provide a Measurement and Verification Plan ("M&V Plan") consistent with Option D: Calibrated Simulation, Savings Estimation Method 2 in the EVO's "International Performance Measurement and Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction."
  - 1. Review the M&V Plan for contractor and subcontractor requirements.
  - 2. Install metering equipment to measure energy usage as directed by the contract documents. Monitor, record, and trend log measurements as directed by the Measurement & Verification Plan.
  - 3. Assist the owner and/or owner's agents to evaluate energy performance and efficiency by comparing actual to predicted performance, as directed by the M&V Plan during the M&V period.
  - 4. The measurement and verification period shall cover at least one year of post-construction occupancy.

**3.3 CONSTRUCTION WASTE MANAGEMENT**

- A. Credit MR 2: Comply with Section 01 74 19 "Construction Waste Management and Disposal."
- B. The project goal shall be to divert a minimum of 95% of waste from landfill.

**3.4 PROTECTION**

- A. Protect stored on-site and installed absorptive materials from moisture damage. Where absorptive materials not intended for wet applications are exposed to moisture, immediately remove from site and dispose of properly.
- B. Protect installed materials using methods that do not support growth of molds and mildews

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1. Immediately remove from site and properly dispose of materials showing signs of mold and signs of mildew, including materials with moisture stains.

- - - END - - -

**SECTION 01 91 00**

**GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 COMMISSIONING DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 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.

## **1.2 Contractual Relationships**

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.
- B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer 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. All Sections listed in the Table of Contents are a Condition of this Section.

### 1.4 SUMMARY

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

### 1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)
COR	Contracting Officer's Representative (see also VA-RE)
COBie	Construction Operations Building Information Exchange

List of Acronyms	
Acronym	Meaning
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning
LEED	Leadership in Energy and Environmental Design
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-RE	VA Resident Engineer
USGBC	United States Green Building Council

## 1.6 DEFINITIONS

**Acceptance Phase Commissioning:** Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed and accepted. The main commissioning activities performed during this

phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

**Commissioning Process:** A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and

assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

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

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

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

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

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

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

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

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

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

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

conditions preventing testing during the normal acceptance testing period.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Precision:** The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an

instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of interest in the

- resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).
3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

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

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

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

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

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

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:
1. Exterior walls, roofing, windows, doors and other exterior penetrations
  2. All equipment of the heating ventilating and air conditioning systems both mechanical and plumbing and direct digital controls
  3. Life safety systems (smoke and fire alarm, fire suppression, fire/smoke dampers)
  4. Domestic water distribution, process water pumping systems, steam/hot water system chilled water system
  5. Emergency power systems

6. All electrical and lighting control systems, including but not limited to electrical distribution system, normal power system, emergency power, grounding/bonding, electrical monitoring, substations
7. Noise and vibration control
8. Data and communication, including public address system, television/cable system, grounding/bonding, security, access control system, video surveillance

#### **1.8 COMMISSIONING TEAM**

- A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.
- B. Members Appointed by Contractor:
  1. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
  2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.
- C. Members Appointed by VA:
  1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
  2. User: Representatives of the facility user and operation and maintenance personnel.
  3. A/E: Representative of the Architect and engineering design professionals.

#### **1.9 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.



2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Witness and assist in Systems Functional Performance Testing.
5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

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

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

8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

**1.11 COMMISSIONING AGENT'S RESPONSIBILITIES**

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

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

#### **1.12 COMMISSIONING DOCUMENTATION**

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

- C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.
- F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.
1. Creating a Commissioning Issues Log Entry:
    - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
    - b. Assign a descriptive title for the issue.
    - c. Identify date and time of the issue.

- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
  - e. Identify system, subsystem, and equipment to which the issue applies.
  - f. Identify location of system, subsystem, and equipment.
  - g. Include information that may be helpful in diagnosing or evaluating the issue.
  - h. Note recommended corrective action.
  - i. Identify commissioning team member responsible for corrective action.
  - j. Identify expected date of correction.
  - k. Identify person that identified the issue.
2. Documenting Issue Resolution:
- a. Log date correction is completed or the issue is resolved.
  - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
  - c. Identify changes to the Contract Documents that may require action.
  - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
  - e. Identify person(s) who corrected or resolved the issue.
  - f. Identify person(s) verifying the issue resolution.
- G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
- 1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate,

- recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
  3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
  4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  5. Commissioning Issues Log.
  6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
1. Documentation of deferred and off season test(s) results.
  2. Completed Systems Functional Performance Test Procedures for off season test(s).
  3. Documentation that unresolved system performance issues have been resolved.
  4. Updated Commissioning Issues Log, including status of unresolved issues.
  5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

### 1.13 SUBMITTALS

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
  4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section.



The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.

- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. 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.
- G. 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.
- H. Data for Commissioning:
  - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
  - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

#### **1.14 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 60 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.
- C. Within 60 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.15 QUALITY ASSURANCE**

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

#### **1.16 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All

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

- B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

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

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

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

### PART 3 - EXECUTION

#### 3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

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

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

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

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

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

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	

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



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<b>Acceptance Phase</b>		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
	Pre-Functional Checklist Verification	L	A	R	R	O	
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	
	Review TAB Report	L	A	R	R	O	
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	R	R	O	
Functional Test Protocols	TAB Verification	L	A	R	R	O	
	Systems Functional Performance Testing	L	A	P	P	P	
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	R	S	R	L	P	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

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<b>Acceptance Phase</b>		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

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

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

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

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

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

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

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

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

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

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

1) The Pre-Functional Checklists.

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

3) The manufacturer's normally used field checkout sheets.

c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.

- d. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
- 3. Sensor and Actuator Calibration
  - a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
  - b. All procedures used shall be fully documented on the point to point spreadsheets clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
- 4. Execution of Equipment Startup
  - a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
  - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
  - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
  - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

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

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall

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

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

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

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
  - 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
  - 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
  - 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.
- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more

effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.
  2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
  3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct

Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.

4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

VRV 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		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min



VRV Unit Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 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
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

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

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		

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

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

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

document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

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

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

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

### 3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire

alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

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

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

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

7. A reference to the specification section describing the test requirements
  8. A copy of the specific sequence of operations or other specified parameters being verified
  9. Formulas used in any calculations
  10. Required pretest field measurements
  11. Instructions for setting up the test.
  12. Special cautions, alarm limits, etc.
  13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
  14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
  15. A section for comments.
  16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
  2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
  4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
  5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be

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

- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.
- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

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

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

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



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

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

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

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

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

### **3.8 DEFERRED TESTING**

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

### 3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

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

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

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. Training Coordination:

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

F. Instruction Program:

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
  - b. Intrusion detection systems.
  - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - i. HVAC instrumentation and controls.
  - j. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - k. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - l. Lighting equipment and controls.
  - m. Communication systems, including intercommunication, surveillance, , public address, mass evacuation, voice and data, and entertainment television equipment.

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

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**SECTION 02 41 00**

**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 PROTECTION**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of Section GENERAL REQUIREMENTS, Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01010, GENERAL REQUIREMENTS, Article 1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. 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. Vacuum and dust the work area daily.
- E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
1. No wall or part of wall shall be permitted to fall outwardly from structures.
  2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
  3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.

4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the VA Medical Center; any damaged items shall be repaired or replaced as approved by the Contracting Officer's Representative. 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 the Contracting Officer's Representative approval.
- G. The work shall comply with the requirements of Section 01 57 19, ENVIRONMENTAL PROTECTION.
- H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.
- C. Remove portions of electrical lines under new building area, including exterior lighting.

#### **1.5 STRUCTURES**

- A. Remove portions of existing building components as required to accommodate new work and provide building access.

#### **1.6 PAVEMENTS**

- A. Remove portions of existing pavements, sub-courses and underground concrete and underground concrete pipe as required to facilitate installation of new building footings, foundations and slabs. Remove concrete wheel stops as directed by COR.

### **PART 2 - PRODUCTS**

#### **NOT USED**

**PART 3 - EXECUTION**

**3.1 DEMOLITION**

- A. Completely demolish buildings components, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new utility service lines.
  - 2. As required for construction of new addition.
- B. Debris, including, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by the contractor daily, off the VA Campus to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer's Representative. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. Remove and legally dispose of all materials, other than earth to remain as part of project work. Materials removed shall become property of contractor and shall be disposed of compliance with applicable federal, state or local permits, rules and/or regulations. All materials 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 Federal, State and local environmental laws and regulation. Dispose of such materials in legally complying approved manner.
- D. 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 Contracting Officer's Representative.
- E. Remove existing utilities to a distance of ten feet beyond new footings and foundations.

**3.2 CLEAN-UP**

- A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to the Contracting Officer's Representative. Clean-up shall include off the Campus disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies cast-in-place structural concrete materials, formwork and reinforcement.
- B. Material and mixes for other concrete.
- C. Grout for base plates and other uses as shown on the drawings.
- D. Epoxy for setting reinforcement or bolts in hardened concrete.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 TOLERANCES**

- A. Slab Finishes: F-number method in accordance with ASTM E1155. Value as indicated on drawings.

**1.4 REGULATORY REQUIREMENTS**

- A. Conform to American Concrete Institute (ACI).

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.
- E. Test Reports: Certified copies of mill tests of reinforcement showing chemical and physical analyses of each heat or melt from which reinforcement was made.
- F. Manufacturer's Literature, Instructions and Code Approval Reports: Submit for Grout and epoxy adhesive.

**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 Concrete Institute (ACI):
  - 117R-90.....Standard Tolerances for Concrete Construction and Materials
  - 301-89.....Specification for Structural Concrete for Buildings
  - 305R-91.....Hot Weather Concreting
  - 306R-88.....Cold Weather Concreting

315-80(92).....Details and Detailing of Concrete Reinforcement  
318/318R-95.....Building Code Requirements for Reinforced Concrete  
347R-94.....Guide to Formwork for Concrete

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

C33/C33M-11a.....Standard Specification for Concrete Aggregates  
C94/C94M-12.....Standard Specification for Ready Mixed Concrete  
C143/C143M-10.....Standard Test Method for Slump of Hydraulic  
Cement Concrete

C150-11.....Standard Specification for Portland Cement

C260-10.....Standard Specification for Air-Entraining  
Admixtures for Concrete

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

E1155-96(2008).....Standard Test Method for Determining  $F_F$  Floor  
Flatness and  $F_L$  Floor Levelness Numbers

D..Concrete Reinforcing Steel Institute (CRSI):

Manual of Standard Practice

**1.7 TESTING AGENCY FOR CONCRETE MIX DESIGN**

- A. Testing agency retained and reimbursed by the Contractor and approved by Contracting Officer's Representative.
- 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.

**1.8 DELIVERY, STORAGE AND HANDLING**

A. Reinforcement:

- 1. Deliver reinforcement from the mill in securely tied bundles, each bundle limited to one size and grade of reinforcement. Identify each bundle with readily visible metal or plastic tags identifying the reinforcement by the same item marking as on the approved shop drawings; tags shall also identify the mill, heat or melt number, and the grade and size of reinforcement.
- 2. After bundles are broken, identify by segregating reinforcement by sizes and grades.
- 3. Store reinforcement off the ground, protected from the elements and foreign material which could adversely affect its bond with concrete.

B. Concrete Materials:

1. Deliver, store, and handle packaged materials in the manufacturers' original, sealed packages, each clearly identified with the manufacturer's name, and name and type of material.
2. Deliver, store, and handle materials subject to damage from dirt and moisture maintaining them clean and dry, off the ground, and suitably protected.
3. Store coarse and fine aggregates in separate, covered bins to prevent them from mixing, and to preserve moisture content of aggregate at batch plant.
4. Store bulk cement in covered bins.

**1.9 LEED SUBMITTALS**

- A. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- B. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating the location of material manufacturer and point of extraction, harvest or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material and fraction by weight that is considered regional.
  1. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
  2. Include statement indicating location of manufacturer and point of extraction, harvest and recovery for each raw material used in regionally extracted and manufactured materials. Indicate distance to Project and fraction by weight of each regionally manufactured material that is regionally extracted.

**PART 2 - PRODUCTS**

**2.1 FORMS**

- A. Wood, plywood, metal or other materials, new at start of work and approved by the Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
- B. Accessories:
  1. Accessories which will be entirely or partially embedded in concrete, such as ties and hangers, shall be of metal and of standard manufacture; wire ties are not acceptable.

2. The portion of embedded accessories remaining in concrete shall have no metal within one inch of face of concrete, and shall have no fractures, spalls, depressions, or other surface disfigurations exceeding 3/4 inch in diameter.
3. Spreader cones on ties shall not exceed one inch in diameter.
- C. Form Sealer: Sealer shall eliminate grain raise as a result of moisture, and shall not interfere with color, bond, or subsequent treatment of or application of finishes to concrete surface; Sonneborn Building Products, Inc. "Form Saver," Grace Construction Materials "Form Film," Burke "Form Sealer," or approved equal.
- D. Form Release Agents:
  1. For Concrete Exposed to View in the Finished Work or to Receive Applied Finishes: Use chemically-active types producing water-insoluble soaps. Release agents shall contain no petroleum-based solvents such as creosote, paraffin, wax, or diesel oil.
  2. For Unexposed Concrete: Any type that will not interfere with bond of finishes to be applied.

## 2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type II.
- B. Coarse Aggregate: ASTM C33 Size 67. Size 67 may be used for footings and walls over 2 inches (1300 mm) thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- C. Fine Aggregate: ASTM C33.
- D. Mixing Water: Fresh, clean, and potable.
- E. Air-Entraining Admixture: ASTM C260.
- F. Vapor Barrier: ASTM D4397, 6 mil (150 um).
- G. Reinforcing Steel:
  1. Bars: ASTM A615, deformed, Grade 60. ASTM A706, deformed, Grade 60 for bars require welding.
  2. Wire for Ties: ASTM A82.
  3. Welded Wire Fabric: ASTM A185.
  4. Spacers, Bar Supports, and Other Accessories: In conformance with ACI 315. Where portions of accessories will be within 1/2 inch of concrete surfaces which will be exposed to the elements in the finished work, such accessories shall be of non-corrosive material or shall be corrosion-resistant treated; aluminum products will not be acceptable.
- I. Expansion Joint Filler: ASTM D1751.
- J. Sheet Materials for Curing Concrete: ASTM C171.
- K. Abrasive Aggregates: Aluminum oxide grains or emery grits.



- L. Liquid Hardener and Dustproofer: Fluosilicate solution or magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.
- M. Grout: Non-shrinking, premixed, non-metallic grout shall be mixed and applied in accordance with manufacturer's recommendations. Grout shall show no settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement, and produce a compressive strength of at least 5,000 psi (35mpa) at 3 days.
- N. Epoxy Adhesive: Hilti "HIT-RE 500-SD" Adhesive Anchoring System, Simpson Strong-Tie "SET-XP" or approved equal.
- O. Patching Mortar: Mix in proportion by volume, one part cement to two parts fine aggregate.

### 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. If concrete will be pneumatically placed, mixes shall be specifically so designed and designated.
  - 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, fly ash, 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 to cement-fly ash ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.
  - 3. Prepare a curve showing relationship between water to cement-fly ash 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 Contracting Officer's Representative or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Contracting Officer's Representative may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.

- C. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- D. Weight: Concrete fill, pads and curbs on metal decking shall be light weight (110 pounds per cubic foot). All other concrete shall be normal weight (145 pounds per cubic foot).
- E. Aggregate Size: Maximum aggregate to be 0.75 inch.
- E. Compressive strength:
  - 1. Slabs, walls and foundations: Compressive strength at 28 days shall be not less than 28 mpa (4000 psi).
  - 2. Concrete fill, pads and curbs on metal decking: Compressive strength at 28 days shall be not less than 21 mpa (3000 psi).
- F. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- G. Cement and water factor:
  - 1. Non-Air-Entrained
    - a. Min. Cement 280 kg/m<sup>3</sup> (470 lbs./c. yd)
    - b. Max. Water Cement Ratio 0.55.
  - 2. Air-Entrained
    - a. Min. Cement 290 kg/m<sup>3</sup> (490 lbs./c. yd)
    - b. Max. Water Cement Ratio 0.45.
- H. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

#### **2.4 REINFORCEMENT FABRICATION**

- A. Fabricate reinforcement in accordance with the requirements of ACI 315, where specific details are not shown or where Contract Documents are not more restrictive.
- B. Fabrication of reinforcement shall begin only after approval of Bar Mill Certificates, lists and shop drawings, with each item of reinforcement fabricated in conformance with such approved documents.
- C. Bend reinforcing steel cold; do not straighten or re-bend, doing damage to the material.

#### **2.5 BATCHING & MIXING**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature is 15.6 degrees C (60 degrees F).

**PART 3 - EXECUTION**

**3.1 FORMWORK CONSTRUCTION**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.
- B. Construction Tolerances: Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
- C. Preparation:
  - 1. Treat contact surface of plywood and board forms with a form sealer in accordance with the manufacturer's printed instructions.
  - 2. Clean form surfaces and reseal before each use. The use of form oil will not be permitted.
- D. Construction:
  - 1. Coordinate design, construction, and installation of formwork to accommodate openings, sleeves, chases, pipes, nailers, anchors, ties, inserts, and other embedded items.
  - 2. Whenever concrete bases and foundations are required for equipment furnished as part of the work of other Sections, verify equipment dimensions prior to placing concrete.
  - 3. Formwork shall be clean and free of foreign material when concrete is placed.
- E. Form Removal:
  - 1. Do not remove forms until concrete has attained sufficient strength to support its own weight and anticipated construction live loads without damage, but in no case less than the following:
    - a. Walls: Four (4) days.
    - b. Footings, Curbs, Walks, Paving: Side forms may be removed 24 hours after concrete placement.

**3.2 REINFORCEMENT PLACEMENT**

- A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.

1. At time of concrete placement, reinforcement shall be free of dirt, oil, scale, loose rust, and other foreign material that could adversely affect the bond with concrete.
2. Fasten reinforcement/support to prevent displacement beyond the tolerances specified in ACI 301, by construction loads and concrete placement. Sizes and dimensions of supports shall be as required to position the reinforcement as shown on the approved shop drawings and in conformance with the minimum concrete protective covering requirements of ACI 301.
3. Furnish reinforcing bars full length whenever possible; splices will be permitted only where shown or noted on the approved shop drawings, or as otherwise permitted by SFIA.
4. Splices may be made in horizontal reinforcement by lapping and placing ends of bars in contact and securely wiring; or bars may be separated sufficiently to permit the embedment of the entire surface of each bar in concrete:
  1. Locate all splices as per drawings. Lap bars 48 diameters minimum.
  2. Stagger splices in adjacent bars.
  3. Where threaded couplers are noted on Drawings, locate couplers in accordance with Drawings. Stagger coupler locations unless noted otherwise.
  4. Obstructions: Should items to be embedded in concrete interfere with placement of reinforcements, notify Contracting Officer's Representative to obtain written approval of procedure before starting.
  5. Concrete Cover: Install reinforcement to achieve the minimum concrete coverage shown or noted on the Drawings, unless otherwise specified.
  6. Welding: Reinforcing bars shall not have welded joints.
  7. Misplaced Reinforcing Bars:
    - a. If reinforcing bars are found to be misplaced after concrete placement, immediately notify Contracting Officer's Representative for recommendations for correcting the misplacement; perform no corrective measures without such prior recommendations.
    - b. Redesign, alterations, corrections, and replacement of concrete or reinforcing bars due to misplaced bars shall be performed at no additional expense to the Government.
  8. Maintenance of Reinforcement:

- a. Continuously inspect/maintain reinforcement in proper position during concreting operations.
- b. Where reinforcement cannot otherwise be kept properly aligned, provide additional bracing, ties, stirrups, and other items as necessary.

### **3.3 VAPOR BARRIER**

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier installed between slab and subbase.
  1. Place 50 mm (2 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
  2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
  3. Patch punctures and tears.

### **3.4 PLACING CONCRETE**

- A. Preparation:
  1. Remove hardened concrete, wood chips, shavings and other debris from forms. Thoroughly clean reinforcement and other items to be embedded in concrete of loose rust and other foreign matter which could inhibit bond with concrete.
  2. Remove loose dirt/foreign material from excavations and forms and standing and saturated soil from excavations and cavities. Placing concrete in standing water is not permitted.
  3. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
  3. Have subgrade, forms and reinforcement inspected and approved by Contracting Officer's Representative 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 (1/4" +/- amplitude) and clean existing surfaces of laitance, foreign matter, and loose particles. Provide shear keys and prepare joints as per Drawings and Specifications. Apply bonding agent between existing and new concrete pours.
- C. Transporting:
  1. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients.
  2. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours.

3. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.
4. Concrete may be pumped from the mixer to the place of deposit, provided that information on mix design adjustments, equipment, and procedures have received Contracting Officer's Representative prior review and written approval.

D. Consolidation:

1. Thoroughly consolidate concrete by puddling with suitable tools during placement, and by thoroughly working around reinforcement and other embedded items, and into corners of forms.
2. In addition to manual spading and tamping, internally vibrate concrete with high-speed mechanical vibrators of sufficient amplitude for thorough consolidation.
3. Vertically insert and remove hand-held vibrators at points 18 to 30 inches apart, vibrating concrete the minimum amount required for consolidation.
  - a. Do not use vibrators to transport concrete in forms.
  - b. Do not secure vibrator to forms or reinforcement.
  - c. Vibration shall be carried on continuously with placing of concrete.

E. Hot weather placing of concrete: Follow recommendations of ACI to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.

F. Cold weather placing of concrete: follow recommendations of ACI 306, to prevent freezing of thin sections less than 12 inches (300 mm) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Contracting Officer's Representative.

**3.4 PROTECTION AND CURING**

A. General: Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Contracting Officer's Representative.

A. Protection:

1. Maintain concrete temperature above 50 degrees F during curing.
2. Protect concrete from sun and rain.
3. Do not subject concrete to loads until it has completely cured and attained minimum 28-day strength.

4. Water cure concrete continuously for minimum duration specified, including Saturdays, Sundays, and holidays; do not permit it to dry out until it has cured for the specified time.
  5. Protect concrete during/after curing from damage from construction operations.
  6. Cover traffic areas with kraft paper and plywood sheets; maintain protective covering in place and in good repair as long as necessary to protect concrete from damage.
  7. Keep finished areas free from traffic for a minimum of four days, or as long as necessary for concrete to have set sufficiently to prevent its being damaged.
- B. Curing: Curing shall immediately follow finishing, and shall be performed as follows:
1. Wall Surfaces: Cure for a minimum of seven days by form-curing with forms thoroughly wetted a minimum of four times a day until forms are removed; if for less than seven days, immediately follow with membrane curing.
  2. Flatwork Surfaces: Membrane cure for a minimum of seven days.

### **3.5 FORM REMOVAL**

- A. Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

### **3.7 SURFACE PREPARATION**

- A. Immediately after forms have been removed and work has been examined and approved by Contracting Officer's Representative, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 parts sand.
1. Repair or replace defective concrete as instructed by Contracting Officer's Representative, and at no additional expense to the Government. Repair materials shall include, as necessary, cements, aggregates, admixtures, and epoxy.
  2. With written approval of Contracting Officer's Representative, some minor defective work may be repaired by use of cement mortar; however, if the defects affect the strength of the structure, its appearance, or are otherwise detrimental, Contracting Officer's Representative may require the removal and replacement of that portion of the structure.
  3. Immediately after form removal, inspect concrete surfaces for poor joints, voids, rock pockets, tie holes, and other defects. Prior to

starting patching, SFIA will examine the defects, following which such defects shall be immediately patched upon SFIA's written approval of patching mixture and method proposed for use.

4. No metal will be accepted within one inch (1") of the face of exposed concrete. Cut nails and tie wires to remain concealed and leave surfaces clean and smooth.
5. Finish: Finish to match adjacent surfaces with no discernable or visible difference in appearance.

### **3.8 FINISHES**

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

1. Unfinished Areas: Vertical and overhead concrete surfaces exposed in unfinished areas, above suspended ceilings in manholes, and other unfinished areas exposed or concealed will not require additional finishing.
2. Interior and Exterior Exposed Areas (To Be Painted): Fins, burrs and similar projections on surface shall be knocked off flush by mechanical means approved by Contracting Officer's Representative and rubbed lightly with a fine abrasive stone or hone. Use an ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and Exterior Exposed Areas (Finished): Finished areas, unless otherwise shown, shall be given a grout finish of uniform color and shall have a smooth finish treated as follows:
  - a. After concrete has hardened and laitance, fins and burrs have been removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone or stone.
  - b. Apply grout composed of 1 part portland cement and 1 part clean, fine sand (smaller than No. 30 sieve). Work grout into surface of concrete with cork floats or fiber brushes until all pits and honeycomb are filled.
  - c. After grout has hardened, but still plastic, remove surplus grout with a sponge rubber float and by rubbing with clean burlap.
  - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish for any area in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

#### **B. Slab Finishes:**

1. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application shall all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to



roughen surface to insure a permanent bond between base slab and applied cementitious materials.

2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
3. Float Finish: Ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials, except as specified, shall be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces shall be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and all monolithic concrete floor slabs exposed in finished work and for which no other finish is shown or specified shall be steel troweled. Final steel troweling to secure a smooth, dense surface shall be delayed as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface shall be free of trowel marks, uniform in texture and appearance.
5. Broom Finish: Finish all exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after the surfaces have been floated.
6. 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:

Slab on Grade:	
Specified overall value	FF 25/FL 20
Minimum local value	FF 17/FL 15
Level suspended slabs (shored until after testing) and topping slabs:	
Specified overall value	FF 25/FL 20
Minimum local value	FF 17/FL 15
Unshored suspended slabs:	
Specified overall value	FF 25

Minimum local value FF 17

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, or roof areas designed as future floors:

Slab on grade:

Specified overall value FF 36/FL 20

Minimum local value FF 24/FL 15

Level suspended slabs (shored until after testing) and topping slabs

Specified overall value FF 30/FL 20

Minimum local value FF 24/FL 15

Unshored suspended slabs:

Specified overall value FF 30

Minimum local value FF 24

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.

7. Measurements

- a. The contractor retained testing laboratory will take measurements as directed by Contracting Officer's Representative, to verify compliance with  $F_F$ ,  $F_L$ , 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 the Contractor's retained testing laboratory.

- b. Contractor not experienced in using  $F_F$  and  $F_L$  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.
- 8. 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.
- 9. 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 Contracting Officer's Representative, until a slab finish constructed within specified tolerances is accepted.

### **3.9 SURFACE TREATMENTS**

- A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th  $m^2$  (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

### **3.10 DRILLED IN ANCHORS**

- A. Install anchors per manufacturer's instructions and as specified on the drawings.
- B. Test anchors as specified on the drawings.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. 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. All Sections listed in the Table of Contents are a Condition of this Section.

**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 Std 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 Contracting Officer's Representative.

**1.4 TOLERANCES:**

- A. Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by AISC 303, Sections 6 and 7, Code of Standard Practice for Buildings and Bridges, except as follows:
- B. 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 REGULATORY REQUIREMENTS:**

- A. AISC 360: Specification for Structural Steel Buildings
- B. AISC 303: Code of Standard Practice for Steel Buildings and Bridges.

**1.6 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.

**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 Institute of Steel Construction (AISC):
1. AISC 360-10 Specification for Structural Steel Buildings
  2. AISC 303-10 Code of Standard Practice for Steel Buildings and Bridges
- 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-11.....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
- A325-10.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum Tensile  
Strength
- A490-12.....Standard Specification for Heat-Treated Steel  
Structural Bolts 150 ksi Minimum Tensile  
Strength
- A500/A500M-10a.....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-11.....Standard Specification for Structural Steel  
Shapes

- E. American Welding Society (AWS):
  - D1.1/D1.1M-10.....Structural Welding Code-Steel
- F. Military Specifications (Mil. Spec.):
  - MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing,  
Repair
- G. 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 Shapes: ASTM A992 for W shapes.
- B. Steel Plates: ASTM A572,  $F_y = 50\text{ksi}$ .
- C. Channels and Angles: ASTM A36.
- D. Structural Tubing: ASTM A500, Grade B or ASTM A501.
- E. Steel Pipe: ASTM A53, Grade B.
- F. Bolts, Nuts and Washers:
  - 1. High-strength bolts, including nuts and washers: ASTM A325.
  - 2. Machine bolts: ASTM A307.
  - 3. Anchor bolts: ASTM F1554, grade 105.
- G. Zinc Coating: ASTM A123.
- H. 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. All framing bolts tightened to a bolt tension not less than 70% of their minimum tensile strength. Tightening done with use of direct tension indicators (bolts or washers) or with twist-off bolts.

### **3.2 FABRICATION:**

- A. Fabrication in accordance with Chapter M, AISC 360.

### **3.3 SHOP PAINTING:**

- A. General: Shop paint steel with primer in accordance with AISC 303, Section 6.
- 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.

3. 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 AISC 303, Section 7B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with AISC 303, Section 7

**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 Contracting Officer's Representative 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 12 01**

**BUCKLING RESTRAINED BRACES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide all parts, materials, and labor required for the design, delivery, testing and erection of buckling-restrained braces, which are designed by the manufacturer to meet stiffness, yield strength, and elongation requirements as indicated on the Drawings and other requirements specified Herein.

**1.2 RELATED WORK:**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 DEFINITIONS:**

- A. Buckling Restrained Brace (BRB): A steel brace consisting of an outer steel casing, an inner steel core, and a concrete matrix between the core and the outer steel casing. The inner steel core resists against tensile and compressive axial loads and is restrained from buckling by the concrete contained in the outer steel casing.

**1.4 QUALITY ASSURANCE:**

- A. The Manufacturer shall have a detailed Quality Assurance Plan.
  - 1. The Quality Assurance Plan shall contain the procedures for manufacturing buckling restrained braces including welding procedures, methodology for verifying and documenting material properties, assembly, inspections, tolerances, methods of control, and sign off.
  - 2. Design Engineer Requirements: The Design Engineer shall be registered in the State of California, have experience with designing buckling restrained braced frame systems, and have a thorough knowledge of the submitted BRB test report.
  - 3. Qualification testing shall conform to Article 2.5.
- B. The Manufacturer shall notify Owner of fabrication schedule at least 30 days prior to fabrication in order to allow Owner or Owner's Representative to observe fabrication process.

**1.5 REGULATORY REQUIREMENTS:**

- A. AISC 360: Specification for Structural Steel Buildings
- B. AISC 303: Code of Standard Practice for Steel Buildings and Bridges.

**1.6 SUBMITTALS:**

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

B. Proposed Design of Buckling Restrained Braces:

1. Design Drawings shall clearly display size, thickness and length of exterior brace casing as well as configuration and size of the full length of the core plates.
2. Calculations shall be provided to display the ability of the proposed "BRB's" to meet the Performance Criteria described herein.
3. The Design Drawings and Calculations shall be sealed and stamped by a Structural Engineer (S.E.) licensed in the State of California.

C. Shop Drawings:

1. Shop drawings shall clearly display all geometries necessary to manufacture BRB's including plate thickness, lengths, plate dimensions inside and outside of the casing, and casing dimensions.
2. Shop drawings shall clearly display all connection information including location of bolts, bolt types, bolt diameters, hole size, and faying surface types.

D. Material Test Reports:

1. Tensile tests and chemical analysis for all steel.
2. Independent coupon tests, if required, used to verify core plate initial yield stress, tensile stress, and ultimate elongation.

E. Technical Report:

1. The Manufacturer shall submit a BRB testing report. The testing configurations used, and the results obtained shall meet the criteria found in the AISC 2005 Seismic Provisions (341-10) including Chapter K3.

F. Certificates:

1. Structural steel.
2. Steel for all connections.
3. Welding materials.
4. Welding Procedure Specification (WPS) for each proposed type of welded joint.
5. Shop coat primer paint.

G. Test Reports:

1. Welders' qualifying tests.

H. Manufacturer's Quality Assurance Plan

**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 Institute of Steel Construction (AISC):

1. AISC 360-10 Specification for Structural Steel Buildings
2. AISC 303-10 Code of Standard Practice for Steel Buildings and Bridges

- 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-11.....Standard Specification for General Requirements  
for Rolled Structural Steel Bars, Plates,  
Shapes, and Sheet Piling
  - A36/A36M-08.....Standard Specification for Carbon Structural  
Steel
  - A325-10.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum Tensile  
Strength
  - A490-12.....Standard Specification for Heat-Treated Steel  
Structural Bolts 150 ksi Minimum Tensile  
Strength
  - A500/A500M-10a.....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
- E. American Welding Society (AWS):
  - D1.1/D1.1M-10.....Structural Welding Code-Steel
- F. Military Specifications (Mil. Spec.):
  - MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing,  
Repair
- G. Occupational Safety and Health Administration (OSHA):
  - 29 CFR Part 1926-2001...Safety Standards for Steel Erection

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS:**

- A Buckling Restrained Braces shall be manufactured and supplied by the following vendor or equal
  - 1. CoreBrace, LLC
    - 5789 West Wells Park Road
    - West Jordan, UT 84081
    - 801.280.0701
    - info@corebrace.com
  - 2. Nippon Steel Engineering USA, Inc

213.896.1142

info@unbondedbrace.com

3. Star Seismic

Park City, UT 84098

435.940.9222

info@starseismic.net

**2.2 MATERIALS:**

A. Core Plate: ASTM A36.

B. Steel Casing: ASTM A500, Grade B or similar.

C. Bolts, Nuts and Washers:

1. High-strength bolts, including nuts and washers: ASTM A325 or A490.

2. "Twist Off" Tension Control Bolt/Nut/Washer Assemblies may be used for 1-1/8 diameter bolts and smaller: ASTM 1852.

D. Welding Materials:

1. Shielded metal arc welding electrodes conform to AWS A5.1, flux-cored arc welding electrodes conform to AWS A5.20, and electrodes used for gas metal arc or submerged arc conform to the requirements of AWS A5.18.

2. The minimum tensile strength of the E70 class electrodes used in production is 70,000 psi (470 Mpa)

3. Materials shall provide production welds with minimum Charpy V Notch properties of 20 ft-lbs (27 J) at -20°F (-30 C)

E. Infill Grout:

1. Manufacturers standard infill that has been demonstrated suitable by subassembly testing per the Recommended Provisions.

G. Primer: Standard shop primer.

**2.3 DESIGN REQUIREMENTS:**

A. A Structural Engineer shall design the buckling restrained braces and associated connections to the building structure to meet the Performance Requirements. The Structural Engineer shall have a thorough knowledge of the qualifying cyclical tests and competently apply the test results to the Project conditions.

B. Interpolation or extrapolation of test results for different member sizes shall be justified by rational analysis that demonstrates stress distributions and magnitudes of internal strains that are consistent with or less severe than the tested assemblies and that considers the adverse effects of larger material and variations in material properties

C. Stability calculations shall include beams, columns and gussets adjoining the BRB's.

D. End rotation effects corresponding to the larger of 2.0 times Design Story Drift or 0.025 radians minimum shall be considered.

## 2.4 PERFORMANCE REQUIREMENTS:

- A. Core plate material shall have a yield range of 42 ksi within  $\pm 4$  ksi. Coupon tests taken from plates at point of manufacture of BRBs shall be used to verify conformance. Additional coupon tests may be performed to replace coupon tests that fall out of acceptable range.
- B. Increasing amplitude cyclic displacement tests per the AISC Seismic Provisions shall provide stable performance up to a displacement corresponding to 2.0 times Design Story Drift or 2% of the story height, whichever is larger.
  - 1. Hysteretic behavior shall display no post-yield loss of strength, degradation, or pinching.
  - 2. Fracture of any portion of the BRB shall not occur during the qualifying tests.
  - 3. A cumulative inelastic ductility number of 200 shall be reached
  - 4. The compression strength adjustment factor at  $2.0 \times$  Design Story Drift shall be no greater than 1.10.
- C. The steel core shall resist compression and tension forces. The steel core area shall be as per the project drawings and based on the yield stress range specified.
- D. The steel and concrete casing shall prevent the steel core from buckling globally and locally during compressive loading without binding due to longitudinal shortening and transverse expansion. Demand for local and global stability of casing checks shall be based on the adjusted brace strength at the maximum yield stress ( $F_{ysc,max}$ ) of the specified yield stress range of the core plate material.
- E. Steel core projections beyond the steel casing and brace connections shall develop the adjusted brace strength without instigation of fracture or instability. For core plate checks use the minimum ( $F_{ysc,min}$ ) of the specified yield stress range for determining demand. For all other materials use  $F_{ysc,max}$  to determine demand.
- F. The adjusted brace strength factors ( $\omega, \beta$ ) shall be determined at a brace strain level equal to  $(2 \times \phi \times C_d \times F_{ysc,min}) / (\rho \times I \times E)$  or  $(2 \times C_d \times P_d) / (A_{sc} \times \rho \times I \times E)$  when  $P_d$  is provided. Where  $C_d$  is the design drift deflection amplification factor,  $E$  is the nominal modulus of elasticity of the core plate material, and  $P_d$  is the demand in the BRBs at the controlling drift design load case with gravity loads excluded.

## 2.5 QUALIFICATION TESTS:

- A. Buckling-restrained brace design shall be based on two qualifying cyclic tests conforming to the AISC Seismic Provisions for Buckling Restrained Braced Frames. As stated in the Provisions, at least one of the two

qualifying tests needs to be a subassembly test to demonstrate the ability of the BRB to withstand rotational demands. The other test may be performed uniaxially or may also be a subassembly test.

- B. The requirements of the Provisions should be met with the following two modifications:
  - 1. The cumulative inelastic axial ductility factor shall be increased from 200 as required by the Provisions to 300.
  - 2. The limiting value of the compression strength adjustment factor shall be reduced from 1.3 as required by the Provisions to 1.10.
- C. The strain level during testing shall be equivalent to, or greater than, the strains that the project braces will be expected to withstand
- D. Qualifying cyclical tests can be based on full-scale cyclical tests previously reported for projects, or research, that are deemed similar to project conditions by the Manufacturer and Project Engineer.

### **PART 3 - EXECUTION**

#### **3.1 FABRICATIONS:**

- A. Braces shall be fabricated in accordance with AISC Code of Standard Practice.
- B. Core plates shall be cut to profile shown on Design Drawings
  - 1. The general roughness cannot exceed 1000 micro-inches in the yielding length.
  - 2. Notches in yield length region up to 1/8-inch may be repaired by grinding to a smooth transition. The length of the transition shall not be less than 10 times the notch depth.
  - 3. Notches in the yielding length region greater than 1/8-inch and less than or equal to 3/8-inch may be repaired using procedures outlined in the Company Quality Assurance Manual. The repairs shall be examined using Ultrasonic Testing (UT) procedures in conformance with AWS D1.1.
  - 4. Notches in the yielding length region greater than 3/8-inch in the yield length shall be rejected.
- C. No splices are allowed in the steel core plate.
- D. Minimum casing dimensions shall be as required by manufacturer or as specified on the project documents.
- E. Holes for bolted connections may be drilled, cut or punched in conformance with AISC standards and burs removed.
- F. Finish shall be manufacturer's standard shop primer. Do not paint connection faying surfaces if connection is designated slip critical unless paint used provides same slip resistance.

- G. Assembly of the different components of the brace shall be done in accordance with the manufacturer's Quality Assurance Manual in a manner that ensures proper performance of the brace.

**3.2 SHIPPING:**

- A. Manufacturer to package BRB's for protection against shipping damage.
- B. Manufacturer shall coordinate delivery dates and quantities with Contractor/Owner. Contractor/Owner shall provide adequate storage space and proper lay-down areas.
- C. Braces shall be stored on dunnage not touching the ground.
- D. Coordinate erection aid requirements with contractor/Owner.

**3.3 ERECTION:**

- A. .General: Erection in accordance with AISC 303, Section 7B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with AISC 303, Section 7
- B. Manufacturer shall coordinate with Owner's Representative to verify proper BRB dimensions.
- C. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of buckling-restrained braces.
- D. No field welding to BRB's is allowed, including non-structural pieces unless approved by manufacturer and Engineer of Record (EOR).
- E. No field cutting or altering is permitted without the approval of the manufacturer and EOR.

**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. Prepare exposed steel surfaces: SSPC-SP10 Near White Blast Cleaning, prior to field painting.
- C. 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 Contracting Officer's Representative 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 36 00**  
**COMPOSITE METAL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. 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:**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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, show decking dimensions including distances from beam centerline to deck edges, 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. Cleaning of steel decking prior to concrete placement.
- 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.

**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. 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

**1.6 LEED SUBMITTALS**

- A. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
- B. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating the location of material manufacturer and point of extraction, harvest or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material and fraction by weight that is considered regional.

1. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
2. Include statement indicating location of manufacturer and point of extraction, harvest and recovery for each raw material used in regionally extracted and manufactured materials. Indicate distance to Project and fraction by weight of each regionally manufactured material that is regionally extracted.

## **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 A572, Fy=50.
- F. Welding Electrode: E70XX 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 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.

## **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. Fastening Deck Units:

1. Fasten floor deck units as shown on the drawings or as follows (whichever is the most stringent):
  - a. Fasten floor deck units to steel supporting members as per drawings but 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.
  - b. 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.
  - c. 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 performed by competent experienced welding mechanics.
- K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up not required for welds or scars that are 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 Contracting Officer's Representative. 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.
  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 metal siding, flashings, tracks and required accessories as shown and specified. This Section includes the following:
  - 1. Exterior load-bearing steel stud walls.
  - 2. Steel joists.
- B. Prior to bid, this Section shall perform preliminary blast calculations and determine requirements to meet the criteria set forth in this Section. Failure of the contractor to determine the extent of the blast criteria on the exterior walls systems prior to award shall not be grounds for additional compensation.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- 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. Calculations: Prepared by a qualified blast consultant.
- D. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.

**1.4 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):  
North American Specification and Commentary for the Design of Cold-Formed Steel Structural Members (2007)
- C. American Society of Testing and Materials (ASTM):  
A653/A653M-10.....Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

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

E488-10.....Standard Test Methods for Strength of Anchors in Concrete Elements

D. American Welding Society (AWS):

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

F. Physical Security Design Manual, July 2007, for Veterans Affairs Life Safety Facilities, Final Draft.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

A. Sheet Steel for joists, studs and accessories 18 gage and lighter: ASTM A653, structural steel, zinc coated G90, with a yield of 230 MPa (33 ksi) minimum.

B. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G90, with a yield of 345 MPa (50 ksi) minimum.

C. Sheet steel for corrugated metal, 20ga, G90.

D. Galvanizing Repair Paint: MIL-P-21035B.

### **2.2 WALL FRAMING**

A. Steel Wall Studs: Manufacturer's standard C-shaped steel studs.

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 wall studs.
2. Flange Width: as shown on the drawings.

### **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. Solid Blocking.
2. Gusset plates.
3. Reinforcement plates.

#### **2.4 ANCHORS, CLIPS, AND FASTENERS**

- A. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing and metal deck, manufacturer's standard elsewhere.
- B. Others as noted on drawings.

#### **2.5 REQUIREMENTS**

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.
- C. Meet minimum VA blast design criteria.

### **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.
  3. Weld jambs and head studs to comply with blast loading criteria.

#### **3.2 ERECTION**

- A. Handle and lift prefabricated panels in a manner as to not distort any member.
- B. Securely anchor tracks to supports as shown.
- 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 headers in all openings as shown.
- G. Studs in one piece for their entire length, splices will not be permitted.
- H. Provide temporary bracing and leave in place until framing is permanently stabilized.
- I. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- J. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.
- K. Provide anchors to resist implied loads.

### **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**

- A. 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. Railings.
  - 3. Ladders.
  - 4. Gratings.
  - 5. Covers and Frames for Pits and Trenches.
  - 6. Interior wall security mesh.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. 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.
- C. 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.
- D. Manufacturer's Literature and Data:
  - 1. Grating, each type.
  - 2. Covers and Frames.

**1.4 QUALITY ASSURANCE**

- A. Each product type shall be the same and be made by the same manufacturer.

- B. Assemble product to the greatest extent possible before delivery to the site.
- C. 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):
  - B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
  - A36/A36M-08.....Structural Steel
  - A47-99(R2009).....Malleable Iron Castings
  - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless
  - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products
  - A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI  
Tensile Strength
  - A653/A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) by the Hot-Dip  
Process
  - A786/A786M-09.....Rolled Steel Floor Plate
  - C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Non-  
shrink)
  - F436-10.....Hardened Steel Washers
  - F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
  - D1.1-10.....Structural Welding Code Steel
  - D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
  - AMP 521-01.....Pipe Railing Manual
  - AMP 500-06.....Metal Finishes Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective  
Coatings:
  - SP 1-04.....No. 1, Solvent Cleaning
  - SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....No. 3, Power Tool Cleaning

#### **1.6 LEED SUBMITTALS**

- A. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
- B. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating the location of material manufacturer and point of extraction, harvest or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material and fraction by weight that is considered regional.
  - 1. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
  - 2. Include statement indicating location of manufacturer and point of extraction, harvest and recovery for each raw material used in regionally extracted and manufactured materials. Indicate distance to Project and fraction by weight of each regionally manufactured material that is regionally extracted.

### **PART 2 - PRODUCTS**

#### **2.2 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Floor Plate:
  - 1. Steel ASTM A786.
  - 2. Aluminum: ASTM B632.
- C. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
- D. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- E. 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. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
- b. ASTM F593 for stainless steel.
- c. Screws: ASME B18.6.1.
- d. Washers: ASTM F436, type to suit material and anchorage.
- e. 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.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
- 2. Aluminum: NAAMM AMP 501.
  - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
  - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
  - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
  - d. Painted: AA-C22R10.
- 3. Steel and Iron: NAAMM AMP 504.



- a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
- b. Surfaces exposed in the finished work:
  - 1) Finish smooth rough surfaces and remove projections.
  - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
- c. Shop Prime Painting:
  - 1) Surfaces of Ferrous metal:
    - a) Items not specified to have other coatings.
    - b) Galvanized surfaces specified to have prime paint.
    - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
    - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
    - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
- 4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
- G. Protection:
  - 1. 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 where shown.
  - 2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
  - 3. Field connections may be welded or bolted.
- B. For Wall Mounted Items:
  - 1. For items supported by metal stud partitions.
  - 2. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
- C. For Trapeze Bars:
  - 1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
  - 2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
  - 3. Continuously weld connections where welds shown.

4. Use modular channel where shown with manufacturers bolts and fittings.

## **2.6 ACCESS DOORS AND FRAMES**

- A. Galvanized ASTM A123, G-90 after fabrication.
- B. Doors:
  1. Provide pre-fabricated steel hinged door and frame as shown.
  2. Hardware:
    - a. Install lock or latch specified in Section 08 71 00, DOOR HARDWARE.

## **2.7 INTERIOR WALL SECURITY MESH**

- A. Heavy gauge steel mesh for interior stud framing. Concealed location. Class 1, Type II, carbon steel, Mesh, complying with ASTM F1267. 9 gauge, 3/4" diamond, .923x2.00, 171 lbs/100 ft squared, 63 percent opening. At IT closets and communication rooms.

# **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. Set frames of access doors and similar items flush with finish floor and, where applicable, flush with side of opening.
- C. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- D. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified.
- E. 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.

## **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 as shown.
  3. Secure steel plate to studs as detailed.
- B. 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.

C. Supports for Trapeze Bars:

1. Secure plates to overhead construction with fasteners where shown.
2. Secure angle brace assembly to overhead construction with fasteners where shown and bolt plate to braces.
3. Fit modular channel unit to equipment and secure with modular channel unit manufacturer's standard fittings as shown.

**3.3 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 steel stairs with railings.
- B. Types:
  - 1. Stairs with steel checker plate treads, rises and top/intermediate landing steel pan filled concrete.
  - 2. Industrial stairs: Open riser stairs, roof mounted.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 Manufacturers (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.
- E. Design connection to existing and new structures, including considerations for seismic movement between buildings.

### **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 Floor Plate: ASTM 786.
- F. Steel Decking: Form from zinc coated steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.
- G. Steel Plate: ASTM A1011.
- H. Iron Castings: ASTM A48, Class 30.
- I. Malleable Iron Castings: ASTM A47.

### **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.
- 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 CLOSED RISER STAIRS**

- A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members with closed treads and risers.
- B. Fabricate pans for platforms from sheet steel. Fabricate pans for platforms from steel decking where shown. Fabricate risers and treads from ¼" thick formed non-slip checkered steel floor plate, galvanized finishes.
- C. Form risers with sanitary cove.
- D. Fabricate stringers, headers, and other supporting members from structural steel, galvanized finish.
- E. Construct newel posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

#### **2.6 INDUSTRIAL STAIRS**

- A. Provide treads, platforms, railings, stringers and other supporting members as shown. As option, pre-manufactured, fixed aluminum stairs are acceptable in lieu of steel fabricated for roof access stairs.
- B. Treads and platforms of checkered steel floor plate:
1. Turn floor plate down to form nosing on treads and edge of platform at head of stairs.
  2. Support tread and platforms with angles welded to plate.
  3. Do not leave exposed fasteners on top of treads or platform surfaces.

4. Provide flat sheet steel risers for stairs with steel plate treads where shown.
4. Provide integral stripes at stair nosing, not less than 2" wide, within 1" of nosing and full width of stair tread and landing, contrasting color.
- C. Treads and platforms of steel grating:
  1. Fabricate steel grating treads and platforms 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.

### **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**

- A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.
- B. Touch-up abraded areas with same primer paint used for shop priming
- 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 & FINISH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies wood blocking, framing, sheathing, furring, nailers, rough hardware, light wood construction and finished wall panels, trim and moldings.

**1.2 RELATED WORK:**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS:**

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

**1.4 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 for Testing And Materials (ASTM):  
D1760-01.....Pressure Treatment of Timber Products  
F844-07.....Washers, Steel, Plan (Flat) Unhardened for  
General Use  
F1667-08.....Nails, Spikes, and Staples
- D. Federal Specifications (Fed. Spec.):

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

E. Commercial Item Description (CID):

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

F. Military Specification (Mil. Spec.):

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

G. U.S. Department of Commerce Product Standard (PS)

PS 20-05.....American Softwood Lumber Standard

**PART 2 - PRODUCTS**

**2.1 LUMBER:**

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.

2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Framing lumber: Minimum extreme fiber stress in bending of 1100.

3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:

1. Conforming to Prod. Std., PS20.

2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. At time of delivery and maintained at the site.

2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.

3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.

2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.

2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.

3. Treat other members specified as preservative treated (PT).

4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

**2.2 FINISHED CARPENTRY:**

A. Wall Paneling at Passageways:

1. Fire Retardant Treated

2. Hardwood plywood

a. Vertical flush un-grooved

b. Thickness: 19 mm (3/4 inch) unless shown otherwise. 15% of installation shall be with 1 1/2" thickness.

c. Prefinished, type of finish is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

d. Use full height/length panels where possible without end joints.

3. Solid hardwood.

a. Select cherry.

b. Tongue and groove, including end matched.

c. Thickness: Not less than 19 mm (3/4 inch). 15% of installation shall be with 1 1/2" thickness.

d. Random Lengths not less than 600 mm (24 inches), 57 mm (2-1/4 inches) wide.

4. Trim and base:

a. Match wood species.

b. Base - terrazzo or wood trim as shown.

5. Use nominal one by 100 mm (4 inches) softwood furring strips.

### **2.3 ROUGH HARDWARE AND ADHESIVES:**

- A. 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.
- B. Washers
  1. ASTM F844.
  2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- C. 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.
- F. Adhesives:
  1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.

## **PART 3 - EXECUTION**

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

- A. Conform to applicable requirements of the following:
  1. AFPA National Design Specification for Wood Construction for timber connectors.
  2. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
  3. APA for installation of plywood or structural use panels.
- B Fasteners
  1. Bolts:
    - a. Fit bolt heads and nuts bearing on wood with washers.
    - b. Countersink bolt heads flush with the surface of nailers.
    - c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
    - d. Use toggle bolts to hollow masonry or sheet metal.
    - e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel

- members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.
2. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
    - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
    - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
  3. Screws to Join Wood:
    - a. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
    - b. Spaced same as nails.
- C. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
  2. Use longest lengths practicable.
  3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
  4. Layers of Blocking or Plates:
    - a. Stagger end joints between upper and lower pieces.
    - b. Nail at ends and not over 600 mm (24 inches) between ends.
    - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
- F. Rough Bucks:
1. Install rough wood bucks at opening in where frames or trim occur.
  2. Brace and maintain bucks plumb and true until work has been built around them.
  3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
  4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.
- G. Wall Paneling:
1. Solid hardwood boards
    - a. Install 25 by 75 mm (1 by 3 inch) furring strips on 400 mm (16 inch) centers horizontally between top and bottom strips. Secure to each stud with two screws.
    - b. Install paneling laid vertically with end joints staggered between adjacent boards.
    - c. Tightly butt joints and blind nail each board at each furring strip.

2. Install edge trim and base as shown, use solid wood members of same species as wall paneling.
3. Joints shall be close fitted, metered, tongue and grooved, rebated, or lapped to exclude water and made up in thick white lead paste in oil.

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**SECTION 06 16 63  
CEMENTITIOUS SHEATHING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Cement board sheathing at exterior framed wall construction.

**1.2 APPLICABLE PUBLICATIONS**

A. Comply with references to extent specified in this Section.

B. American National Standards Institute (ANSI):

1. A118.9-10 - Cementitious Backer Units.

C. ASTM International (ASTM):

1. C954-15 - 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
2. C1002-14 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
3. C1325-14 - Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

**1.3 SUBMITTALS**

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

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.
3. Warranty.

C. Samples:

1. Cement Board: 200 mm by 200 mm (8 inches by 8 inches), minimum size.
2. Fasteners: One of each type used.

**1.4 DELIVERY AND STORAGE**

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

### **1.5 STORAGE AND HANDLING**

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

### **1.6 WARRANTY**

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant sheathing against material and manufacturing defects.
  - 1. Warranty Period: 10 years.

## **PART 2 - PRODUCTS**

### **2.1 PRODUCTS - GENERAL**

- A. Provide each product from one manufacturer.
- B. Sustainable Construction Requirements:
  - 1. Sheathing Recycled Content: percent post-consumer total recycled content, minimum. Select products with recycled content to achieve overall Project recycled content requirement.

### **2.2 SHEATHING**

- A. Glassmat gypsum substrate complying with ASTM 1177 with laminates steel sheet. Steel sheet 22 gauge/0.027 inch (0.686) minimum based-metal thickness, complying with ASTM A653 CS, Grade 33 and with a G40 minimum hot-dipped galvanized coating conforming to ASTM A924.
  - 1. Thickness: 16 mm (5/8 inch).
  - 2. Width: 1219 mm (48 inches), minimum.
  - 3. Basis of Design: Sure-Board Series 200B.

### **2.3 ACCESSORIES**

- A. Steel Drill Screws: Corrosion-resistant, self-drilling.
  - 1. ASTM C1002, Type S for fastening to framing less than 0.8 mm (33 mils) thick.
  - 2. ASTM C954 for fastening to framing 0.8 mm (33 mils) thick and greater.
- B. Joint Reinforcement: Alkali resistant tape as recommended by sheathing manufacturer.
- C. Bonding Material: As recommended by sheathing manufacturer.



- D. Air Barrier: As specified in Section 07 27 26, FLUID-APPLIED MEMBRANE AIR BARRIER.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Verify framing is plumb and level and in plane.
- D. Correct substrate deficiencies.

#### **3.2 SHEATHING INSTALLATION**

- A. Install products according to manufacturer's instructions.
  - 1. Secure units to framing members with screws spaced maximum 200 mm (8 inches) o.c. and not closer than 13 mm (1/2 inch) from edge of unit.
  - 2. Install screw heads without penetrating cement board surface.
  - 3. Install sheathing with 6 mm (1/4 inch) gap where sheathing abuts masonry or similar materials to prevent wicking of moisture.
  - 4. Install sheathing with 10 mm (3/8 inch) gap where non-load-bearing construction abuts structural elements or building expansion joints.
  - 5. Horizontal Installation: Abut ends of boards over centers of studs. Stagger end joints minimum one stud spacing for adjacent boards. Fasten boards at perimeter and within field of board to each stud.
  - 6. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Fasten boards at perimeter and with fin field of board to each stud.
  - 7. Apply bonding material to imbed tape and completely fill board joints, and gaps between each panel.

#### **3.3 PROTECTION**

- A. Remove loose or spalling joint finish. Patch areas missing joint finish.
- B. Replace broken or damaged boards.
- C. Protect boards from moisture using temporary coverings until finishes are applied.

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**SECTION 06 41 00**

**MILLWORK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior millwork.
- B. Items specified:
  - 1. Cabinets
  - 2. Countertops
  - 3. Cabinet Hardware
  - 4. Preparation for installing equipment and utilities

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
  - 2. Show construction and installation.
- C. Samples:
  - Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
- D. Certificates:
  - 1. Indicating moisture content of materials meet the requirements specified.
- E. Manufacturer's literature and data:
  - 1. Finish hardware
  - 2. Electrical components

**1.4 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 Contracting Officer's Representative. Store at a minimum temperature of 21°C (70°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.

### 1.5 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 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, Profiles, and Tubes
  - E84-09.....Surface Burning Characteristics of Building Materials
- 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
  - A156.16-02.....Auxiliary Hardware
- E. Hardwood Plywood and Veneer Association (HPVA):
- HP1-09.....Hardwood and Decorative Plywood
- F. National Particleboard Association (NPA):
- A208.1-99.....Wood Particleboard
- G. Architectural Woodwork Institute (AWI):
- AWI-99.....Architectural Woodwork Quality Standards and Quality Certification Program
- I. U.S. Department of Commerce, Product Standard (PS):
- PS20-05.....American Softwood Lumber Standard
- J. 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
- K. Composite Panel Association
- CARB Compliant Products
- L. Woodwork Institute of California (WIC)
- Manual of Millwork

### 1.6 QUALITY ASSURANCE

- A..Perform work in accordance with AWI and WIC custom quality.
- B..Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of three years experience.

C..Millwork shall be completed by one responsible manufacturer.

**1.7. DELIVERY, STORAGE AND PROTECTION**

A..During and after installation maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

**PART 2 - PRODUCTS**

**2.1 WOOD MATERIALS**

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, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use Prime for painted or opaque finish.

**2.2 PANEL MATERIALS**

A. Softwood Plywood:

1. Grading and Marking:

- a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
- b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.

2. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.

3. Shelving Plywood:

- a. Interior Type, any species group.
  - b. Veneer Grade: A-B or B-C.
- 4. Other: As specified for item.
- B. Hardwood Plywood:
  - 1. HPVA: HP.1
  - 2. Species of face veneer shall be as shown or as specified in connection with each particular item.
  - 3. Inside of Building:
    - a. Use Type II (interior) A grade veneer for transparent finish.
    - b. Use Type II (interior) Sound Grade veneer for paint finish.
  - 4. Use plain sliced red oak.

### **2.3 PARTICLEBOARD**

- A. NPA A208.1
- B. Plastic Laminate Particleboard Cores:
  - 1. Use Type 1, Grade 1-M-3, or Type 2, Grade 2-M-2, unless otherwise specified.

### **2.4 PLASTIC LAMINATE**

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
  - 1. Plastic laminate clad plywood or particle board.
  - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

### **2.5 ADHESIVE**

- A. For Plastic Laminate: Fed. Spec. A-A-1936.
- B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.
- C. For Exterior Millwork: Unextended melamine resin, phenol resin, or resorcinol resin.

### **2.6 COUNTERTOPS & SINKS**

- A. Cultured Stone Surfacing: Solid, synthetic stone composite of resins with integral color and design, stain resistant to domestic chemicals and cleaners.
- B. Sink supports shall be painted triangular metal adequate in number and gauge to support applied loads.

- B. Solid surface integral sinks where schedule provided and installed per this Section. Similar to Dupont Model 810.
- C. Stainless steel sink where scheduled and specified per Section 22 40 00, PLUMBING FIXTURES.

## **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. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
  - 3. 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. Routed finger pulls where shown.
    - 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. Sliding Door Tracks: B07063.
    - d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
    - e. Concealed Hinges: B1601, minimum 110 degree opening.
    - f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
    - g. Cabinet Door Catch: B0371 or B03172.
    - h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
  - 2. Cabinet Locks: ANSI A156.11.
    - a. Drawers and Hinged Door: E07262.
    - b. Sliding Door: E07162.

## **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: 15 percent.
  - 2. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

## **2.9 FIRE RETARDANT TREATMENT**

- A. Where wood members and plywood are specified to be fire retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.
- B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.
- C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.
- D. Treat wood for maximum flame spread of 25 and smoke developed of 25.
- E. Fire Resistant Softwood Plywood:
  - 1. Use Grade A, Exterior, plywood for treatment.
  - 2. Meet the following requirements when tested in accordance with ASTM E84.
    - a. Flame spread: 0 to 25.
    - b. Smoke developed: 100 maximum
- F. Fire Resistant Hardwood Plywood:
  - 1. Core: Fire retardant treated softwood plywood.
  - 2. Hardwood face and back veneers untreated,
  - 3. Factory seal panel edges, to prevent loss of fire retardant salts.

## **2.10 FINISHING MATERIALS**

- A. Stain, Varnish and Finishing Materials as required by AWI and WIC.

## **2.11 FABRICATION**

- A. General:
  - 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
  - 2. Finish woodwork shall be free from pitch pockets.
  - 3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
  - 4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
  - 5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
  - 6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
  - 7. 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.
  - 8. Plastic Laminate Work:
    - a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.



- b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
  - c. Provide plastic backing sheet on underside of countertops and sills including back splashes and end splashes of countertops.
  - d. Use backing sheet on concealed large panel surface when decorative face does not occur.
- B. Counters:
- 1. Fabricate to AWI premium grade construction in conformance with AWI Section 400, CASEWORK.
  - 2. Use softwood for structural framing member's standard sizes, space not over 400 mm (16 inches) on center.
  - 3. Use red oak for exposed hardwood trim and edging.
  - 4. Use drawer guides on drawers with pulls.
  - 5. Use pulls and concealed hinges on doors.
  - 6. Use adjustable shelf standards with shelf rests.
  - 7. Use decorative plastic laminate on exposed surfaces including interior of cabinet.
  - 8. Provide cut outs for electrical devices and outlets.

## **PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain work areas and storage areas to a minimum temperature of 21°C (70°F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

### **3.2 INSTALLATION**

- A. General:
  - 1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
  - 2. Secure trim with fine finishing nails, screws, or glue as required.
  - 3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
  - 4. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
  - 5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.

6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.

B. Counters:

1. Secure framing to floor with expansion bolts.
2. Secure counter top to support with wood cleats or metal angles screwed on 150 mm (6 inch) centers.
3. Conceal fasteners on exposed sides. Exposed fasteners permitted under counter top.
4. Secure integral sink.

**3.3 ADJUSTING**

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly or correctly.

**3.4 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, fixtures and built-in equipment.

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**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. All Sections listed in the Table of Contents are a Condition of this Section.

**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.
- D. Performance Test: ASTM field test for 20% of the insulated cavities for the framed buildings.

**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
  - C578-10.....Rigid, Cellular Polystyrene Thermal Insulation
  - C665-06.....Mineral Fiber Blanket Thermal Insulation for  
Light Frame Construction and Manufactured  
Housing

## **PART 2 - PRODUCTS**

### **2.1 INSULATION - GENERAL**

- A. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- B. 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.
- C. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
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 EXTERIOR FRAMING OR FURRING INSULATION**

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

### **2.3 RIGID INSULATION:**

- A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.
- B. Cellular Glass Block: ASTM C552, Type I.

### **2.4 SPRAY APPLIED INSULATION**

- A. Self support cellulose spray applied: ASTM 1149-11.
- B. R-value 3.8/inch.
- C. Color shall be selected from manufacturer's standards.

### **2.5 ACOUSTICAL INSULATION**

- A. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- B. Thickness as shown; of widths and lengths to fit tight against framing.

### **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 batt or blanket insulation with tight joints and filling to frame void completely. Seal cuts, tears, and unlapped joints with tape.
- B. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

## **3.2 EXTERIOR FRAMING OR FURRING BLANKET INSULATION**

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.

## **3.3 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.

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**SECTION 07 22 00**  
**ROOF AND DECK INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Roof and deck insulation on new construction ready to receive roofing or waterproofing membrane over concrete deck.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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):
- C208-08.....Cellulosic Fiber Insulating Board
- C552-07.....Cellular Glass Thermal Insulation
- C726-05.....Mineral Fiber Roof Insulation Board
- C728-05.....Perlite Thermal Insulation Board
- 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 20.
- 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.
- G. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to [www.biopreferred.gov](http://www.biopreferred.gov).

#### **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. Fastening requirements.
- C. Federal Sustainable Design Submittals:
  - 1. Product Data for Federally-Mandated Bio-Based Materials: For roof materials, indicating USDA designation and compliance with definitions for bio-based products, Rapidly Renewable Materials, and certified sustainable wood content.
- D. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Nailers, cants, and terminations.
  - 2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
- E. Samples:
  - 1. Roof insulation, each type.
  - 2. Nails and fasteners, each type.
- F. 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.

G. Laboratory Test Reports: Thermal values of insulation products.

H. Layout of tapered roof system showing units required.

I. 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. Non-membrane Roof Sealants: 300 g/L.
  - g. Sealant Primers for Non-porous 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. Cellular Glass Board Insulation: ASTM C552, Type IV, kraft-paper sheet faced.
- D. Perlite Board Insulation: ASTM C728, expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
- E. Cellulosic Fiber Board Insulation: ASTM C208, Type II, Grade 1 for built-up asphalt or modified bitumen roofing.
- F. Tapered Roof Insulation System:
- 1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.

2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1:48 (1/4 inch per 12 inches).

### **2.3 INSULATION ACCESSORIES**

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
  1. Wood Cant Strips: Refer to Division 06 Section "Rough Carpentry."
  2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
  3. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
    - a. Cellulosic Fiberboard: ASTM C208.
    - b. Mineral Fiberboard: ASTM C726.
    - c. Perlite Board: ASTM C728.
- C. Vapor Retarder:
  1. Glass-Fiber Felts: ASTM D2178, Type IV, asphalt impregnated.
  2. 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).

### **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 VAPOR RETARDER INSTALLATION**

- A. 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.

### 3.4 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: Install preformed insulation cant strips 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. 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.
3. Where tapered insulation is used, the insulation thickness 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.

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**SECTION 07 24 00**

**EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Manufacture's Requirements for the proper design, use, and installation of an Exterior Insulation and Finish System (EIFS).

**1.2 RELATED WORK**

- A. All the sections listed in the Table of Contents are condition of this section.

**1.3 SUBMITTALS**

- A. General: Submit Samples, Evaluation Reports, warranties and Certificates in accordance with Division 01 General Requirements Submittal Section.

**1.4 PROJECT / SITE CONDITIONS**

- A. Installation Ambient Air Temperature: Minimum of 40°F (4°C) and rising, and remain so for 24 hours thereafter.
- B. Substrate Temperature: Do not apply materials to substrates whose temperature are below 40°F (4°C) or contain frost or ice.
- C. Inclement Weather: Do not apply materials during inclement weather unless appropriate protection is employed.
- D. Sunlight Exposure: Avoid, when possible, installation of the materials in direct sunlight. Application of Acrylic Finishes in direct sunlight in hot weather may adversely affect aesthetics.
- E. Materials shall not be applied if ambient temperature exceeds 120°F (49°C) or falls below 40°F (4°C) within 24 hours of application. Protect materials from uneven and excessive evaporation during hot, dry weather.
- F. Prior to installation, the substrate shall be inspected for surface contamination, or other defects that may adversely affect the performance of the materials and shall be free of residual moisture.

**1.5 APPLICABLE PUBLICATIONS**

ASTM B117	Test Method for Salt Spray (Fog) Testing
ASTM C1135	Test Method for Determining Tensile Adhesion Properties of Structural Sealants
ASTM D968	Standard Test Methods for Abrasion Resistance

	of Organic Coatings by Falling Abrasive
ASTM D1037	Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D2247	Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity
ASTM D2294	Standard Test Method for Creep Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal).
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3273	Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E84	Test Method for Surface Burning Characteristics of Building Materials.
ASTM E108	Standard Test Methods for Fire Tests of Roof Coverings
ASTM E119	Standard Test Method for Fire Tests of Building Construction and Materials.
ASTM E330	Test Method for Structural Performance by Uniform Static Air Pressure Difference.
ASTM E331	Test Method for Water Penetration by Uniform Static Air Pressure Difference.
ASTM E695	Method for Measuring Relative Resistance to Impact Loading.
ASTM E2134	Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS)
ASTM E2430	Standard Specification For Expanded Polystyrene ("EPS") Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems ("EIFS")
ASTM E2485	Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings



ASTM E2486	Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
ASTM G155/ G153	Accelerated Weathering for Exposure of Nonmetallic Materials. Fed. Spec. Coating, Textured (For Interior and Exterior Masonry Surfaces) TT-C-555B
MIL STD 810B	Military Standard, Environmental Test Methods
NFPA 259	Test Method for Potential Heat of Building Materials.
NFPA 268	Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
NFPA 285	Standard Method of Test for the Evaluation of Flammability characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components Using the Intermediate-scale, Multistory Test Apparatus.

#### 1.6 ASSEMBLY DESCRIPTION

A. Standard Class PB Exterior Insulation and Finish System (EIFS): Base Coat with embedded Reinforcing Fabric Mesh, Primer, and Finish Coat. This system is installed over glass mat gypsum sheathing.

B. Functional Criteria:

1. General:

a. Insulation Board: At system termination, completely encapsulate insulation board edges by mesh reinforced base coat. The use of and maximum thickness of insulation board shall be in accordance with applicable building codes and EIFS manufacturer's requirements.

b. Flashing: Flashing shall be continuous and watertight. Flashing shall be designed and installed to prevent water infiltration behind the cladding. Refer to Division 07 Flashing Section for specified flashing materials.

2. Performance Requirements

- a. System to meet the performance and testing requirements of the International Code Council Acceptance Criteria AC 219
  - b. Shall meet the testing requirements of the Product Performance Sheet.
3. Substrate Systems:
- a. Shall be engineered to withstand applicable design loads including required safety factor.
  - b. Maximum deflection of substrate system under positive or negative design loads shall not exceed  $L/240$  of span.
  - c. Substrate dimensional tolerance: Flat within  $1/4$  in (6.4 mm) in any 4 ft (122 cm) radius.
  - d. Surface irregularities: Sheathing not over  $1/8$  in (3 mm); masonry not over  $3/16$  in (4.8 mm).
4. Impact Resistance Classification:
- a. Ultra High Impact Resistance, >150 in-lbs (> 17.0 J) Impact Range
5. Expansion Joints: Continuous expansion joints shall be installed at the following locations in accordance with manufacturer's recommendations:
- a. At building expansion joints.
  - b. At substrate expansion joints.
  - c. At floor lines.
  - d. Where EIFS panels abut one another.
  - e. Where EIFS abuts other materials.
  - f. Where significant structural movement occurs, such as at
    - (i) Changes in roof line.
    - (ii) Changes in building shape and/or structural system.
  - g. Where substrate changes
  - h. Substrate movement and expansion and contraction of EIFS and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as follows:

- (i) 1/2 in (12.7 mm) where EIFS abuts other materials.
- (ii) 3/4 in (19 mm) when EIFS abuts the EIFS.
- (iii) Larger width where indicated on drawings.

#### **1.7 QUALITY ASSURANCE**

##### **1. Qualifications:**

- a. All EIFS assembly materials must be manufactured or sold by a single-source manufacturer and must be purchased direct from the manufacturer or its authorized distributor.
- b. Applicator:
  - (i) Must be experienced and competent in installation of plaster-like materials.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- 1. Delivery: Deliver materials in original packaging with manufacturer's identification.
- 2. Storage: Store materials in a cool, dry location, out of sunlight, protected from weather and other harmful environment, and at a temperature above 40°F (4°C) and below 110°F (43°C) in accordance with manufacturer's instructions.

#### **1.9 COORDINATION AND SCHEDULING:**

- 1. Coordination: Coordinate water-resistive membrane & air barrier coating materials installation with other construction operations.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- 1. Components: Obtain components from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from the EIFS manufacturer for this project.

#### **2.2 MATERIALS**

- 1. Adhesives
  - a. Base Coat & Adhesive: 100% acrylic polymer base, ready to use, applied without the addition of cement.
- 2. Insulation Board: Comply with Section 07 21 13, THERMAL INSULATION

3. Base Coats:
  - a. Base Coat: 100% acrylic polymer base, requiring the addition of Portland cement.
4. Reinforcing Mesh:
  - a. Standard Mesh: Weight 4.5 oz. per sq. yd. (153 g/sq m); coated for protection against alkali. Standard reinforcement Ultra High Impact 358.20 Mesh.
  - b. Short Detail Mesh: Reinforcing mesh used for backwrapping and details.
5. Primer:
  - a. Primer: 100% acrylic based coating to prepare surfaces for acrylic or elastomeric finishes.
6. Finish
  - a. Factory blended, 100% acrylic polymer based finish, integrally colored. Finish type, texture and color as selected by Project Designer
  - b. Pigments System: Fade resistant pigment system offering superior fade resistance; factory tinted only; acrylic or elastomeric finish or coating.
  - c. Clear Sealer: 100% acrylic, transparent, permeable, dirt resistant sealer for use as a protective coating over acrylic finishes.
7. Portland Cement: ASTM C150, Type I or Type I-II.
8. Water: Clean, cool, potable water

### **2.3 RELATED MATERIALS AND ACCESSORIES**

1. Substrate Materials:
  - a. Glass mat gypsum sheathing conforming to ASTM C1177.
2. Flashing: Refer to Division 07 Flashing Section for flashing materials.
3. Sealant System:
  - a. Sealant for expansion joints between panelized EIFS sections shall be ultra-low modulus designed for minimum 100% elongation and minimum 50% compression and as selected by Project Designer.

- b. Sealant for perimeter seals around window and door frames and other wall penetrations shall be low modulus, designed for minimum 50% elongation and minimum 25% compression, and as selected by Project Designer.
- c. Sealants shall conform to ASTM C 920, Grade NS.
- d. Expansion joints between sections of EIFS shall have a minimum width of 3/4 in (19 mm).
- e. Perimeter seal joints shall be a minimum width of 1/2 in (12.7 mm).
- f. Sealant backer rod shall be closed-cell polyethylene foam.
- g. Apply sealant to tracks or base coat of EIFS.
- h. Refer to EIFS manufacturer's current bulletin for listing of sealants which have been tested and have been found to be compatible with EIFS materials.
- i. Color shall be as selected by Project Designer.
- j. Joint design, surface preparation, and sealant primer shall be based on sealant manufacturer's recommendations and project conditions.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- 1. Verify project site conditions under provisions of Section 01 00 00.
- 2. Advise Contractor of discrepancies preventing proper installation of the EIFS materials. Do not proceed with the work until unsatisfactory conditions are corrected.

#### **3.2 PREPARATION**

- 1. Protection: Protect surrounding material surfaces and areas during installation of system.
- 2. Clean surfaces thoroughly prior to installation.
- 3. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.3 MIXING**

- 1. Mix materials in accordance with manufacturer's instructions.

**3.4 APPLICATION**

1. General: Installation shall conform to this specification and manufacturer's written instructions.
2. Apply base coat and fully embed mesh in base coat; include diagonal mesh patches at corners of openings and reinforcing mesh patches at joints of track sections. Apply multiple layers of base coat and mesh where required for specified impact resistance classification.
3. Apply primer to base coat after drying. Primer may be omitted if it is not required by the manufacturer's product data sheets for the specified finish coat or otherwise specified for the project.
4. Finish Coat: Apply finish coat to match specified finish type, texture, and color. Do not apply finish coat to surfaces to receive sealant. Keep finish out of sealant joint gaps.

**3.5 CLEAN-UP**

1. Removal: Remove and legally dispose of EIFS materials from job site.
2. Clean surfaces and work area of foreign materials resulting from material installation.

**3.6 PROTECTION**

1. Provide protection of installed materials from water infiltration into or behind them.
2. Provide protection of installed materials from dust, dirt, precipitation, and freezing during installation, and continuous high humidity until fully cured and dry.
3. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the Client Office Representative.

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**SECTION 07 27 26**

**FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR PERMEABLE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies fluid-applied vapor-permeable membrane air barrier material and accessories used for exterior above grade wall assembly air barriers and their extension and connection to adjacent air barrier components in roof and opening construction to provide a durable, continuous, air- and moisture- impermeable full-building system.

**1.2 RELATED WORK**

- A. All Work listed in the Table of Contents are a Condition of this Section.

**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.

1. Air Barrier Association of America (ABAA):Quality Assurance Program

2. American Society of Testing and Materials (ASTM):

C920-10.....Standard Specification for Elastomeric Joint Sealants

C1193-09.....Standard Guide for Use of Joint Sealants

D412-06.....Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension

D2369-10.....Standard Test Method for Volatile Content of Coatings

E96/E96M-05.....Standard Test Methods for Water Vapor Transmission of Materials

E162-09.....Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

E783-02.....Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

E1186-03(2009).....Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

E2178-03.....Standard Test Method for Air Permeance of  
Building Materials

E2357-05.....Standard Test Method for Determining Air  
Leakage of Air Barrier Assemblies

3. U.S. Environmental Protection Agency (EPA)

40 CFR 59, Subpart D....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General: Membrane air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Membrane air barriers shall accommodate substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without moisture deterioration and air leakage exceeding performance requirements.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.2 L/s x sq. m of surface area at 75 Pa (0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.)per ASTM E 2357.
- C. Material Compatibility: Provide membrane air barrier materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by membrane air barrier manufacturer based on testing and field experience.

#### **1.5 QUALIFICATIONS:**

- A. Approvals: Approval by Contracting Officer is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:
- B. Manufacturer Qualifications: Manufacturer regularly and presently manufactures fluid-applied membrane air barrier material meeting section requirements as one of its principal products.
  - 1. Manufacturer's product submitted has been in satisfactory and efficient operation on five similar installations for at least five years.
    - a. Submit list of installations, include name and location of project and name of owner.
  - 2. Accreditation: Manufacturer is accredited by the Air Barrier Association of America.



- C. Installer Qualifications: Installer has technical qualifications, experience, certifications, trained personnel, membrane air barrier manufacturer's approval, and facilities to install specified items.
  - 1. Installer's applicators shall be trained and certified by manufacturer of air barrier system.
  - 2. Installer's full time on-site field supervisor shall have completed three projects of similar scope within last year, be able to communicate verbally with Contractor, Architect, testing agency, and employees.
- D. Testing Agency Qualifications: Testing laboratory accredited by International Accreditation Service, Inc. or American Association for Laboratory Accreditation.
  - 1. Testing agencies personnel shall be experienced in the installation of specified air barrier system and qualified to perform observation and inspection specified in Field Quality Control Article to determine Installer's compliance with the requirements of this Project.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Fluid-applied membrane air barrier.
  - 2. Primer.
  - 3. Mastic.
  - 4. Counterflashing strip.
  - 5. Modified bituminous strip.
  - 6. Sprayed polyurethane foam sealant.
  - 7. Opening transition assembly.
  - 8. Joint sealant.
  - 9. Printed installation instructions for conditions specified.
- C. Certificates:
  - 1. Indicating membrane air barrier manufacturer's qualifications as specified.
  - 2. Indicating approval of installer by membrane air barrier manufacturer.
  - 3. Indicating qualifications of installer and installer's personnel.

4. Indicating air barrier manufacturer's determination that proposed materials are chemically and adhesively compatible with adjacent materials.

5. Indicating products meet project limitations on VOC content.

D. Inspection Reports: Daily reports of testing agency and reports of testing and inspection agency. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.

**1.7 COORDINATION:**

A. Coordinate installation of work of this Section with adjacent and related work to ensure provision of continuous, unbroken, durable air barrier system.

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING:**

A. Deliver materials to job in manufacturer's original unopened containers.

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).

**1.9 ENVIRONMENTAL REQUIREMENTS:**

Ambient Surface and Material Conditions: Not less than 4 degrees C (40 degrees F), during application of waterproofing, visibly dry, and complying with manufacturer's written instructions.

**1.10 WARRANTY:**

Warrant membrane air barrier installation against air and moisture leaks subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Source Limitations: Obtain membrane air barrier materials and accessories from single manufacturer.

B. VOC Content: Maximum 250 g/L per 40 CFR 59, Subpart D (EPA Method 24).

**2.2 MEMBRANE AIR BARRIER:**

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane, meeting the following:

1. Air Permeance, ASTM E 2178: 0.02 L/s x sq. m of surface area at 75-Pa (0.004 cfm/sq. ft of surface area at 1.57-lbf/sq. ft.) pressure difference.
2. Vapor Permeance, ASTM E 96/E96M: Minimum 580 ng/Pa x s x sq. m (10 perms).
3. Elongation, Ultimate, ASTM D 412, Die C: 200 percent, minimum.
4. Combustion Characteristics: Flame spread, not greater than 25; smoke developed, not greater than 450, ASTM E 84.
5. Thickness of Membrane Air Barrier: Not less than 1.0 mm (40 mils), applied in single continuous coat.

### **2.3 ACCESSORY MATERIALS:**

- A. Primer: Liquid waterborne primer meeting VOC requirements, recommended for substrate by membrane air barrier manufacturer.
- B. Counterflashing Sheet: Modified bituminous, 1.0-mm- (40-mil- thick self-adhering composite sheet consisting of 0.9 mm (36 mils) of rubberized asphalt laminated to polyethylene film.
- C. Substrate Patching Material: Manufacturer's standard trowel-grade filler material.
- D. Sprayed Polyurethane Foam Sealant: Foamed-in-place, 24- to 32-kg.cu. m (1.5- to 2.0-lb/cu. ft) density, with flame-spread index of 25 or less per ASTM E 162.
- E. Flexible Opening Transition: Cured low-modulus silicone extrusion with reinforcing ribs, sized to fit opening widths, designed for adhesion to or insertion into aluminum framing extrusions, and compatible with air barrier system materials and accessories.
- F. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, approved by membrane air barrier manufacturer for adhesion and compatibility with membrane air barrier and accessories.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION:**

- A. Surface Condition: Before applying membrane air barrier materials, ensure substrates are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.

B. Verify concrete surfaces have cured for time period recommended by membrane air barrier manufacturer, free from release agents, concrete curing agents, and other contaminants.

C. Verify masonry joints are flush and filled with mortar.

### **3.2 INTERFACE WITH OTHER WORK**

A. Commencement of Work: Commence work once membrane air barrier substrates are adequately protected from weather and will remain protected during remainder of construction.

B. Sequencing of Work: Coordinate sequencing of work with work of other sections that form portions of building envelope air barrier to ensure that flashings and transition materials can be properly installed.

C. Subsequent Work: Coordinate work with work of other sections installed subsequent to membrane air barrier to ensure complete inspection of installed membrane air barrier and sealing of membrane air barrier penetrations necessitated by subsequent work.

### **3.3 AIR BARRIER INSTALLATION**

A. General: Prepare substrates and install and apply air barrier components in accordance with air barrier manufacturer's written instructions consistent with manufacturer's qualifying tested assemblies.

### **3.4 PREPARATION**

A. Prepare and treat substrate in accordance with membrane air barrier manufacturer's written instructions.

B. Mask adjacent finished surfaces.

C. Remove contaminants and film-forming coatings from concrete.

D. Remove projections and excess materials and fill voids with substrate patching material.

E. Prepare and treat joints and cracks in substrate per ASTM C 1193 and membrane air barrier manufacturer's written instructions.

F. Apply primer to substrates.

### **3.5 APPLICATION OF TRANSITION STRIPS**

A. Install transition strips and accessory materials according to membrane air barrier manufacturer's written instructions.

B. Connect and seal membrane air barrier material to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior glazing and window systems, curtain wall systems, door framing, and other openings.

- C. Flexible Opening Transition: Prime concealed perimeter frame surfaces of windows, storefronts, curtain walls, louvers, and doors. Apply flexible opening transition so that a minimum of 75 mm (3 inches) over coverage is achieved over each substrate.
  - 1. Fill gaps at perimeter of openings with foam sealant.
- D. Penetrations: Fill gaps at perimeter of penetrations with foam sealant. Seal transition strips around penetrating objects with termination mastic.
- E. Flashings: Seal top of through-wall flashings to membrane air barrier with continuous transitions strip of type recommended by membrane air barrier manufacturer for type of flashing.

### **3.6 FLUID AIR-BARRIER MEMBRANE INSTALLATION**

- A. Apply fluid membrane air barrier material in full contact with substrate to produce a continuous seal with transition strips according to membrane air barrier manufacturers written instructions.
  - 1. Apply fluid membrane in thickness recommended by manufacturer, but not less than thickness specified in this section.
- B. Leave membrane air barrier exposed until tested and inspected by Owner's testing agency and approved by Resident Engineer.
- C. Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with requirements.

### **3.7 TESTING:**

- A. Testing Agency: Contractor shall engage a qualified testing agency to perform tests and inspections, including documenting of membrane air barrier prior to concealment.
  - 1. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements, including the following:
  - 2. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 3. Continuous structural support of air-barrier system has been provided.
  - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 5. Site conditions for application temperature and dryness of substrates have been maintained.

6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  7. Surfaces have been primed, if applicable.
  8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  9. Termination mastic has been applied on cut edges.
  10. Strips and transition strips have been firmly adhered to substrate.
  11. Compatible materials have been used.
  12. Transitions at changes in direction and structural support at gaps have been provided.
  13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  14. All penetrations have been sealed.
  15. Inspections and testing shall be carried out at the following rate:
    - a. Up to 10,000 square feet (930 square meters) - one inspection
    - b. 10,001 - 35,000 square feet (931 - 3,250 square meters) - two inspections
    - c. 35,001 - 75,000 square feet (3,251 - 6,970 square meters) - three inspections
    - d. 75,001 - 125,000 square feet (6,971 - 11,610 square meters) - four inspections
    - e. 125,001 - 200,000 square feet (11,611 - 18,580 square meters) - five inspections
    - f. Over 200,00 square feet (18,580 square meters) - six inspections.
  16. Forward written inspection reports to the COR within 5 working days of the inspection and test being performed.
  17. If the inspections reveal any defects, promptly remove and replace defective work at no additional cost to the Government.
- B. Inspections shall include:
1. Compatibility of materials within membrane air barrier system and with adjacent materials.
  2. Suitability of substrate and support for membrane air barrier materials.

3. Suitability of conditions under which membrane air barrier will be applied.
4. Adequacy of substrate priming.
5. Proper application and joint and edge treatment of transition strips, flexible opening transitions, and accessory materials.
6. Continuity and gap-free installation of membrane air barrier, transition strips, and accessory materials.

### **3.8 CLEANING AND PROTECTION**

- A. Clean spills, stains, and overspray resulting application utilizing cleaning agents recommended by manufacturers of affected construction. Remove masking materials.
- B. Protect membrane air barrier from damage from subsequent work. Protect membrane materials from exposure to UV light in excess of that acceptable to membrane air barrier manufacturer; replace overexposed materials and retest.

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**SECTION 07 40 00**

**SIDING PANELS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies uninsulated metal wall panels at the mechanical equipment screen walls as shown.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 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 and roof 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

**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 Materials (ASTM):
  - A653/A653M-10.....Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - A463-10.....Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
  - A924/A924M-10.....Steel Sheet, Metallic Coated 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
  - C1396-11.....Standard Specification for Gypsum Board

C553-08.....	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C591-09.....	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
C612-10.....	Mineral Fiber Block and Board Thermal Insulation
E119-10.....	Fire Test of Building Construction and Materials

## **PART 2 - PRODUCTS**

### **2.1 SHEET STEEL**

- A. Minimum 0.8mm thick for wall panels.
- B. Steel, Sheet, Galvanized: ASTM A653/A653M, Structural.
  - 1. Grade 40, galvanized coating conforming to ASTM A924/A924M, Class Z 275 G-90.
- C. Steel, Sheet, Commercial: ASTM A1008, Type C.
- D. Steel, Sheet, Aluminized: ASTM A463. Steel shall be coated on both sides with 0.5 ounce of aluminum per square foot (0.15 Kg/sm).

### **2.2 FASTENERS**

- A. Fasteners for steel panels shall be galvanized or cadmium plated steel.
- B. Fasteners of size, type and holding strength as recommended by manufacturer.

### **2.3 FABRICATION**

- A. Uninsulated siding panels shall be single sheets, of 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 one continuous length for full height or at least one story height with no horizontal joints, except at openings. Construct panels as follows:
  - 1. Wall panels:
    - b. Galvanized steel.
  - 3. 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.
  - 4. Sub-girts shall be 1.0 mm (0.0396 inches) thick galvanized steel hat channels designed to receive panel fasteners or clips.

### **2.4 FINISH**

- A. For steel face sheets, the finishes shall be as follows:
  - 1. Fluorocarbon finish, consisting of a prime coat and a polyvinylidene fluoride finish coat of 1.0 mil minimum dry film thickness on one side, and a wash coat of 0.5 mil minimum dry film thickness applied to reverse side.

- B. Aluminum alloy used for color coating shall be as required to produce specified color. Color shall be as specified in Section 09 06 00, SCHEDULE FOR FINISHES. Color for sheet aluminum shall not deviate more than the colors of extrusion samples.

### **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: 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. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. 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 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 42 00**

**SOLID PHENOLIC EXTERIOR WALL PANEL SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies Solid Phenolic Exterior Wall Panel System (composite wall panel).

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 MANUFACTURER'S QUALIFICATIONS**

- A. Solid Phenolic Exterior Wall Panels shall be products of a manufacturer regularly engaged in the fabrication and erection of wall panel type and design shown and specified.

**1.4 SYSTEM DESCRIPTION**

- A. Performance Requirements: Provide panels that have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Wall panel, (4) four 300 mm (twelve inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall panels, showing layout, profiles and product components including details of edge conditions, panel joints, anchorage, anchor details and attachment to adjoining units of work, accessories, finish colors, patterns and textures.
- D. Manufacturer's Literature and Data: Submit product data, including manufacturer's product specifications sheet for specified products.
- E. Quality Assurance Submittals: Submit the following:
  - 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
  - 2. Certificates:
    - a. Qualification Certificates: Submit certificate indicating compliance with qualification requirements in Quality Assurance article.

- b. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 3. Manufacturer's Instructions: Manufacturer's installation instructions.
- 4. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
- F. Closeout Submittals: Submit the following:
  - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Warranty: Warranty documents specified herein.
- G. Fire Test Report: Report of fire test by recognized testing laboratory for fire rating specified, showing details of construction.

#### **1.6 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
  - 2. ASTM E119 Fire Resistance of Building Construction and Materials.
  - 3. ASTM G26/G155 Accelerated Weathering
  - 4. ASTM C297 Bond Strength
  - 5. ASTM D1037 Flexural Strength
  - 6. ASTM D2247 Water Resistance
  - 7. ASTM E330 Structural Performance
  - 8. ASTM D1761 Mechanical Fastener Withdrawal Resistance
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 259 Potential Heat of Building Materials
  - 2. NFPA Multistory Flammability Characteristics
  - 3. NFPA 268 Ignitability of Exterior Wall Assemblies
  - 4. NFPA 251 Fire Resistance of Building Construction and Materials

#### **1.7 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility, capable of providing field service representation during fabrication and approving application method.
    - a. Obtain from a single manufacturer.

2. Fabricator/Installer Qualifications: Installer shall be approved by the manufacturer and experienced in performing work of similar type and scope.
- B. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Contracting Officer's Representative and Architect's acceptance of finish color, texture, pattern and workmanship standards. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
  1. Mock-Up Size: Full height by 20' wide.
  2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
- C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

#### **1.8 DELIVERY, STORAGE & HANDLING**

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

#### **1.9 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

#### **1.10 WARRANTY**

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Contracting Officer's Representative's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Contracting Officer's Representative may have under Contract Documents.

## **PART 2 - PRODUCTS**

### **2.1 SOLID PHENOLIC WALL PANELS**

- A. Fabricator: Only fabricators licensed by manufacturers will be permitted.
- B. Color: As specified in Section 09 06 00, Schedule for Finishes. Architect. Selected color shall be on exposed sides.
- C. Finish: Naturals Directional
- D. Panel Core: Type FR fire retardant black core.
- E. Panel Standard Sizes: Provide panel sizes and joint layout per project requirements to minimize cuts and material waste.
- F. Performance Characteristics:
  - 1. Modulus of Elasticity: 1,200,000 psi, minimum.
  - 2. Tensile Strength: 13,000 psi.
  - 3. Flexural Strength: 16,000 psi, minimum.
  - 4. Surface Impact Resistance: 9 lbf index, minimum.
  - 5. Scratch Resistance: 0.79 lbf index, minimum.
  - 6. Panel Thickness: 10 mmthick.
  - 7. Fire Performance: Maximum flame spread index of 5 per ASTM E84 (Type 1, Class A).
  - 8. Smoke Development Index: 5
  - 9. Water Absorption (EN 438-2 (7)): Less than 1.0%
  - 10. Porosity: Non porous surface and edges.
  - 11. Microbial Characteristics: Will not support micro-organic growth.
  - 12. Cleanability: Resists dirt pickup. Easily cleaned.
  - 13. Color Stability (ISO 105 A02-87 (3000 hr xenon lamp test)): 4-5 grey scale.

### **2.2 FABRICATION**

- A. Factory fabricate Solid Phenolic Wall Panels and accessory items in accordance with manufacturer's recommendations and approved submittals.
- B. Fabricate panels to profile indicated.

### **2.3 ACCESSORIES**

- A. Metal Plate Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.



- B. Manufacturers Standard Extrusions: Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.
- C. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.040 inch thick unless otherwise indicated. Formed from 0.062-inch- (1.58-mm / 14ga) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Provide lap strip under flashing at abutted conditions with lapped surfaces sealed with a full-bead of non-hardening sealant. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.
- D. Panel Sealants:
  - 1. Joint Sealant: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.
  - 2. Coordinate sealant of interfacing components with the metal-faced composite wall panel sealant for product compatibility.
  - 3. Install sealant as per the sealant manufacturer's recommendations.
- E. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
- F. Attachment System Components: Manufacturer's standard components, formed from extruded aluminum, for rout-and-return dry-gasketed installation system.

#### **2.4 FASTENING SYSTEM**

- A. Fastening System: Stainless steel concealed fastener attachment as designed and tested by the manufacturer of the phenolic panel. Cladding panel installation with metal to metal fasteners.

- B. Cladding Panel Fasteners: 12-11 TW-S-D13 Type A cladding fasteners; 304 stainless steel fastener with pan head and gimlet point for attaching cladding panels to aluminum framework.
1. Material: 304 Stainless Steel
  2. Head Style: 0.512 inch diameter pan head with T-20 TORX drive.
  3. Strength:
    - a. Tensile: 2,144 Lb, ultimate
    - b. Torsional: 65 in-lbs, minimum
    - c. Shear: 220 Lb
  4. Washer: 304 or 302 stainless steel bonded sealing washer with grey EPDM sealing element.
  5. Spacers: Stainless steel with a diameter and length of 1/2 inch.

## **2.5 INSTALLATION MATERIALS**

- A. Provide extruded aluminum trim; color matched, corrosion resistant screws; color matched corrosion resistant blind rivets; concealed corrosion resistant metal tongues.

## **2.6 MISCELLANEOUS METAL FRAMING**

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 Z120 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated with gauge per structural, performance and installation requirements.
1. Subgirts: C- or Z-shaped sections minimum 0.064-inch nominal thickness.
  2. Zee Clips: 0.079-inch minimum nominal thickness.
  3. Flat strap minimum 20 ga.
  4. Base or Sill Angles: 0.079-inch minimum nominal thickness.
  5. Hat-Shaped, Rigid Furring Channels:
    - a. Depth: 3/4 inch.
  6. Cold-Rolled Furring Channels: Minimum 1/2-inch wide flange and 3/4 inch depth.
  7. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
  8. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
  9. Sheet Metal Fabrications: G90 galvanized steel, minimum 16 ga.

- a) Fabricate with intermediate rib stiffeners to perform per 1.3 - Performance Requirements.
- B. Fasteners for Miscellaneous Metal Framing: As required by structural calculations. Minimum requirement is of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## **2.7 MISCELLANEOUS MATERIALS**

- A. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Panel Fasteners: Suitable fasteners designed to withstand design loads. Stainless steel fastener with a minimum 7/16" diameter head and neoprene washer.

## **2.8 FINISHES**

- A. Exterior Finish: Integral decorative surface with UV resistance and color stability.
- B. Field Color: Two-Coat Mica Enhanced Fluoropolymer: AAMA 2605. 3-coat Fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Concealed Finish: Manufacturers random color finish.
  - 2. Color: Manufacturer's standard color as selected by Architect and per Section 09 06 00, Schedule for Finishes.

## **PART 3 - EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- 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. Flashing: All flashing and related closures and accessories in connection with the solid phenolic 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.
- C. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

### **3.2 EXAMINATION**

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Notify COR if deficiencies exist and do not proceed until corrections are made.

### **3.3 PREPARATION**

- A. Prepare surface to receive Solid Phenolic Wall Panels as required by the manufacturer.
- B. Miscellaneous Framing: Install subgirts, sheet metal fabrications, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.
  - 1. Design framing systems to resist specified loads.
  - 2. Fabricate sheet metal with intermediate stiffener ribs to resist specified loads.
  - 3. Install miscellaneous framing members to achieve dimensions as shown on Drawings and to support composite metal panel fasteners and clips.

### **3.4 INSTALLATION**

- A. Install Solid Phenolic Wall Panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals.
- B. Fasten Solid Phenolic Wall Panels to supporting substrate with fasteners approved for use with adjoining construction.

- C. Accessory Items: Install corner profiles, gaskets and trim with fasteners and adhesive appropriate for use with adjoining construction as indicated on drawings and as recommended by manufacturer.
- D. Interface with other work as required by this project.
- E. Installed panels shall have open joints.
  - 1. Fabricated Joints: Allow a minimum 1/2 inch (12.7 mm) of free space for movement of panels.
  - 2. Vertical joints to have hat channel directly behind the joint.
  - 3. Coordinate exact sizes and dimensions with the drawings, field conditions and approved shop drawings.
- F. Every vertical section of the façade cladding shall have a ventilation opening at the bottom and top, having a width/depth of 2.36 in<sup>2</sup>/ft.

### **3.5 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.

### **3.6 FIELD QUALITY REQUIREMENTS**

- A. Manufacturer's Field Services: Upon Government's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.6 CLEANING**

- A. After completion of work, remove coverings and protection of adjacent work areas. All exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

### 3.7 PROTECTION

- A. Protect Solid Phenolic Wall Panels and other components from damage during and after erection, and until project is complete. Should any damage to installed product be discovered, repair or replace to the Contracting Officer's satisfaction.

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**SECTION 07 54 23**

**THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Thermoplastic Polyolefin (TPO) sheet roofing mechanically fastened to roof deck.
- B. Roof and Deck Insulation

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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):
  - 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
  - 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

- E1980-01.....Standard Test Method for Measuring Solar  
Reflectance of Horizontal and Low-Sloped  
Surfaces in the Field
- E 2430 -05. . . . . Rigid Polystyrene Insulation
- C 168. . . . . Test method for Thermal Insulation
- C 177. . . . . Test for Steady State Heat flux Measurements,  
and Thermal insulation
- 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: Roof Nav Approved Roofing Assemblies and Products.  
1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.  
1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof  
Components
- H. National Roofing Contractors Association: Roofing and Waterproofing  
Manual
- I. 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. [www.energystar.gov](http://www.energystar.gov).
  2. Solar Reflectance Index: Not less than 78 when calculated according  
to ASTM E1980 based on testing identical products by a qualified  
testing agency. [www.coolroofs.com](http://www.coolroofs.com).

#### **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 an independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor 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 Thermoplastic Polyolefin (TPO) roofing for storage, handling and application.
  2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
  3. Recommendations of ANSI/SPRI ES-1 for roof edge design.
  4. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
    - a. Corner Uplift Pressure: (75 lbf/sq. ft.).
    - b. Perimeter Uplift Pressure: (75 lbf/sq. ft.).
    - c. Field-of-Roof Uplift Pressure: (75 lbf/sq. ft.).
  5. 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-75.
  - b. Hail Resistance: MH.
- E. Pre-Roofing Meeting:
- 1. Prior to roofing, discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection with COR 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. Roof Insulation
  - 3. Fastening requirements.
  - 4. Application instructions.
- C. Samples:
  - 1. Nails and fasteners, each type.
- D. Shop Drawings: Include plans, sections, details, and attachments.
  - 1. Base flashings and terminations.
  - 2. Layout of Insulation, crickets, edge conditions and roof drains, scuppers etc.
- 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.
  - 3. Laboratory test reports: Thermal values of insulation products.

4. Indicating Thermal conductance, and minimum average thickness of insulation.

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. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

#### **1.9 WARRANTY**

A. 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.

#### **1.10 QUALITY ASSURANCE:**

A. Roof insulation on steel deck shall have a flame spread rating no greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84, or shall have successfully passed FM Approvals 4450

### **PART 2 - PRODUCTS**

#### **2.1 TPO MEMBRANE ROOFING**

A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with no backing.

B. 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.
- 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.
- H. Roof and Deck Insulation:
  - 1. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.
  - 2. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
  - 3. Tapper Roof Insulation System:
    - a. Fabricate of polyisocyanurate. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
    - b. Cut to provide high and low points with crickets and slopes as shown.
    - c. Minimum thickness of tapered sections: 38 mm (1-1/2 inch).
    - d. Minimum slope 1:48 (1/4 inch per 12 inches).

## **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.
- B. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

## **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.

### **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 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 deg. C (40 deg. F).
  - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

### **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: Install preformed insulation cant strips at junctures of roofing system with vertical construction.
5. Use same insulation as existing for roof repair and alterations unless specified otherwise.

#### **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.

### **3.6 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.
  - e. At parapet walls, intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 300 mm (12 inches) on centers or as shown on NRCA manual.

I. Mechanically-Attached System:

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.

### **3.7 INSTALLATION OF FLASHING**

- A. Install flashings as the membrane is being installed. If the flashing cannot 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 as shown.
  2. Coordinate installation with metal expansion joint cover or roof expansion joint system.
- E. Repairs to membrane and flashings:
1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fish-mouthed.
  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.

### **3.8 FIELD QUALITY CONTROL**

- A. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
1. Examine and probe seams in the membrane and flashing in the presence of COR 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 fish-mouths.
- C. Final Roof Inspection:
1. Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  2. 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. 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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**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Formed sheet metal work for wall and roof flashing/counterflashings, mechanical curb openings, copings, roof edge metal, drainage specialties, formed expansion joint covers and flexible and aluminum trim at openings (jambs, heads, sills) are specified in this section.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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
- 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
- E. ASTM International (ASTM):  
B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
- F. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual
- G. Federal Specification (Fed. Spec):  
A-A-1925A.....Shield, Expansion; (Nail Anchors)

H. International Code Commission (ICC): International Building Code,  
Current Edition

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Flashing and sheet metal shall be design to resist Wind Uplift Forces.
- B. Wind Design Standard: Fabricate and install copings roof-edge flashings, tested per ANSI/SPRI ES-1 as indicated on Drawings.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: For all specified items, including:
  - 1. Flashings
  - 2. Copings
  - 3. Gravel Stop-Fascia
  - 4. Scuppers and Conductors
  - 5. Expansion joints
  - 6. Fascia-cant
  - 7. Aluminum flashings at openings, including flexible flashings.
  - 8. Flashing dams at opening corners and penetrations through exterior walls systems for electrical and other exterior boxes.
- C. Manufacturer's Literature and Data: For all specified items, including:
  - 1. Two-piece counterflashing
  - 2. Expansion joint cover, each type
  - 3. Fascia-cant
- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

### **PART 2 - PRODUCTS**

#### **2.1 FLASHING AND SHEET METAL MATERIALS**

- A. Aluminum Sheet: ASTM B209, alloy 3003-H14 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.

#### **2.2 FLASHING ACCESSORIES**

- A. Fasteners:
  - 1. Use stainless steel for aluminum alloy.
  - 2. Nails:
    - a. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

- b. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
- 3. Expansion Shields: Fed Spec A-A-1925A.
- B. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- C. Flexible Flashing: .9 mm (35 mils) self-adhering, vapor permeable, SBS rubberized asphalt compound with integral cross-laminated polyethylene film. Impermeable to air, moisture and water vapor. Self-sealing when penetrate with self-tapping screws or nails. Peel and stick, no flame applications.
- D. Fabricated sheet metal flashings at openings and penetrations.

### **2.3 SHEET METAL THICKNESS**

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Exposed Locations:
  - 1. Stainless steel: 0.4 mm (0.015 inch).
- C. Thickness of aluminum or galvanized steel is specified with each item.

### **2.4 FABRICATION, GENERAL**

- A. Jointing:
  - 1. In general, stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
  - 2. Jointing of stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
  - 3. Joints shall conform to following requirements:
    - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
    - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
    - c. Lap joints shall finish not less than 100 mm (4 inches) wide.
  - 4. Flat and lap joints shall be made in direction of flow.
- 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. 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 continuous cleats.
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. 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 insure 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. 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.
2. 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. Stainless Steel: Finish No. 2B or 2D.
  2. Aluminum:
    - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
    - b. Colors per Section 09 06 00, Schedule for Finishes.

**2.6 BASE FLASHING**

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
  1. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
  2. Use 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.

**2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. 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. Manufactured assemblies may be used.
  - 4. 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.
- B. One-piece Counterflashing:
  - 1. Back edge turned up and fabricated 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).
- C. Surface Mounted Counterflashing; one or two piece:
  - 1. Use at existing or new surfaces where flashing can not 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.
- D. 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.

## **2.8 GRAVEL STOPS**

- A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
  2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
  3. Fabricate roof flange not less than 100 mm (4 inches) wide.
  4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
  5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
    - a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
    - b. Fabricate bottom edge of formed fascia to receive edge strip.
    - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).
- B. Formed Flat Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 1.25 mm (0.050 inch) thick aluminum.
  2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
  3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
  4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
  5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.
- C. Formed Sheet Metal Gravel Stops and Fascia:
1. Factory fabricate prepackaged system, complete with fastenings.
  2. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
  3. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

## **2.9 EXPANSION JOINT COVERS**

- A. Unless otherwise indicated in drawings, expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.

## **2.10 FLASHINGS AT ROOF PENETRATIONS**

- A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.
- B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.
  - 1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
  - 2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
  - 3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
- C. Fabricate sleeve base flashing with roof flange of stainless steel.
  - 1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
  - 2. Extend sleeve around collar up to top of collar.
  - 3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
  - 4. Fabricate interior diameter 50 mm (2 inch) greater than collar.
- D. Fabricate hood counter flashing from same material and thickness as sleeve.
  - 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.

## **2.11 PRE-FINISHED ALUMINUM FLASHINGS**

- A. Formed Sheet Metal Corners and Sills:
- B. Use flexible base flashing at vertical and horizontal surfaces extending membrane waterproofing intersections.
- C. Form flashing bent from strip. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

## **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. 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.
6. 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.
7. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
8. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
9. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
10. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
11. 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.
12. 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.
- 13. Paint aluminum in contact with mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
- 14. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

### **3.2 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).

### **3.3 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. General:
  - 1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
  - 2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
  - 3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.

4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
  5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
  6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
1. Where flashing is installed 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.
  2. 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.
  3. Where flashing or hood is mounted on pipe.
    - a. Secure with draw band tight against pipe.
    - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturers instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

### **3.4 REGLETS**

- A. Install reglets where indicated in drawings, in a manner to provide a watertight installation.
- B. Butt and align end joints of each section of reglet and securely hold in position until concrete or mortar are hardened:
  - 1. Coordinate reglets for anchorage into construction.

### **3.5 GRAVEL STOPS**

- A. General:
  - 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
  - 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
  - 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
  - 4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
  - 5. Set flange in roof cement when installed over built-up roofing.
  - 6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal gravel stops and fascia:
  - 1. Install with end joints of splice plates sheets lapped three inches.
  - 2. Hook the lower edge of fascia into a continuous edge strip.
  - 3. Lock top section to bottom section for two piece fascia.
- C. Scuppers:
  - 1. Install scupper where occurs, with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
  - 2. Set scupper at roof as indicated in drawings and fasten to wood blocking.
  - 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 COPINGS**

- A. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.
- B. Aluminum Coping:



1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

**3.7 EXPANSION JOINT COVERS, INSULATED**

- A. Install expansion joint covers at locations shown 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 expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.
- D. At transition between horizontal and vertical expansion joint, continue joint cover up the vertical face of the wall. Cover joint cover with edge strip.

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**SECTION 07 84 00**

**FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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**

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

**1.6 QUALITY ASSURANCE**

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

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

E84-10.....Surface Burning Characteristics of Building  
Materials

E814-11.....Fire Tests of Through-Penetration Fire Stops

C. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479-10.....Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue Certification Listings

## **PART 2 - PRODUCTS**

### **2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Have no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
  - 1. Classified for use with the particular type of penetrating material used.
  - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
  - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

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

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

### **3.2 PREPARATION**

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the

firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

### **3.3 INSTALLATION**

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

### **3.4 CLEAN-UP AND ACCEPTANCE OF WORK**

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

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**SECTION 07 92 00**

**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 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.
  - 3. Notify COR seven days in advance of dates and times when test joints will be erected.
  - 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.
- 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. Joints in 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
  - 2. Primers
  - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

#### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations:
  - 1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
  - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

#### **1.6 DELIVERY, HANDLING, AND STORAGE**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.



- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

#### **1.7 DEFINITIONS**

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

#### **1.8 WARRANTY**

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

#### **1.9 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C834-10.....Latex Sealants.
  - C920-10.....Elastomeric Joint Sealants.

### **PART 2 - PRODUCTS**

#### **2.1 SEALANTS**

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

C. S-3:

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.

D. S-4:

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

E. S-5:

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

## **2.2 CAULKING COMPOUND**

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

## **2.3 COLOR**

- A. Sealants shall match color of adjacent surface.
- B. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- C. Caulking shall be light gray or white, unless specified otherwise.

## **2.4 JOINT SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## **2.5 FILLER**

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

## **2.6 PRIMER**

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

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

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing 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 concrete and masonry materials.
  3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous surfaces, including metals, with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
1. Apply primer prior to installation of back-up rod or bond breaker tape.
  2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.3 BACKING INSTALLATION**

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

F. Take all necessary steps to prevent three sided adhesion of sealants.

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

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

### **3.5 INSTALLATION**

A. General:

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

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

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

- 1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
- 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.

3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL**

- A. Field-Adhesion Testing:
  1. Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer.
  2. Perform one test for first 30 m (100 feet) of joint length for each type of elastomeric sealant and joint substrate per elevation..
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
  1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- E. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.7 CLEANING

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

### 3.8 LOCATIONS

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1, S-2
- 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. Pipe Penetrations: Type S-9
- D. Horizontal Traffic Joints:
  - 1. Concrete Paving: Type S-11 or S-12
- E. Interior Caulking:
  - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
  - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete: Types C-1 and C-2.
  - 3. Exposed Isolation Joints at top of full height walls: Types C-1 and C-2.

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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.
- B. Types of assemblies:
  - 1. Interior wall joint - exposed
  - 2. Interior wall joint - concealed
  - 3. Interior ceiling joint
  - 4. Interior floor joint - elevated slab
  - 5. Interior floor joint - slab on grade - exposed
  - 6. Interior floor joint - concealed
  - 7. Exterior wall joint - face to face
  - 8. Exterior wall joint corner
  - 9. Exterior metal coping joint
  - 10. Exterior roof joint
  - 11. Smoke Seals at joints in smoke barrier locations

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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.

**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-08.....Structural Steel

A167-99 (R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet, and Strip

A283/A283M-07.....Low and Intermediate Tensile Strength Carbon  
Steel Plates

A786/A786M-05 (R2009) ....Rolled Steel Floor Plates

B209M-07.....Aluminum and Aluminum-Alloy Sheet and Plate  
(Metric)

B221M-08.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes (Metric)

D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective  
Coatings for Metal

E119-10.....Fire Tests of Building Construction and  
Materials

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):

251-06.....Tests of Fire Endurance of Building  
Construction and Materials

F. Underwriters Laboratories Inc. (UL):

263-11.....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. Thermoplastic Rubber:

1. ASTM C864.

2. Dense Neoprene or other material standard with expansion joint  
manufacturers having the same physical properties.

G. Zinc-Molybdate Primer: Fed. Spec. TT-P-645.

H. 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.

### **2.2 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 (six 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. Interior Wall Joint Cover Assemblies:
1. Surface Mounted Metal Cover Plates:
    - a. Concealed frame for fastening to wall on one sides of joint.
    - b. Extend cover to lap each side of joint and to permit free movement on one side.
    - c. Provide concealed attachment of cover t frame cover in close contact with adjacent finish wall surfaces.
    - d. Use angle cover plates at intersection of walls.
    - e. Use smooth surface cover plates matching floor plates.
    - f. Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.
- E. Exterior Wall Joint Assemblies:
1. Variable movement with seal designed to prevent water and air infiltration.
  2. Use vinyl seal strip as secondary seal behind primary seal.

3. Cover Plate Assemblies:

- a. Surface mounted cover plate.
- b. Concealed frame for fastening to wall on one side of joint.
- c. Extend cover to lap each side of joint and to permit free movement on one side.
- d. Provide concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
- e. Use angle cover plate of intersection of walls.

E. 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 specified in section 09 06 00, SCHEDULE FOR FINISHES.
5. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.

**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.
  - b. Color anodized finish: AA-C22A42, Chemically etched medium matte, integrally colored anodic coating, Class I Architectural, 0.7-mil thick. Dyes not accepted.
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. 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.
- N. Sealants:
  - Install to prevent water and air infiltration.

#### **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 FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. For doors and frames.

**1.4 SHIPMENT**

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

**1.5 STORAGE AND HANDLING**

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

**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. 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):
  - 128-09.....Acoustical Performance for Steel Door and Frame Assemblies
  - A250.8-03 (R2008).....Standard Steel Doors and Frames
- D. American Society for Testing and Materials (ASTM):
  - A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled

A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low Alloy and High Strength Low  
Alloy with Improved Formability

E. The National Association Architectural Metal Manufacturers (NAAMM):  
Metal Finishes Manual (AMP 500-06)

F. National Fire Protection Association (NFPA):  
80-10.....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 FABRICATION GENERAL**

#### **A. GENERAL:**

1. Follow ANSI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
4. Mop stop (cut-off stop) at all frames adjacent to hard surface flooring. Mop stop shall be fully welded, ground and finished smooth with no visible seams.
5. Removable keyed mullion at double doors where scheduled.

- B. Standard Duty Doors: ANSI A250.8, Level 1, Full flush seamless design of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.

C. Heavy Duty Doors: ANSI A250.8, Level 2, Full flush seamless design of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

D. Smoke Doors:

1. Close top and vertical edges flush.
2. Provide seamless vertical edges.
3. Provide clearance at head, jamb and sill as specified in NFPA 80.

## **2.2 METAL FRAMES**

A. General:

1. Frames for interior doors: 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 doors specified to have automatic door operators; Security doors (Type 36); service window: minimum 1.7 mm (0.067 inch) thick.
4. 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.

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 or panel shown or specified.

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.

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.

## **2.3 SHOP PAINTING**

- A. 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. Powder actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
  - 1. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.

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

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

- A. Install doors and hardware as specified in 8 11 13, HOLLOW METAL DOORS AND FRAMES; Section 08 14 00, INTERIOR WOOD DOORS; 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 pre-finish, pre-fit option.
- B. Section includes fire rated doors.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Show every door in project and schedule location in building.
  - 2. Indicate type, grade, finish and size; include detail of glazing, 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.
  - 2. Specified STC RATING for sound retardant rated door assembly in place.

### 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, Job Site Information.
- C. Label package for door opening where used.

### 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. Window and Door Manufacturers Association (WDMA):
  - I.S.1A-11.....Architectural Wood Flush Doors
  - I.S.4-09.....Water-Repellent Preservative Non-Pressure Treatment for Millwork
  - I.S.6A-11.....Architectural Wood Stile and Rail Doors
  - 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.....Screw-holding Test Method
- C. National Fire Protection Association (NFPA):
  - 80-10.....Protection of Buildings from Exterior Fire
  - 252-08.....Fire Tests of Door Assemblies
- D. ASTM International (ASTM):
  - E90-09.....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 per Section 09 06 00.
    - a. A grade face veneer standard optional.



- b. AA grade face veneer
  - c. Match face veneers for doors for uniform effect of color and grain at joints.
  - d. Door edges shall be same species as door face veneer except maple may be used for stile face veneer on birch doors.
  - e. On doors required to have transparent finish on one side and paint finish on other side; use veneers as required for transparent finish on both sides.
  - f. 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.

## **2.2 PREFINISH, PREFIT OPTION**

- A. Flush doors may 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**

- A. 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 Contracting Officer's Representative.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies access doors or panels.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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.

**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. Non-continuous hinges as required to maintain alignment of panel with frame.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction.
- D. Hinge: Continuous steel hinge with stainless steel pin.
- E. Provide latch release device operable from inside of door.

**2.2 ACCESS DOORS, FLUSH PANEL**

- A. Door Panel:
  - 1. Form of 1.9 mm (0.0747 inch) thick steel sheet.
  - 2. Reinforce to maintain flat surface.
- B. Frame:
  - 1. Form of 1.5 mm (0.0598 inch) thick steel 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. Provide removable hinge pin to allow removal of panel from frame.

**2.3 FINISH**

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

**2.4 SIZE**

- A. As shown on drawings.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

**3.2 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.

**3.3 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 STOREFRONTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies aluminum tempered glass balanced doors and other components to make a complete assembly.

**1.2 RELATED WORK:**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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, installation details and glass elevations and images.
- C. Manufacturer's Literature and Data:
  - 1. Doors, each type.
  - 2. Ceramic frit.
- D. Samples:
  - 1. Two samples of anodized aluminum of each color showing finish and maximum shade range. Glass showing color and finish.
- 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's Representative 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 storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store balanced glass door 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

**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, windows and transoms.
  2. For color anodized finish, use aluminum alloy as required to produce specified color.
- 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.

## **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 TEMPERED BALANCED GLASS DOORS:**

- A. Glass - GL4. See Section 09 06 00, Schedule for Finishes.
- B. Pivots, concealed torsion bar, Balanced hardware:
  - 1. All balanced door hardware, including hydraulic check, shall be cast bronze and shall be cast, machined and assembled by the door and frame fabricator. Exposed hardware shall be finished as specified below.
  - 2. Cast bronze mechanism and other integral parts must be heavy duty and must be designed to allow variation in adjustments to meet this

particular job with respect to door size, door weight and varying or internal building pressures.

3. Balanced hardware shall consist of the following items:
  - a. Cast bronze hydraulic check shall be concealed in the head frame and have first and second speed adjustment. The hydraulic check unit must be removable without requiring the removal of the door, head frame or any other hardware. Closer arms are unacceptable.
  - b. Each door to have a heavy duty steel tube hinge shaft 1-3/4 inch (44 mm) diameter with 1/4 inch (6 mm) minimum wall thickness. Hinge shaft to be furnished complete with spring closing mechanism. The spring closer shall be adjustable at the floor to meet varying wind or building conditions. Top and bottom arms shall be one piece bronze castings, welded to hinge shaft. Two piece arms, aluminum arms, or steel painted arms will not be acceptable.
  - c. Hardware shall include a spring-cushioned door roller bumper located in the guide channel. The operating mechanism in the head shall include ball bearing pivots, cast bronze hydraulic check and cast bronze door guide channel with minimum dimensions of  
2-3/8 inch (60 mm) by 3/4 inch (19 mm) thick and a minimum wall thickness of 9/16 inch (14 mm).
  - d. Means shall be provided which make possible field adjustment for proper perimeter clearance of each door leaf in relation to its finished framework to accommodate on-site conditions.
  - e. All doors shall have a semi-automatic hold open device located in the bottom rail.
  - f. Doors shall have a maximum of 8 lbs. spring tension adjustment at pull handle. Adjust hydraulic check so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.
  - g. Standard locking hardware to be bottom rail deadlock. Office locking hardware to be 5"x9" lock and strike heavy duty Grade 1 mortise.
  - h. Push pull and panic hardware.

## **2.5 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Fluorocarbon Finish: AAMA 605.2, high performance coating. Color Finish: Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 7 mils thick. More than 50 percent variation of the maximum shade range approved will not be accepted in a



single component or in adjacent components, stiles, and rails on a continuous series.

**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 (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.
- B. Install hardware specified under Section 08 71 00, DOOR HARDWARE.

**3.2 ADJUSTING:**

- A. After installation of balanced glass door work is completed, adjust and lubricate operating mechanisms to insure proper performance.

**3.3 PROTECTION, CLEANING AND REPAIRING:**

- A. 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
    - a. Glass
    - b. Integral steel channel reinforcing for general and blast support.
    - c. Closures, trim, subsills and flashings.
    - D. Fasteners, anchors, and related reinforcement.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a condition of this Section.

**1.3 SYSTEM PERFORMANCE:**

- A. Fabricate and install blast resistant façade wall systems including but not limited to curtain wall, and non-load bearing façade wall systems to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, glass retention, and hardware.
- B. In conjunction with meeting aesthetic and performance requirements, the Contractor may propose alternate design methods for consideration.
- C. General: Design exterior façade wall systems to meet the performance requirements for a 'Life-Safety Protected' facility at a minimum dynamic design pressure of 4-psi, considering a 14-msec time duration, in accordance with the Physical Security Design for VA Facilities.
- D. Window System Design: Exterior curtain wall glazing systems shall be designed as follows:
  - 1. Acceptable Glass Response for Blast Resistant Window Systems:  
Glazing is to meet the equivalent of GSA Performance Condition 3B or better. Condition 3B is defined as glazing breaks, glass fragments enter the space, and land on the floor no further than 10 feet (3 meters) from the window.
  - 2. Glass Design: Use WinGARD 5.5.1 or latest to design exterior glass panes to resist ramp-down dynamic air-blast loads corresponding to a peak pressure of 4-psi that linearly decays over a 14-msec time duration.
  - 3. Supporting Structure Design: Design frame members and mullions to the applied blast load over the appropriate effective area of the frame or mullion.

- a. Ductility ( $\mu$ ): Provide a maximum ductility value for the flexural response of  $\mu \leq 3$  for steel or aluminum.
  - b. Support Rotation ( $\theta$ ): Provide a maximum rotation value for the flexural response as follows:
    - i.  $\theta \leq 3.8$  degrees for structural steel
    - ii.  $\theta \leq 3$  degrees for aluminum
  - c. 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.
4. Connection Design:
- a. Design connections to the lesser of the following for inbound and rebound loading effects:
    - i. Design connections to the average glass pane edge shears by distributing the dynamic loads over the perimeter length of the frame.
    - ii. Reaction forces at a connection joint based on the flexural yield capacity of mullion elements that frame into the joint.
  - b. 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.
5. Spandrel Panel Design: Analysis shall be performed to determine the response of spandrel glass, panels and/or the back-up wall system. Performance should focus on the limitation of flying debris into occupied space.
- a. Glass: Laminated meeting a Performance Condition Level 3B or better.
  - b. Metal Panel: Metal panels backing up the spandrel glass are to be designed for:
    - i. Deformation:  $L/30$
    - ii. Connections: Develop capacity of the metal panels
6. Exterior Appendage Design: Exterior appendages to the window system (i.e. Sun and Wind Screens) shall be connected to their supporting

elements with connections able to develop the component's plastic flexural capacity (using plastic section modulus,  $Z$ )

E. Light-Gage Framing Design: Light-gage framing supporting exterior façade wall and glazing systems shall be dynamically designed as follows:

1. Ductility ( $\mu$ ): Provide a maximum ductility value for the flexural response of  $\mu \leq 2$ .
2. Support Rotation ( $\theta$ ): Provide a maximum support rotation value for the flexural response of  $\theta \leq 3.8$  degrees for simply supported and continuous spans and  $\theta \leq 1.9$  degrees for cantilever elements.
3. Connection: Design connections to develop the plastic flexural capacity of the element.
4. Built-up sections shall be fastened at regular intervals along the length such that the plastic flexural capacity of the composite section can be developed without instability.

F. Non-Load Bearing Wall Sheathing: Composite wall panels, corrugated deck and metal plate façade wall systems shall be dynamically designed for:

1. Deformation:  $L/30$
2. Connection: Develop plastic flexural capacity of the panel.

#### **1.4 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.
  - i. Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- f. Qualification of Welders:
  - i. 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. 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.
- C. Glazing Bite: The required window system bite must be verified in the field.
- D. 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.)

#### 1.5 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. 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.
  4. Calculations: Prepared by a qualified blast consultant.
- D. Calculations: Provide calculations prepared by qualified blast consultant verifying that façade elements 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.
    - e. Blast calculations are to be submitted at the same time as the related shop drawings.
    - f. Calculations for members to support sun screen.
  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 façade window and wall systems. Submit engineering calculations to show that element 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. Window and Wall System (mullion and frame elements): A clear load path to support connections shall be provided. Supporting analysis that illustrates each component's response to design loading shall be provided. Analysis shall consider both flexural and shear responses. Analysis shall verify the element's ability to develop its plastic flexural capacity without instability. Calculations must include, but may not be limited to, analysis of the following
  - i. Global Performance: Analysis shall verify that the plastic moment of the element, 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.
  - ii. Lateral Torsional Buckling: Analysis shall verify the ability of the element to provide adequate resistance against lateral torsional buckling under maximum calculated deflections.
  - iii. Local Buckling: Analysis shall verify the ability of the element and its individual components and connections to provide adequate resistance against localized buckling along the entire load path under maximum calculated deflections.
- c. Structural Silicone: Analysis shall verify the capacity of the silicone to retain the glass under maximum calculated deflections.
- d. Anchorage: Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Analyze the 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.
- e. 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.
- f. 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 design loads from the glazing area.

E. 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. Where normal color variations are anticipated, include 2 or more units in set indicating extreme limits of color variations.

F. Glass:

1. Specified in Section 08 80 00, GLAZING.

G. 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.
  - i. Deflection and structural tests.
  - ii. Water penetration tests.
  - i. Air infiltration tests.
  - ii. Delamination tests.
  - iii. Thermal conductance tests.
  - iv. 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.

H. 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.

I. Manufacturer's Field Reports:

- 1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project. Indicate results of field testing of mockup field panel, and any directions given Contractor for corrective action.
- 2. Certificates: Engineer's qualifications that meet or exceed Quality Assurance criteria. At a minimum, qualifications must list each project in which the Engineer performed analysis of window systems, the effective start and end dates of performance of the analysis, and a reference.

**1.6 TESTING REQUIREMENTS**

1. Testing Requirements:

- a. Testing of façade systems shall include the entire window or wall system, including connections, and shall include but not be limited to the following:
  - i. A minimum of three (3) identical specimens should be tested for the design blast load summarized herein or higher. Those specimens should be similar to the configuration indicated in the project documents with respect to geometry (within 10%), material properties, connections, etc.
  - ii. Test charge construction and the standoff distance from the center of the charge to the exterior face of the test specimen(s) shall be measured and documented for tests using explosives.
  - iii. Blast source construction (compressed gas and/or explosives) shall be measured and documented for shock tube tests.
  - iv. A minimum of two (2) pressure transducers shall be used on each test reaction structure to measure the pressure-time waveform acting on the exterior face of tested specimens. A minimum of one (1) interior pressure transducer shall be used in each test structure.

- b. Where façade window system performance is demonstrated through testing, testing methods shall be in accordance with ASTM F 1642-96.
- c. Test Reports: Evidence of testing in accordance with ASTM F 1642-F methods for dynamic testing shall be submitted in the form of a test report from an independent testing agency. The test report package shall include, but not be limited to, the following:
  - i. Brief description of the test performed and the test apparatus
  - ii. Table of comparison between test specimens windows and project configuration
  - iii. Table of test results by system type/location
  - iv. Summary of recorded air-blast pressure-time history from each pressure transducer
- d. Testing shall be performed by an independent testing agency whose personnel meet or exceed Quality Assurance criteria.

#### **1.7 QUALITY ASSURANCE**

- a. Provide products that meet the requirements of Physical Security Design Manual (PSDM) July 2007, for Veteran Affairs Life Safety Facilities, Final Draft.

#### **1.8 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.

#### **1.9 PROJECT CONDITIONS**

- A. Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

**1.10 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
- 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
- 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
- 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)

M. Physical Security Design Manual, July 2007, for Veterans Affairs Life  
Safety Facilities, Final Draft.

**1.11 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 glass, 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 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 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.
- C. Performance Requirements:
- 1. System shall meet or exceed all performance requirements specified.
  - 2. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:
  - 3. 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 measured in accordance with ASTM E330.
  - 4. 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.
  - 5. 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.

6. 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).
7. Blast Resistance:
  - a. Air-blast loads corresponding to a peak pressure of 4 psi and impulse of 28 psi-msec, and limit deflection to less than L/30. Anchor to resist blast loads and flexural capacity of frame elements. Provide 50 ksi steel channels in vertical mullions to resist implied loads.

## 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. Comply with recommendations of sealant manufacturer for specific sealant selections.
  5. 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.
  6. 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.
  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 manufacture's recommendations.
- I. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.

## **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. Steel sections shall be sized and installed complete within aluminum sections to meet blast criteria and supports for sun screen devices. Steel anchors at slabs, floors and roof shall be designed to resist loads and anchors shall be provided by

this section and embedded in concrete items turned over to General Contractor for installation at locations defined by this Section.

- 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.

#### **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 605.2, high performance coating.
- C. Colors per Section 09 06 00, Schedule for Finishes.

### **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).
- K. 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 windows, 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 FACADE  
FOR LIFE-SAFETY RATED BUILDINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. 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 WORK:**

- A. Cold-Formed Metal Framing: Section 05 40 00
- B. Glazed Aluminum Curtain Walls: Section 08 44 13
- C. Glazing: Section 08 80 00
- D. Hollow Metal Frames: Section 08 11 13
- E. Cast In Place Concrete: section 03 30 00.
- F. Solid Phenolic External Wall Panel System: Section 07 42 00

**1.3 SYSTEM PERFORMANCE:**

- A. Fabricate and install blast resistant façade wall systems including but not limited to curtain wall, and non-load bearing façade wall systems to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, glass retention, and hardware.
- B. In conjunction with meeting aesthetic and performance requirements, the Contractor may propose alternate design methods for consideration.
- C. General: Design exterior façade wall systems to meet the performance requirements for a 'Life-Safety Protected' facility at a minimum dynamic design pressure of 4-psi, considering a 14-msec time duration, in accordance with the Physical Security Design for VA Facilities.
- D. Window System Design: Exterior curtain wall glazing systems shall be designed as follows:
  - 1. Acceptable Glass Response for Blast Resistant Window Systems:  
Glazing is to meet the equivalent of GSA Performance Condition 3B or better. Condition 3B is defined as glazing breaks, glass fragments enter the space, and land on the floor no further than 10

feet (3 meters) from the window.

2. Glass Design: Use WinGARD 5.5.1 or latest to design exterior glass panes to resist ramp-down dynamic air-blast loads corresponding to a peak pressure of 4-psi that linearly decays over a 14-msec time duration.

3. Supporting Structure Design: Design frame members and mullions to the applied blast load over the appropriate effective area of the frame or mullion.

a. Ductility ( $\mu$ ): Provide a maximum ductility value for the flexural response of  $\mu \leq 3$  for steel or aluminum.

b. Support Rotation ( $\theta$ ): Provide a maximum rotation value for the flexural response as follows:

i.  $\theta \leq 3.8$  degrees for structural steel

ii.  $\theta \leq 3$  degrees for aluminum

c. 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.

4. Connection Design:

a. Design connections to the lesser of the following for inbound and rebound loading effects:

i. Design connections to the average glass pane edge shears by distributing the dynamic loads over the perimeter length of the frame.

ii. Reaction forces at a connection joint based on the flexural yield capacity of mullion elements that frame into the joint.

b. 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.

5. Spandrel Panel Design: Analysis shall be performed to determine the response of spandrel glass, panels and/or the back-up wall system. Performance should focus on the limitation of flying debris into occupied space.

- a. Glass: Laminated meeting a Performance Condition Level 3B or better.
- b. Metal Panel: Metal panels backing up the spandrel glass are to be designed for:
  - i. Deformation:  $L/30$
  - ii. Connections: Develop capacity of the metal panels

6. Exterior Appendage Design: Exterior appendages to the window system (i.e. Sun and Wind Screens) shall be connected to their supporting elements with connections able to develop the component's plastic flexural capacity (using plastic section modulus,  $Z$ )

7. Operable windows shall open outwards and respond to air-blast loading by closing shut without causing incipient failure of glazing. Windows shall be continuously supported by a mechanical stop around the perimeter with a capacity to force failure of the glass pane.

E. Light-Gage Framing Design: Light-gage framing supporting exterior façade wall and glazing systems shall be dynamically designed as follows:

- 1. Ductility ( $\mu$ ): Provide a maximum ductility value for the flexural response of  $\mu \leq 2$ .
- 2. Support Rotation ( $\theta$ ): Provide a maximum support rotation value for the flexural response of  $\theta \leq 3.8$  degrees for simply supported and continuous spans and  $\theta \leq 1.9$  degrees for cantilever elements.
- 3. Connection: Design connections to develop the plastic flexural capacity of the element.

4. Built-up sections shall be fastened at regular intervals along the length such that the plastic flexural capacity of the composite section can be developed without instability.

F. Non-Load Bearing Wall Sheathing: Insulated metal panels, corrugated deck, metal plate, and plywood sheathing at exterior face of façade wall systems shall be dynamically designed for:

1. Deformation:  $L/30$

2. Connection: Develop plastic flexural capacity of the panel

#### **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 façade elements meet specific blast resistance requirements detailed in this Section. Consultant shall be hired by General Contractor and all cost associated with Consultant's cost paid by Contractor.

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.
  - e. Blast calculations are to be submitted at the same time as the related shop drawings
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 façade window and wall systems. Submit engineering calculations to show that element 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. Window and Wall System (mullion and frame elements): A clear load path to support connections shall be provided. Supporting analysis that illustrates each component's response to design loading shall be provided. Analysis shall consider both flexural and shear responses. Analysis shall verify the element's ability to develop its plastic flexural capacity without instability. Calculations must include, but may not be limited to, analysis of the following:
    - i. Global Performance: Analysis shall verify that the plastic moment of the element, 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.

- ii. Lateral Torsional Buckling: Analysis shall verify the ability of the element to provide adequate resistance against lateral torsional buckling under maximum calculated deflections.
- iii. Local Buckling: Analysis shall verify the ability of the element and its individual components and connections to provide adequate resistance against localized buckling along the entire load path under maximum calculated deflections.
- a. Structural Silicone: Analysis shall verify the capacity of the silicone to retain the glass under maximum calculated deflections.
- b. Anchorage: Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Analyze the 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.
- c. 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.
- d. 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 design loads from the glazing area.

C. Testing Requirements:

1. Testing of façade systems shall include the entire window or wall system, including connections, and shall include but not be limited to the following:
  - a. A minimum of three (3) identical specimens should be tested for the design blast load summarized herein or higher. Those specimens should be similar to the configuration indicated in the project documents with respect to geometry (within 10%), material properties, connections, etc.
  - b. Test charge construction and the standoff distance from the center of the charge to the exterior face of the test specimen(s) shall be measured and documented for tests using explosives.
  - c. Blast source construction (compressed gas and/or explosives) shall be measured and documented for shock tube tests.
  - d. A minimum of two (2) pressure transducers shall be used on each test reaction structure to measure the pressure-time waveform acting on the exterior face of tested specimens. A minimum of one (1) interior pressure transducer shall be used in each test structure.
2. Where façade window system performance is demonstrated through testing, testing methods shall be in accordance with ASTM F 1642-96.
3. Test Reports: Evidence of testing in accordance with ASTM F 1642-F methods for dynamic testing shall be submitted in the form of a test report from an independent testing agency. The test report package shall include, but not be limited to, the following:
  - a. Brief description of the test performed and the test apparatus
  - b. Table of comparison between test specimens windows and project configuration
  - c. Table of test results by system type/location
  - d. Summary of recorded air-blast pressure-time history from each pressure transducer

4. Testing shall be performed by an independent testing agency whose personnel meet or exceed Quality Assurance criteria.

D. Certificates: Engineer's qualifications that meet or exceed Quality Assurance criteria. At a minimum, qualifications must list each project in which the Engineer performed analysis of window systems, the effective start and end dates of performance of the analysis, and a reference.

#### **1.5 QUALITY ASSURANCE**

- A. Provide products that meet the requirements of Physical Security Design Manual (PSDM) January, 2015, for Veteran Affairs Life Safety Facilities, Final Draft.
- B. 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.
- C. Glazing Bite: The required window system bite must be verified in the field.
- D. 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-05..... Standard Specification for Carbon Structural Steel

ASTM A123/A123M-02..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B221-06..... Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

C. National Association of Architectural Metal Manufacturers (NAAMM) AMP 500-505-88.....Metal Finishes Manual

D. Physical Security Design Manual (PSDM) July 2007, for Veteran Affair Life Safety Facilities, Final Draft.

E. WinGARD Version 5.5.1 or latest

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER/FABRICATOR**

A. 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. The yield strength of framing members may be increased to account for 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: The yield strength may be increased by a factor of 1.02.
    - c. Light Gage Metal: The yield strength may be increased by a factor of 1.33.
  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 200 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.
- 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.

### **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.
- 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 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. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 GENERAL**

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

**1.4 WARRANTY**

- A. The Warranty period shall be two years in lieu of one year for all items except as noted below:
  - 1. Locks, latchsets, and panic hardware: 5 years.
  - 2. Door closers and continuous hinges: 10 years.

### 1.5 MAINTENANCE MANUALS

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

### 1.6 SUBMITTALS

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

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

- C. Samples and Manufacturers' Literature:

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

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

independent laboratory, within four years of submittal of reports for approval.

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

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

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

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

#### **1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Keying: All cylinders shall be keyed into existing 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 Contracting Officer's Representative.

#### 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 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.

## **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: Aluminum.
  - 3. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
  - 4. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
  - 5. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
  - 6. 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 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. 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.

#### **2.4 DOOR STOPS**

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. 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. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

## **2.5 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 seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with 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 shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design. 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.

2. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
3. Lock and latch set for tempered glass balanced doors shall be heavy duty Grade 1, mortised.

C. Exterior Door Security: Exterior hollow metal doors shall have flush latch protection plate (latchguard), for mortise locksets, (76 x 299mm), 3" x 11", steel, US26D.

## 2.6 KEYS

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

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

## 2.7 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. Fabricate door protection kick plates items from vinyl acrylic or polyvinyl chloride resilient material with simulated wood grain to match doors, minimum 1.5 mm (0.060-inch) thick.
  2. Provide kick plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Kick plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E).
  3. 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.

## **2.8 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.

## **2.9 DOOR PULLS - ALUMINUM DOORS**

- A. Interior Aluminum Doors - Conform to ANSI A156.6. Pull Type J401, 152 mm (6 inches) high by 19 mm (3/4 inches) diameter with plate Type J302, 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Provide pull with projection of 70 mm (2 3/4 inches) and a clearance of 51 mm (2 inches). Cut plates of door pull plate for cylinders, or turn pieces where required.
- B. Exterior Aluminum Doors - Thirty degree end cuts (capped ends) on 38 mm (1-1/2 inch) diameter tubular aluminum pull, 72" long.

## **2.10 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 J302 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.

## **2.11 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.

## **2.12 FLUSH BOLTS**

- A. Conform to ANSI 156.3. Type 27, constant latching flush bolts, wood doors, top and bottom bolts, dust proof strikes, 3/4" throw.

## **2.13 THRESHOLDS**

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. 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 fame face.

## **2.14 WEATHERSTRIPS (FOR EXTERIOR DOORS)**

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m³/s/m).

## **2.16 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR SMOKE 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).

## **2.17 SMOKE CONTROL SEALS FOR SMOKE CONTROL DOORS**

- A. Conform to ANSI A156.22. Silicone. Provide jamb and head mounted type. Provide type specific for door construction (wood or metal).

## 2.18 MISCELLANEOUS HARDWARE

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

## 2.19 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.

## 2.20 BASE METALS

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

Finish	Base Metal
652	Steel
626	Brass or bronze



630	Stainless steel
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### PART 3 - EXECUTION

#### 3.1 HARDWARE HEIGHTS

- A. Locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- B. Hardware Heights from Finished Floor:
  - 1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  - 2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  - 3. Deadlocks centerline of strike 1219 mm (48 inches).
  - 4. Centerline of door pulls to be 1016 mm (40 inches).
  - 5. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  - 7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
  - 8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

#### 3.2 INSTALLATION

- A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with 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)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

(hollow core wood doors)		
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- 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.
- B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

HW-1

Each Pair Double Doors to Have:

NON-RATED/INTERIOR ALUMINUM FRAME GLASS

See Section 08 41 13 for balanced door hardware. All door hardware by installer as a total solution including but not limited to: pivots and arms, hidden torsion bar closing system for ADA compliance, mortised office function locksets and corresponding glass mounted door strike, and key cylinder. Smoke seals a smoke barrier doors as scheduled.

HW-2

Each Door to Have:

NON-RATED/EXTERIOR HOLLOW METAL

1 1/2 pair Butt Hinges	
1 Lockset	Storeroom Function
1 Key Cylinder	
1 Electric Strike	
1 Closer	
1 Kick Plate	
1 Overhead Stop	
1 Threshold	
1 Sill Sweep	
1 Weatherstripping	
1 Drip Cap	
1 Latch Guard	
1 Card Reader	
1 Door Position Sensor	

HW-3

Each Door to Have:

NON-RATED/INTERIOR SC WOOD

1 Lockset	Storeroom Function
1 1/2 pair Butt Hinges	
1 Key Cylinder	
1 Closer	
1 Overhead Stop	
1 Kickplate	
1 Smoke Seal	

HW-4

Each Door to Have:

NON-RATED/INTERIOR SC WOOD

- 1 Pull Bar
- 1 Push Plate
- 1 1/2 Pair Butt Hinges
- 1 Closer
- 1 Wall Stop
- 1 Kickplate
- 1 Smoke Seal

HW-5

Each Door to Have:

NON-RATED/INTERIOR SC WOOD

- 1 Lockset Entry Function
- 1 Key Cylinder
- 1 1/2 Pair Butt Hinges
- 1 Closer
- 1 Kick Plate
- 1 Wall Stop
- 1 Smoke Seal

HW-6

Each Door to Have:

NON-RATED/INTERIOR ALUMINUM

- 2 1/2 Pair Butt Hinges
- 2 Lockset Entry Function
- 2 Key Cylinder
- 2 Closers
- 2 Kickplates
- 2 Wall Stops
- 2 Sets Smoke Seals
- Wire and raceway for future card reader and position sensor

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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 and sliding doors.

**1.2 RELATED WORK**

- A. All sections listed in the TOC are a condition of this contract.
- B. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- C. Door hardware; Section 08 71 00, DOOR HARDWARE.
- D. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- E. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.
- F. Section 28 31 00, FIRE DETECTION AND ALARM.
- G. All construction and associated accessories are required to be ligature resistant in resident accessed areas.

**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.
- 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. 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 Contracting Officer's Representative 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 will move the doors from the fully closed to fully opened position in three 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**

- 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. 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.
- 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. At sliding doors, provide two photoelectric beams mounted at heights of 600 mm (24 inches) and 1200 mm (48 inches) in the door frame on sliding doors. Provide overhead safety presence sensors at door head on each side of the opening. Beams shall parallel door openings to prevent doors from closing when anyone is in the center of the door or doors. When beams are activated, doors shall recycle to full open position.

Actuation shall include a motion detector mounted on each side of the door for detection of traffic in each direction.

- C. 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.
- D. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.
- E. 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 Contracting Officer's Representative.

#### **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 the Contracting Officer's Representative.

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**SECTION 08 80 00**

**GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies glass, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 LABELS**

- A. Temporary labels:
1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
  2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
  3. Temporary labels shall remain intact until glass is approved by Contracting Officer's Representative.
- B. Permanent labels:
1. Locate in corner for each pane.
  2. Label in accordance with ANSI Z97.1.
    - a. Tempered glass.
    - b. Organic coated glass.

**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 ASCE 7 and the IBC.
  2. Test in accordance with ASTM E 1300.
  3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

C. Blast Resistant Requirements:

1. Fabricate glass assemblies to meet GSA Performance Condition 3B for Glass Response and WinGARD 5.5.1 for glass design at peak pressure of 4-psi the linearly decays over a 14-msec time duration.
2. Spandrel panel design Level 3B with metal back-up at L/30.
3. Ductility and rotation see Section 08 56 53, BLAST RESISTANT FAÇADE FOR LIFE-SAFETY RATED BUILDINGS.
4. Minimum 1'2" glass bite.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Certificates:
1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
  2. Certificate on shading coefficient.
  3. Certificate on "R" value when value is specified.
- B. 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. Elastic compound for metal sash glazing.
  4. Glazing cushion.
  5. Sealing compound.
  6. Art work for ceramic coated lites
- E. Samples:
1. Size: 150 mm by 150 mm (6 inches by 6 inches).
  2. Tinted glass.
  3. Reflective glass.
  4. Insulated glass.
  5. Ceramic coated glass.
- 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.
- G. Calculations: Prepared by a qualified blast consultant.

#### 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.

#### 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.
  - 3. Laminated glass units to remain laminated for 5 years.

#### 1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
  - C864-05.....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks, and Spacers
  - C920-11.....Elastomeric Joint Sealants
  - C964-07.....Standard Guide for Lock-Strip Gasket Glazing
  - C1036-06.....Flat Glass
  - C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass.
  - C1376-10.....Pyrolytic and Vacuum Deposition Coatings on  
Flat Glass
  - E84-10.....Surface Burning Characteristics of Building  
Materials
  - E119-10.....Standard Test Methods for Fire Test of Building  
Construction and Material

E2190-10.....Insulating Glass Unit

C. Code of Federal Regulations (CFR):

16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010

D. National Fenestration Rating Council (NFRC)

E. Glass Association of North America (GANA):

Glazing Manual (Latest Edition)

Sealant Manual (2009)

F. American Society of Civil Engineers (ASCE):

ASCE 7-10.....Wind Load Provisions

G. Physical Security Design Manual, July 2007, for Veterans Affairs Life Safety Facilities, Final Draft.

H. WinGARD Version 5.5.1 or latest.

## **PART 2 - PRODUCTS**

### **2.1 GLASS**

A. Use thickness stated unless specified otherwise in assemblies.

B. GL-1 - 1-1/8" Laminated Insulating (match existing Lobby building)

1. Thickness, 6 mm (1/4 inch), color, Low E coated, tempered

2. Air space, 13.2 mm (1/2 inch)

3. Thickness, 4.7 mm (3/16 inch), tempered

4. 1.5 mm (0.060 inch) clear thick interlayer PVB

5. Thickness, 4.7 mm (3/16 inch), tempered

C. GL-3 - 1-1/8" Laminated Insulating Spandrel (match existing Lobby building)

1. Thickness, 6 mm (1/4 inch), color, opaque, Low E coated, tempered

2. Air space, 13.2 mm (1/2 inch)

3. Thickness, 4.7 mm (3/16 inch), tempered

4. 1.5 mm (0.060 inch) clear thick interlayer PVB

5. Thickness, 4.7 mm (3/16 inch), tempered

D. GL-4 - 1/2" Ceramic Coated

1. Thickness, 13.2 mm (1/2 inch), color, tempered

2. See drawing for pattern details

3. Provide lites for balanced doors

E. GL-5 - 5/16" monolithic low iron glass with 3Form Seaweed, green, scale B.

F. GL-6 - 1" - 3Form Chroma or approved equal custom formed LED light box with strip controller, renewable matte, light diffusing ghost film, blue color resin. Custom lighting installation.



G. GL-7 - 6 mm (1/4 inch), laminated tempered glass

## **2.2 HEAT-TREATED GLASS**

A. Clear Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch) and as indicated.

## **2.3 COATED GLASS**

A. Spandrel Glass:

1. ASTM C1048, Kind HS, Condition B, Type I.
2. Thickness, 6 mm (1/4 inch).

B. Low-E Tempered Glass:

1. ASTM C1048, Kind FT, 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.

C. Ceramic Coated Vision Glass:

1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with ceramic coating applied by silk-screen process.
2. Pattern as indicated in drawings.
3. Apply coating to second surface of insulating laminated glass units.
4. Thickness, 6 mm (1/4 inch).

D. Ceramic Coated Spandrel Glass:

1. ASTM C1048, Kind FT, Condition B, Type I, Class 1, Quality q3 with ceramic coating applied over and fused into glass surface.
2. Pattern as indicated in drawings.
3. Apply coating to second surface.
4. Thickness, 6 mm (1/4 inch).

## **2.4 LAMINATED GLASS**

A. Two or more lites of glass bonded with an interlayer material for use in building glazing

B. Colored Interlayer:

1. Use color interlayer ultraviolet light color stabilization.
2. The interlayer assembly shall have uniform color presenting same appearance as tinted glass assembly.

C. Use 1.5 mm (0.060 inch) thick interlayer for:

1. Heat strengthened or fully tempered glass assemblies.

D. Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing where 1.5 mm (0.060 inch) interlayer is not otherwise shown or required.

## **2.5 LAMINATED GLAZING ASSEMBLIES**

### **A. Tinted Tempered Glazing:**

1. Exterior pane ASTM C1036, Type I, Class 3, Quality q3, 6 mm (1/4 inch) thick.
2. Interior pane ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 6 mm (1/4 inch) thick.

### **B. Tempered Obscure Glazing:**

1. One pane ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 6 mm (1/4 inch) thick.
2. One pane ASTM C1048, Kind FT, Type II, Class 1, Form 3, Quality q8, Finish f1, Pattern, 6 mm (1/4 inch) thick.

## **2.6 INSULATING GLASS UNITS**

A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.

B. Assemble units using glass types specified.

## **2.7 GLAZING ACCESSORIES**

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work 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 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.
- F. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- H. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
  2. Class 25
  3. Grade NS.
  4. Shore A hardness of 25 to 30 Durometer.
  5. Minimum 200 psi in tension.
- I. 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.

## **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. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Patterned Glass:
  - 1. Install units with one patterned surface with smooth surface on the weather side.
  - 2. Install units in interior partitions with pattern on corridor side and in same direction in all openings.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- H. 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.

### **3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing tape or 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 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Contracting Officer's Representative.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

### **3.6 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### **3.7 GLAZING SCHEDULE**

- A. 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 unless otherwise indicated or specified.
- B. Insulating Glass:
  1. Install SEU clear tempered glass in interior pane of dual glazed windows, storefronts, and sidelights.
  2. Install SEU Low-e tempered in exterior pane of dual glazed windows, storefronts, and sidelights.

C. Pattern Glass (obscure):

1. Use tempered patterned glass where shown.

- - - E N D - - -

**SECTION 09 06 00**  
**SCHEDULE FOR FINISHES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.
- B. See Drawings for abbreviations used on room finish schedule and within individual specification Sections.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 MANUFACTURERS**

- A. All trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by Contracting Officer for finish requirements.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Provide quadruplicate samples for color approval of materials and finishes specified in this section.

**1.5 APPLICATION PUBLICATIONS**

- A. The publications listed in each Section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation within each Section.

**PART 2 - PRODUCTS**

**2.1 PRODUCT FINISHES**

- A. The finishes for the products listed in each Section are defined as follows:

**DIVISION 5 - METALS**

**05 12 00 Structural and Miscellaneous Metal**

Exposed Framing:	PT2
Interior Exposed Miscellaneous Framing:	PT2
Interior Counter Supports:	PT2

Exterior Metal Stairs:	Galvanized
<b>05 31 00 Metal Decking</b>	
Exposed Deck:	PT2

**DIVISION 6 - WOOD AND PLASTIC**

<b>06 10 00 Rough and Finish Carpentry</b>	
Interior Wall Panels - WD-1:	T&G Select Cherry, 6" wide Stain ST1
Interior Exposed Trim:	Select Hardwood Cherry, Stain ST1
<b>06 41 00 Millwork</b>	
PL-1 Millwork tops (copy areas)	Wilsonart, 4170-60, Beige Pampas
PL-2 Millwork faces (copy)	Natural Veneer, Maple
PL-3 Millwork faces (island, coffee)	Natural Veneer, Prensa Rio Fino Walnut
S-1 Cultured Stone Surface(island,coffee):	Ceasarstone Quartz Surfaces, 4600, Organic White
S-2 Cultured Stone Surface (toilets):	Ortstone, QC 31008, Cappuccino with Corian Rice Paper Solid Surface Lavatory
Loop Pulls:	626 Brushed Chrome
Locks:	626 Brushed Chrome

**DIVISION 7 - THERMAL MOISTURE PROTECTION**

<b>07 42 00 Solid Phenolic Exterior Wall Panels</b>	
Color - WP1:	Trespa, Uni Color, Ocean Gray
Color - WP2:	Trespa, Wood Decors, NW19 Dark Mahogany
Color - WP3:	
<b>07 60 00 Flashing &amp; Sheet Metal</b>	
Metal Gravel Stop:	Mill or Finish per Architect
Copings:	Match adjacent wall panel
Flashings & Counterflashings:	Mill or Finish per Architect selection
<b>07 40 00 Siding Panels (screen wall)</b>	MBCI Perma Clad - 36" coverage, 9" O.C. rib span, 5/8" rib height, 26 gauge, color TBD
Interior Ceiling Panels	¾" perforated corrugate aluminum sheet, staggered round holes, three



sizes, varies, 22 gauge, 37%  
perforated with acoustical batt,  
pre-painted premium color per  
Architect color selection.

**07 92 00 Sealants and Caulking**

Color: To match adjacent surfaces

**07 95 13 Expansion Joint Cover Assemblies**

Floor Expansion Joint - exposed  
Floor Expansion Joint - concealed  
Wall Expansion Joint Interior  
Wall Expansion Joint Exterior  
Ceiling Expansion Joint  
Roof to Wall Expansion Joint

**DIVISION 8 - DOORS AND WINDOWS**

**08 11 13 Hollow Metal Doors and Frames**

Color: Refer to Door Schedule for Paint  
Color Distribution

**08 14 00 Interior Wood Doors**

Stain: Select Maple - ST1 - Natural  
Maple

**08 41 13 Aluminum Entrances and Storefronts**

Framing Color: Painted - Grey per Architect selection  
Hardware Color: 626, Brushed Chrome

**08 44 13 Glazed Aluminum Curtainwall**

Framing Color: Painted - Grey per Architect selection

**08 71 00 Hardware and Weatherstripping**

Locksets and Closers: 626, Brushed Chrome  
Hinges: 626, Brushed Chrome  
Weatherstripping: Field paint to match frames

**08 80 00 Glass and Glazing**

GL1 - Exterior Color - Tempered Insulated  
GL3 - Exterior Spandrel Color - Tempered Insulated  
GL4 - Interior Tempered Sand Blast Digital Custom Image and  
Color - 1/2" Tempered  
GL5 - Pressed Tempered 3Form - Organics Seaweed  
GL6 - 3Form Light Box Color - Chroma Surf Blue + ghost  
GL7 - 1/4" Tempered Laminated Tempered Glass

**DIVISION 9 - FINISHES**

**09 30 13 Porcelain Tiling**

CT1	(toilet floor)	Daltile, Pietre Jura, Multicolor Porcelain, P066, 24" x 24"
CT2	(toilet wall)	Daltile, Gesso Matte, Glazed Ceramic, 12" x 24"
CT3	(toilet accent)	Daltile, CW22, 5 colors, 12x18 per architect selection and distribution
CT4	(floor tile, coffee)	Crossville, Sidecar, 6" x 36"
CT5	(drinking fountain wall)	Daltile, Mate Paramount White MY67
GRT 1, 2, 3		Per Architect's selection

**09 51 00 Acoustical Tile Ceiling System**

AT2.		Armstrong Cirrus Angled Tegular, 24" x 24" x 7/8" Color: White finish. NCR 0.70
AT5:		Linwood Linear, Suspended T & G Wood Planks, butt joints, 6" wide x 3/4" deep, Natural Maple
AT6:		Whisper Cloud, Ceiling Clouds, Fabric Carnegie, Criation Baumann-Rialto, Color:201
AT7:		Whisper Cloud, Ceiling Clouds by Innovasia, Fabric Carnegie, Criation Baumann-Porto, Color:219
Type 1.	Exposed Grid:	Armstrong Prelude XL 15/16" Color: Standard White

**09 65 13 Resilient Base and Accessories**

RF1		Mannington, Colorfields, 884, Cumulus, 24" x 24"
RB1		Armstrong, 29, Moonrock, 6" high
Rt-2		Johnsonite, Excelon SDT, 51950 Marble Beige

**09 67 23 Epoxy Terrazzo**

TER1		White - Similar to NTMA EP3-73 w/10% Pearl aggregate
TER2		Grey - Similar to NTMA EP4-84 w/10% Pearl aggregate
TER3		Grey/Black - Similar to NTMA EP4-80 w/10% Pearl aggregate & 10% recycled chips

**09 68 00     Carpeting**

CPT1	Tandus, Cypher, 04074, Warm Front, 39304, 24" x 24"
CPT2	Shaw, Kasuri Tile, Style No.:5T046, Color name: Galvanized, Color No. 92515, 24" x 24"

**09 90 00     Painting**

PT1	TBD
PT2	TBD
PT3	TBD
PT4	TBD
PT5	TBD
PT6	TBD
PT7	TBD

**DIVISION 10 - SPECIALTIES**

**10 14 00     Interior Signs**

Color:	See drawings AS803 & AS804 and VA Palo Alto Standards
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**10 21 13     Toilet Compartments**

Color:	Hadrian Solid Plastic, 219 Frost Granite
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**10 26 00     Wall Protection**

Corner Guard	Pawling, Flush Mounted, color TBD
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**10 28 00     Toilet Accessories**

Accessories	No. 4 Stainless Steel Satin Finish
Mirror	30" x 42" Channel Framed Mirror
Grab Bar	Stainless Steel

VA Provided Toilet Accessories - Contractor Installed

Toilet Paper Dispenser  
Paper Towel Dispenser  
Soap Dispenser - Liquid  
Soap Dispenser - Powder  
Toilet Seat Cover Dispenser  
Baby Change Station  
Infant Seats  
Sanitary Napkin Dispenser

Sanitary Napkin Disposal

**10 44 13 Fire Extinguisher Cabinets**

Finish: Larsen, Architectural Series,  
Vertical Duo, #4 Stainless Steel

**DIVISION 12 - FURNISHINGS**

**12 24 00 Blinds**

Roller Shades	Mecho Shades, Phifer Shear Weave 4000 fabric, ECO/Granite with aluminum fascia, 5% open, 3% open.
Black-out Shades	Mecho Shade, Midnite Blackout, 0200 Series, Opaque, Silver 0105

**12 52 19.13 Upholstered Cushion Wall Covering**

WC-1	Carnegie: Buff, 6518, 42(caramel)
WC-2	Carnegie: Buff, 6518, 48(gray)

**2.2 GENERAL NOTES**

- A. See Architectural Finishes Schedule, specifications and interior elevations for additional finishes information.
- B. Paint exposed interior columns, beams and miscellaneous steel per Architect color selection.
- C. Paint exposed soffits and gypsum board ceilings per Architect color selection.
- D. Prime painted, exposed structural, exposed metal deck, and miscellaneous metals to be painted per Architect selection.
- E. Paint electrical and communications equipment rooms prior to and after installation of equipment. Paint all exposed metals, conduits and other parts for finished appearance.
- F. Paint exposed electrical and communications equipment, piping, conduit, duct and other equipment. Paint all exposed metals, conduits and other parts for finished appearance.
- G. Prepare backing and install VA supplied toilet accessories.
- H. Install signage at locations per VA COR instructions.
- I. Prepare, sand, fill, prime and paint interior structural steel cross bracing and structural steel plates colors(s) as directed by Architect.

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See sheets SS301 and SS302 and structural sheets for additional information.

**PART 3 - EXECUTION**

NOT USED

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**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel studs wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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: The underside of structure overhead shall be the underside of the roof/floor construction supported by beams.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturer's Literature and Data:
  - 1. Studs, runners and accessories.
  - 2. Furring channels.
  - 3. 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, access panels and corner details.
  - 3. Typical support for external attachments

**1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- A. 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

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

E580-09.....Application of Ceiling Suspension Systems for  
Acoustical Tile and Lay-in Panels in Areas  
Requiring Moderate Seismic Restraint.

C. Physical Security Design Manual, July 2007, for Veterans Affairs Life  
Safety Facilities, Final Draft.

**PART 2 - PRODUCTS**

**2.1 PROTECTIVE COATING**

A. Galvanize steel studs, runners (track), rigid (hat section) furring  
channels, "Z" shaped furring channels, and resilient furring channels,  
with coating designation of G-60, per ASTM A123.

**2.2 STEEL STUDS AND RUNNERS (TRACK)**

A. ASTM C645, modified for thickness specified and sizes as shown.

1. Use ASTM A653 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 as shown.

D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

**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. 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.
- C. 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.
- D. 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.
- E. Tie Wire and Hanger Wire:
  1. ASTM A641, soft temper, Class 1 coating.
  2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- F. Attachments for Wall Furring:
  1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
  2. For concrete 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.

**PART 3 - EXECUTION**

**3.1 INSTALLING STUDS**

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8 inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

- D. Where studs are shown to terminate above suspended ceilings, extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead.
- F. Frame jambs of openings as shown.
- G. Fasten studs as shown.
- H. Form building expansion joints as shown.

### **3.2 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 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.

### **3.3 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, heating fixtures, access panel frames, wall bumpers, 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.

Including locations for future VA supplied and installed accessories and equipment such as; toilet accessories, caulk boards, projection screens and similar.

### **3.4 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS**

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
  - 1. Space framing at 600 mm (24 inch) centers for gypsum board anchorage.
- B. Use clips, bolts, or wire ties for direct attachment to steel framing.
- C. Existing concrete construction exposed:
  - 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.
- D. Do not fasten to steel decking.
- E. Construct and install ceiling bracing system as shown and in accordance with ASTM E580.

### **3.5 TOLERANCES**

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8 inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8 inch.)
- C. Level or align ceilings within 3 mm (1/8 inch.)

- - - E N D - - -



**SECTION 09 29 00**

**GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies installation and finishing of gypsum board and gypsum sheathing.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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. Cornerbead and edge trim.
  - 2. Finishing materials.
  - 3. Laminating adhesive.
  - 4. Gypsum board and sheathing, 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.

**1.4 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- A. In accordance with the requirements of ASTM C840.

**1.5 ENVIRONMENTAL CONDITIONS**

- A. In accordance with the requirements of ASTM C840.

**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):
  - 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
C1047-05.....	Accessories for Gypsum Wallboard and Gypsum Veneer Base
C1177-06.....	Glass Mat Gypsum Substrate for Use as Sheathing
C1658-06.....	Glass Mat Gypsum Panels
C1396-06.....	Gypsum Board
E84-08.....	Surface Burning Characteristics of Building Materials

## **PART 2 - PRODUCTS**

### **2.1 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. 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.

### **2.2 GYPSUM SHEATHING**

- A. ASTM C1177/ C1177M, water-resistant core, 16 mm (5/8 inch) thick.

### **2.3 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

### **2.4 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

### **2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE**

- A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

## **PART 3 - EXECUTION**

### **3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:

1. Two sides of partitions:
    - a. Fire rated partitions.
    - b. Smoke partitions.
    - c. Sound rated partitions.
  2. One side of partitions or furring:
    - a. Inside of exterior wall furring or stud construction.
    - b. Room side of room without suspended ceilings.
    - c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
  3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
  2. At ceiling of suspended gypsum board ceilings.
  3. At existing ceilings.

### **3.2 INSTALLING GYPSUM BOARD**

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- D. 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. No offset in exposed face of walls and partitions will be permitted because of single-ply application requirements.
  6. 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.
- E. Electrical and Telecommunications Boxes: Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- F. 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. Install for complete coverage of metal studs as shown. Install within wall cavities to blocking to create smoke barriers as 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.
  - 1. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.



- F. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum sheathing.

#### **3.4 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
  - 1. Gypsum board is fastened and held close to framing or furring.
  - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

#### **3.5 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide STC equivalent to the sound rated construction.

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**SECTION 09 30 13**

**PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies ceramic, porcelain and tile backer board.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Base tile, each type, each color, each size.
  2. Porcelain tile, each type, color, patterns and size.
  3. Wall (or wainscot) tile, each color, size and pattern.
  4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
1. Porcelain tile, marked to show each type, size, and shape required.
  2. Chemical resistant mortar and grout (Epoxy and Furan).
  3. Cementitious backer unit.
  4. Leveling compound.
  5. Organic adhesive.
  6. Slip resistant tile.
  7. Fasteners.
- D. Certification:
1. Master grade, ANSI A137.1.
  2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
    - a. Chemical resistant mortar and grout (epoxy and furan).
    - b. Modified epoxy emulsion.
    - c. Cementitious backer unit.
    - d. Leveling compound.
    - e. Organic adhesive.
  3. List of successful in-service performance locations.

#### 1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):  
A137.1-08.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):  
C109/C109M-11.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)  
C627-10.....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester  
C954-11.....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness  
C979-10.....Pigments for Integrally Colored Concrete  
C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method  
C1178/C1178M-11.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel  
C1325-08.....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
- D. Tile Council of America, Inc. (TCA):  
2007.....Handbook for Ceramic Tile Installation

### PART 2 - PRODUCTS

#### 2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
  - 1. Tile type, manufacturer, color, size and finish per Section 09 06 00, Schedule for Finishes.
  - 2. Inspection procedures listed under the Appendix of ANSI A137.1.
  - 3. Abrasion Resistance Classification:
    - a. Tested in accordance with values listed in Table 1, ASTM C 1027.

- b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
- c. Class IV, 6000 revolutions for remaining areas.
- 4. Slip Resistant Tile for Floors:
  - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
    - 1) Not less than 0.7 (wet condition) for bathing areas.
    - 2) Not less than 0.8 on ramps for wet and dry conditions.
    - 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
  - b. Tile Having Abrasive Grains:
    - 1. Unglazed Ceramic Tile: Abrasive grains throughout body of the tile.
    - 2. Quarry Tile: Abrasive grains uniformly embedded in face at rate of approximately 7.5 percent of surface area.
- 5. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- 6. Factory-Applied Temporary Protective Coating:
  - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
  - b. Do not coat unexposed tile surfaces.
- B. Unglazed Ceramic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.
- C. Glazed Wall Tile: Cushion edges, glazing.
- D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds.

## **2.2 FASTENERS**

- A. Screws for Cementitious Backer Units.
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
  - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

### **2.3 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Organic Adhesives: ANSI A108.1, Type 1.
- C. Chemical-Resistant Bond Coat:
  - 1. Epoxy Resin Type: ANSI A108.1.
  - 2. Furan Resin Type: ANSI A108.1.
- D. Edge Strips:
  - 1. Aluminum edge of tile strips at door frames and other wall penetrations.
  - 2. Furan Resin Type: ANSI A108.1.

### **2.4 GROUTING MATERIALS**

- A. Coloring Pigments:
  - 1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  - 2. Add coloring pigments to grout by the manufacturer.
  - 3. Job colored grout is not acceptable.
  - 4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- B. White Portland Cement Grout:
  - 1. ANSI A108.1.
  - 2. Use one part white Portland cement to one part white sand passing a number 30 screen.
  - 3. Color additive not permitted.
- C. Commercial Portland Cement Grout: ANSI A108.1 color as specified.
- D. Latex-Portland Cement Grout: ANSI A108.1 color as specified.
  - 1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
  - 2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.
- E. Chemical-Resistant Grout:
  - 1. Epoxy grout, ANSI A108.1.
  - 2. Furan grout, ANSI A108.1.

### **2.5 PATCHING AND LEVELING COMPOUND**

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
  - 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
  - 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
  - 3. Tensile strength - 600 psi per ANSI 118.7.
  - 4. Density - 1.9.

- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

## **2.6 CLEANING COMPOUNDS**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

## **2.7 WATERPROOFING MEMBRANE**

- A. Compatible with mortar and tile materials. High density polyethylene (HDP), 3mm thick, waterproofing membrane.
- B. System accessories, performed corners, sealants and sealing tapes.

# **PART 3 - EXECUTION**

## **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

## **3.2 ALLOWABLE TOLERANCE**

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
  - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
  - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:

1. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

### **3.3 SURFACE PREPARATION**

#### **A. Cleaning Concrete or Masonry:**

1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

#### **B. Patching and Leveling:**

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
  - a. Thickness of compound as required to bring finish tile system to level finish at walls and elevation as shown at floors.
  - b. Float finish.
  - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

#### **C. Additional preparation of concrete floors for tile set with epoxy, or furan-resin shall be in accordance with the manufacturer's printed instructions.**

#### **D. Walls:**

1. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

### **3.4 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD**

- #### **A. Install in accordance with manufacturer's instructions. TCA Systems W245-01.**



- B. Treat joints with tape and latex-Portland cement mortar or adhesive.

### **3.5 PORCELAIN TILE - GENERAL**

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines:
- C. Install waterproofing membrane per manufacturers written instructions at toilet room locations beneath tile flooring at second floor.
- C. Installing Mortar Beds for Floors:
  - 1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
  - 2. Install floor mortar bed reinforcing centered in mortar fill.
  - 3. Screed finish to level plane or slope to drains where shown, float finish.
  - 4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
  - 5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.
  - 6. Install perimeter aluminum trips at edges of tile fields.
- D. Workmanship:
  - 1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
  - 2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
  - 3. Form intersections and returns accurately.
  - 4. Cut and drill tile neatly without marring surface.
  - 5. Cut edges of tile abutting penetrations, finish, or built-in items:
    - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
    - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
  - 6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
  - 7. Remove and reset tiles that are out of plane or misaligned.
  - 8. Floors:

- a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
  - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
  - c. In areas where floor drains occur, slope to drains where shown.
  - d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
- a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
  - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
  - c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.
  - d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
  - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
  - c. Make joints in quarry tile work 6 mm (1/4 inch) wide. Finish joints flush with surface of tile.
  - d. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
- a. Tile installed with chemical-resistant mortars and grouts.
  - b. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).

### **3.6 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR**

- A. Due to the denseness of porcelain tile use latex Portland cement bonding mortar that meets the requirements of ANSI A108.1. Bonding mortars shall be mixed in accordance with manufacturer's instructions. Improper liquid ratios and dwell time before placement of bonding mortar and tile shall affect bond.

### **3.7 GROUTING**

#### **A. Grout Type and Location:**

1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile dry-set grout, or commercial Portland cement grout.
2. Grout for quarry tile floor and base:
  - a. Grout for Kitchens:
    - 1) Chemical-resistant grout as specified and recommended by manufacturer of bond coat.
    - 2) Use only furan resin grout within 600 mm (2 feet) of ovens, steam kettles, water heaters, steam pipes, and prep and serving areas.
    - 3) Epoxy grout designed for equivalent heat resistance to furan resin grout may be used for furan resin grout.

#### **B. Workmanship:**

1. Install and cure grout in accordance with the applicable standard.
2. Portland Cement grout: ANSI A108.1.
3. Epoxy Grout: ANSI A108.1.
4. Furan and Commercial Portland Cement Grout: ANSI A108.1 and in accordance with the manufacturer's printed instructions.
5. Dry-set grout: ANSI A108.1.

### **3.8 CLEANING**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

### **3.9 PROTECTION**

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

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**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**PART 1- GENERAL**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.
- C. Suspended corrugated sheets with acoustic backers.
- D. Seismic Restraint.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation
  - 2. Acoustical units, each type
- C. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**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):
  - 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
  - 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
  - E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
  - E1264-(R2005).....Classification for Acoustical Ceiling Products

**PART 2- PRODUCTS**

**2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system.
  - 1. Ceiling suspension system members fabricated from galvanized cold-rolled steel, bonderized.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- 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.

**2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

**2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

**2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
  - 1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
  - 2. Flush ceiling insert type:
    - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
    - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
    - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:

1. Galvanized steel.
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

D. Tile Splines: ASTM C635.

## 2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

## 2.6 ADHESIVE

- A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.
- B. Developing minimum strength of 7 kg/m<sup>2</sup> (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

## 2.7 ACOUSTICAL UNITS

- A. General:
  1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
  2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
  3. Class A Flame Spread: ASTM 84
  4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
  5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
  6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise.
  7. Lay-in panels: Sizes as shown, with square edges.
  8. Tile type, size, color and manufacturer per Section 09 06 00, Schedule for Finishes.

## **2.7 ACOUSTICAL UNITS**

### **A. General:**

1. Meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
2. Design and geometric shape per drawings.
3. Class A Flame Spread: ASTM 84
4. Hanging cables and cable supports.
8. Tile and fabric type, size, color and manufacturer per Section 09 06 00, Schedule for Finishes.

## **2.7 SUSPENDED STEEL SHEETS**

### **A. See Schedule of Finishes for materials.**

## **PART 3 EXECUTION**

### **3.1 CEILING TREATMENT**

- A. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- B. Moldings:
  1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
- C. Perimeter Seal:
  1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.

### **3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

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

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.



8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structural joists overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems.

C. 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. Tile in concealed grid upward access suspension system:
  1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
  2. Make corners and arises full, and without worn or broken places.

**3.4 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 or rubber base.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 manufacturer's recommendations for adhesives.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Base: 150 mm (6 inches) long, each type and color.

**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):
  - F1861-08.....Resilient Wall Base

**PART 2 - PRODUCTS**

**2.1 GENERAL**

Use only products by the same manufacturer and from the same production run.

## **2.2 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Thermoplastics, Group 2-layered. Style B-cove.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

## **2.3 PRIMER (FOR CONCRETE FLOORS)**

As recommended by the adhesive and tile manufacturer.

## **2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

Provide products with latex or polyvinyl acetate resins in the mix.

## **2.5 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° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°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 Contracting Officer's Representative.
- B. Submit proposed installation deviation from this specification to the Contracting Officer's Representative indicating the differences in the method of installation.
- C. The Contracting Officer's Representative 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, lockers, laboratory, pharmacy furniture island cabinets 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 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.

- D. 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 19**  
**RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the installation of solid vinyl tile flooring, vinyl composition tile flooring, rubber tile flooring, and accessories.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 300 mm (12 inches by 12 inches) for each type, pattern and color.
  - 2. Edge Strips: 150 mm (6 inches) long, each type.
  - 3. Feature Strips: 150 mm (6 inches) long.
- D. Shop Drawings:
  - 1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 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
  - F1066-04 (R2010).....Vinyl Composition Floor Tile
  - F1344-10.....Rubber Floor Tile
  - F1700-04 (R2010).....Solid Vinyl 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

## 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 E 648.
- D. Smoke density: Less than 450 per ASTM E662.
- Resilient Flooring Schedule:
1. SVT1(resident room)Mannington, Nature Paths, Dissolve Fade 12321, 18"  
x 36"



2. SVT2(circulation)Mannington, Nature Paths, Dissolve Recede, 12327, 18" x 36"
3. SVT3(kitchen/seating)Mannington, Nature Paths, Dissolve Scatter, 12329, 18" x 36"

## **2.2 VINYL COMPOSITION TILE**

- A. ASTM F1066, Composition 1, Class I (solid color) or Class 2 (through pattern) as scheduled, 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout thickness.

## **2.3 SOLID VINYL-TILE**

- A. ASTM F1700, 300 mm (12 by 12 inches) square, 3 mm (1/8 inch) thick, homogenous throughout.
- B. Color and Pattern uniformly distributed throughout thickness.
- C. Where solid vinyl tiles are specified, seek products with recycled content.

## **2.4 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.

## **2.5 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive and tile manufacturer.

## **2.6 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.

## **2.7 POLISH AND CLEANERS**

- A. Cleaners RFCI CL-1.
- B. Polish: ASTM D4078.

## **2.8 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. Extruded aluminum, mill finish, mechanically cleaned:
  1. Drill and counter sink edge strip for flat head screws.
  2. Space holes near ends and approximately 225 mm (9 inches) on center between.
- D. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

## **2.9 SCREWS**

Stainless steel flat head screw.

## **PART 3 - EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °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.

### **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 67 23.50**  
**EPOXY TERRAZZO FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies epoxy terrazzo flooring systems with integral cove base and precast terrazzo stair units.
- B. Resinous (Epoxy Terrazzo) Flooring Systems:
  - 1. Thinset Epoxy or Urethane Matrix Terrazzo.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product to be provided.
  - 2. Application and installation instructions.
  - 3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
  - 1. Product data for products having recycled content, submit documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
    - a. Include statements indicating costs for each product having recycled content.
  - 2. Product data for field applied adhesives, include printed statement of VOC content indicating compliance with environmental requirements.
- E. Samples:
  - 1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project. Provide one sample on either side of the color range selected (one darker, one lighter).
  - 3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.

- 4. Accessories: (6 inches) 152 mm long sample of exposed strip item.
- F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
  - 1. Patterns.
  - 2. Edge configuration.
  - 3. Divider strips.
  - 4. Control-joint strips.
  - 5. Accessory strips.
  - 6. Abrasive strips.
  - 7. Stair treads, risers, and landings.
- G. Certifications and Approvals:
  - 1. Manufacturer's certification of material and substrata compliance with specification.
  - 2. Manufacturer's approval of installer.
  - 3. Contractor's certificate of compliance with Quality Assurance requirements.
- H. Warranty: As specified in this section.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of five years.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of 5 years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
  - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
  - 2. Contractor shall have completed at least 10 projects of similar size and complexity. Include list of at least 5 projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
  - 3. Installer's Personnel: Employ persons trained for application of specified product.
- C. Source Limitations:
  - 1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
  - 2. Provide secondary materials, including marble chips, aggregate, strips, patching and fill material, joint sealant, and repair

- material of type and from source recommended by manufacturer of primary materials.
3. Obtain marble chips color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.
  4. Material furnished shall meet NTMA Specifications.
- D. NTMA Standards: Comply with NTMA's "Terrazzo Specification and Design Guide" and written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and establish quality standards for materials and execution.
1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by VA Resident Engineer.
    - a. Include 48 inch (1200 mm) length of integral cove base.
  2. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.
  3. Sign off from VA Resident Engineer on texture must be complete before installation of flooring system.
- F. Pre-Installation Conference:
1. Convene a meeting not less than thirty days prior to starting work.
  2. Attendance:
    - a. Contractor
    - b. VA Resident Engineer
    - c. Manufacturer and Installer's Representative
  3. Review the following:
    - a. Environmental requirements
      - 1) Air and surface temperature
      - 2) Relative humidity
      - 3) Ventilation
      - 4) Dust and contaminants
    - b. Protection of surfaces not scheduled to be coated
    - c. Inspect and discuss condition of substrate and other preparatory work performed
    - d. Review and verify availability of material; installer's personnel, equipment needed
    - e. Design and patterns and edge conditions.
    - f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy terrazzo) flooring system
    - g. Application and repair
    - h. Field quality control

- i. Cleaning
  - j. Protection of coating systems
  - k. One-year inspection and maintenance
  - l. Coordination with other work
- G. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.
- H. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the terrazzo installation. The Contractor shall maintain these records for one year after Substantial Completion.

#### **1.5 MATERIAL PACKAGING DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.

#### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
  - 1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.



### 1.7 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

### 1.8 APPLICABLE PUBLICATIONS

- A. The 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. ACI (American Concrete Institute):  
Comm. 503.1-92(2010)....Four Epoxy Specifications (Reapproved 2003).
- C. American Society for Testing and Materials (ASTM):  
B221-13.....Standard Specification for Aluminum and Aluminum Alloy  
C92-95(2010).....Standard Test Methods for Sieve Analysis and Water Content  
C109-12.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2" or 50 mm Cube Specimens)  
C190-85.....Method of Test for Tensile Strength of Hydraulic Cement Mortars (Withdrawn 1990)  
C307-03(2012).....Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing  
C413-01(2012).....Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes  
C531-00(2012).....Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes  
C579-01(2012).....Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

C580-02(2012).....Standard Test Method for Flexural Strength and  
Modulus of Elasticity of Chemical-Resistant  
Mortars, Grouts, Monolithic Surfacing, and  
Polymer Concretes

C722-04(2012).....Standard Specification for Chemical-Resistant  
Monolithic Floor Surfacing

C811-98(2008).....Standard Practice for Surface Preparation of  
Concrete for Application of Chemical-Resistant  
Resin Monolithic Surfacing

D56-05(2010).....Standard Test Method for Flash Point by Tag  
Closed Cup Tester

D635-10.....Standard Test Method for Rate of Burning and/or  
Extent and Time of Burning of Plastics in a  
Horizontal Position

D638-10.....Standard Test Method for Tensile Properties of  
Plastics

D695-10.....Standard Test Method for Compressive Properties  
of Rigid Plastics

D696-08.....Standard Test Method for Coefficient of Linear  
Thermal Expansion of Plastics Between -30°C and  
30°C With a Vitreous Silica Dilatometer

D790-10.....Standard Test Methods for Flexural Properties

D2240-05(2010).....Standard Test Method for Rubber Property –  
Durometer Hardness

D3108-13.....Standard Test Method for Coefficient of Friction

D3960-05.....Standard Practice for Determining Volatile  
Organic Compound

D4060-10.....Standard Test Method for Abrasion Resistance of  
Organic Coatings by the Taber Abraser

D4541-09.....Standard Test Method for Pull off Strength  
Coatings

E162-13.....Standard Test Method for Surface Flammability of  
Using a Radiant Heat Energy Source

E648-10.....Standard Test Method for Critical Radiant Flux  
of Floor- Covering Systems Using a Radiant Heat  
Energy Source

F1679-04.....Standard Test Method for Using Variable  
Incidence Tribometer

F1869-11.....Standard Test Method for Measuring Moisture  
Vapor Emission Rate of Concrete Subfloor Using  
Anhydrous Calcium Chloride

- F2170-11.....Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- G21-09.....Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- D. Military Specification (Mil Spec): Deck Covering Underlay Materials
- MIL-PRF-3135.....Para. 3.6, Resistance to Elevated Temperature  
Para. 3.15, Impact Resistance  
Para. 4.7.3, Indentation Resistance  
Para. 4.7.3, Indentation, No Cracking or Loss of Bond Water Absorption  
Para. 4.7.4.2.1, Indentation under Steadily Applied Load  
Para. 4.7.5.1, Resistance to Elevated Temperatures  
Para. 4.7.8, Water Absorption  
Para. 4.7.14, Adhesion
- MIL-D-3134F.....Deck Covering Material
- MIL-STD-810E.....Environmental Requirements and Related Test Methods
- E. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 501.....Finishes for Aluminum
- F. National Terrazzo and Mosaic Association, Inc. (NTMA).  
"Terrazzo Specifications and Design Guide"  
"Terrazzo Color Palette"
- G. Terrazzo, Tile and Marble Association of Canada. (TTMAC).
- H. Underwriters Laboratories (UL):  
UL 410.....Slip Resistance of Floor Surface Materials

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION FOR RESINOUS (EPOXY TERRAZZO) FLOORING**

- A. System Descriptions:
1. Monolithic, multi-layer, trowel applied multi-component epoxy urethane terrazzo and integral cove base. UV stable and breathable where required.
- B. Systems shall meet or exceed all applicable NTMA and TTMAC standards.
- C. Combination of epoxy resin, marble, glass, mirror, and cleaned aggregates conforming too NTMA gradation standards and ASTM C-33. Caulk, clean and seal with manufacturers recommended products. Grind and polish exposed surfaces. No foreign matter in aggregates.

- D. System Components: Verify specific requirements as systems vary by manufacturer. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
1. Bond Coat (Primer): Verify inclusion of primer in manufacturer's system.
    - a. Resin: Epoxy.
    - b. Formulation Description: 100 percent solids.
    - c. Binder: Formulated to meet physical properties of MIL-D-3134F.
    - d. Application Method: Apply by spray, brush, or roller.
      - 1) Thickness of coats: Verify thickness as systems vary by manufacturer; approximate range from 5 to 6 mils (0.13 to 0.15 mm) to 150 to 250 square feet per gallon (52.76 to 87.93 square meters per liter).
  2. Body Coat:
    - a. Resin: Epoxy or Urethane.
    - b. Formulation Description: 100 percent solids.
    - c. Binder: Formulated to meet physical properties of MIL-D-3134F.
    - d. Application Method: Varies by manufacturer; hand or power troweled.
      - 1) Trowel application:
        - a) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from 3/16 inch or 1/4 inch or 3/8 inch (4.76 to either 6.35 mm or 9.5 mm).
        - b) Number of coats: One.
    - e. Aggregates: Verify amount per thickness as systems vary by manufacturer:
      - 1) Marble (#1 size maximum), glass, pearl or granite chips or other approved materials. Colored rubberized aggregates per Section 09 06 00, Schedule for Finishes.
  3. Grout Coat:
    - a. Resin: Epoxy.
    - b. Formulation Description: 100 percent solids.
    - c. Application Method: Varies by manufacturer. Apply by red rubber squeegee or spring-steel trowel.
      - 1) Apply to rough ground mortar coat to completely fill all voids.
      - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 8 to 10 mils (0.2 to 0.25 mm) to a maximum of 400 to 500 square feet per gallon (140.65 to 175.81 square meters per liter).
  4. Seal Coat/Top Coat:
    - a. Resin: Single- or multi-component Urethane.

- b. Formulation Description: 100% solids. It shall have a pH factor between 7 and 10 and shall be a penetrating type specially prepared for use on terrazzo. It shall not discolor or amber the terrazzo and shall produce a slip resistant surface. Flash point of sealer shall be a minimum of 80 degrees F (26 degrees C) when tested in accordance with ASTM D 56.
  - c. Application Method: Varies by manufacturer. Apply using notched squeegee and backroll or using a lambs wool applicator.
    - 1) Apply to fine ground mortar coat to completely fill all voids.
    - 2) Thickness of coat: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 4 to 5 mils (0.1 to 0.13 mm) to a maximum of 500 to 750 square feet per gallon (175.81 to 263.74 square meters per liter).
    - 3) Number of coats: One.
  - d. Aggregates: Verify inclusion of slip-retardant aggregates in seal coat/top coat.
  - e. Textured Top Coat: Slip Resistant in accordance with UL 410.
- E. System Characteristics:
- 1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES.
  - 2. Integral cove base: 1 inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate. Verify cove base installation with manufacturer's system.
  - 3. Overall System Thickness: Verify thickness as systems vary by manufacturer; approximate range from a minimum of 3/16 inch (4.76 mm) to a maximum of either 1/4 inch or 3/8 inch (6.35 mm or 9.5 mm).
  - 4. Finish: Standard anti-slip resistant to meet or exceed 0.06 dry; 0.08 wet.
- F. Physical Properties:
- 1. Conform to ASTM C722, Type A, Epoxy resin, quartz aggregate.
  - 2. Other physical properties of seamless troweled (quartz epoxy) resinous flooring system in addition to C722 when tested to be as follows:

Test	Property	Value
ACI 503 R	Adhesion	350 psi /100% concrete failure
ASTM C-109	Compressive Strength	4000 PSI
ASTM C-190	Tensile Strength	800 PSI
ASTM C-307	Tensile Strength	800 PSI

Test	Property	Value
ASTM C-413	Water Absorption	< 0.5%
ASTM C-531	Thermal Coefficient of Linear Expansion	$4.7 \times 10^{-8}$
ASTM C-579	Compressive Strength	6000 PSI
ASTM C-580	Flexural	2000 to 4500 psi
ASTM C-92	Flash Point	140 degrees F
ASTM D-635	Flame Spread	< 0.25 inches (6.35 mm)/self extinguishing
ASTM D-638	Tensile Strength	3000 psi
ASTM D-695	Compressive Strength	12,000 psi
ASTM D-696	Thermal Co-efficient of Linear Expansion	$14 \times 10^{-6}$ inch /inch /degrees F
ASTM D-790	Flexural Modulus	500000 psi
ASTM D-2240 Shore D	Surface Hardness	80-90
ASTM D3108	Chemical Resistance	Refer to manufacturer's Chemical Resistance Charts for appropriate topping materials for required degrees of UV stability, resistance to environmental conditions, anticipated chemical reagents, or other applicable requirements
ASTM D-3960	Volatile Organic Compounds (VOC)	Primer Coat: 0 Base Coat: 0 Top Coat: 0
ASTM D-4060, CS-17	Abrasive Resistance	0<0.1 gm max weight loss
ASTM D-4541	Tensile Bond Strength	Cohesive Failure of Concrete
ASTM E-162	Flammability	<1
ASTM E-648	Critical Radiant Flux	<1
ASTM F-1679	Co-efficient of Friction	Dry - 0.81 Wet - 0.56
ASTM G-21	Microbial Resistant	Passes

Test	Property	Value
MIL STD 810E	Fungus Resistance	No Growth
Mil PRF-3135	Indentation Characteristics	<5% / no cracking and loosening
-	Skid Resistance	Must pass
-	Density	125 lb/cu. ft.

## 2.2 SUPPLEMENTAL MATERIALS

- A. Precast epoxy risers, treads and landings.
- B. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous floor coating.
- C. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.
- D. Strips:
  - 1. Dividing strips "L" shaped as manufactured for use with resinous (Epoxy Terrazzo) flooring system.
    - a. Brass, 14 gauge.
    - b. Plastic dividing strips shall not be used.
  - 2. Control Joint double "L" shaped strips as manufactured for use with resinous (Epoxy Terrazzo) flooring system. Position strips back to back.
    - a. Brass, 14 gauge.
    - b. Plastic strips shall not be used.
- D. Patching and Fill Material: Resinous product of or approved by resinous (Terrazzo) flooring manufacturer for application indicated.
- E. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

## 2.3 BASE CAP STRIP

- A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 3/16 inch (4.76 mm) depth of base material, "J" configuration.
- C. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM AMP 501:
    - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.018 mm (0.7 mils) or thicker.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine the areas and conditions where resinous (epoxy terrazzo) flooring system with integral base is to be installed with the VA Resident Engineer.
- B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work.
  - 1. MVT threshold for resinous (terrazzo) flooring shall not exceed 3 lbs/1000 square feet in a 24 hour period.
  - 2. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
  - 3. Perform additional substrata preparation as recommended by resinous flooring manufacturer's technical representative to obtain satisfactory results of moisture vapor transmission testing prior to commencement of the work.
  - 4. Provide a written report showing test placement and results.

### **3.2 PROJECT CONDITIONS**

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) thereafter.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
  - 1. Comply with infection control measures of the VA Medical Center.

### **3.3 INSTALLATION REQUIREMENTS**

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the resinous (terrazzo) flooring system with integral cove base.
- B. Substrata shall be approved by manufacture technical representative.

### **3.4 PREPARATION**

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.



- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Mechanically prepare substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
    - c. Comply with SSPC-SP 13, Surface Preparation of Concrete.
  - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
  - 3. Verify that concrete substrates are dry.
    - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
    - b. Perform maximum moisture-vapor-emission test, ASTM F 1869. Proceed with application only after substrates has obtained satisfactory results. If needed perform additional moisture tests until substrates pass testing.
  - 4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- B. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.
- E. Prepare wall to receive integral base:
  - 1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
  - 2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
  - 3. Grind, cut or sand protrusions to receive base application.

### 3.5 APPLICATION

- A. General: Apply each component of resinous (epoxy terrazzo) flooring system with integral base according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
  - 1. Verify that the substrate (dryness, pH level, etc.) is acceptable by the manufacturer's technical representative.
  - 2. Use manufacturer recommended cleaning products.
- B. Prepare substrata for resinous (terrazzo) flooring system:
  - 1. Apply waterproof membrane as recommended by resinous flooring manufacturer at all vertical junctures and the entire flooring substrata. Embed fabric reinforcement into waterproof membrane liquid. Overlap all seams a minimum of 2 inches (51 mm).
  - 2. Apply crack isolation membrane as recommended by resinous flooring manufacturer and at all slabs at the existing building.
  - 3. Apply substrata smoothing/patching underlayment as recommended by resinous flooring manufacturer.
- C. Resinous (epoxy terrazzo) flooring system: Per manufacturer's written instructions. Based on the porosity of the substrata additional coats may be required:
  - 1. Primer (Bond) Coat.
  - 2. Strips: Set divider and control strips as indicated on plans. Strips shall be set in a full bed of epoxy adhesive and allowed to cure before proceeding with the work.
  - 3. Body Coat: Apply body coat (including aggregate) evenly over the primer (bond) coat to the desired thickness.
  - 4. Power grind to expose aggregate.
  - 5. Grout Coat.
  - 6. Progressively fine grind and polish floor. Cleanse terrazzo with potable water and rinse. Remove excess rinse water and apply grout using identical Portland cement, color pigments as used in topping, ensuring to fill all voids. Cure Grout as recommended by manufacturer.
    - a. Grout may be left on terrazzo until all heavy and messy work in project is completed.
    - b. Fine grind until all grout is removed from surface.
    - c. Upon completion, terrazzo flooring shall display a minimum of 70% of marble chips.
  - 7. Cleaning: Wash all surfaces with a neutral cleaner. Rinse with clean water and allow surface to dry
  - 8. Chemical Vitrification; Honing and buffing fluorosilicates treatment.

9. Cove base: Apply cove base mix to wall surfaces at locations shown to form cove base to form 6-inch (152 mm) cove base height. Follow manufacturer's instructions and details including taping, mixing, priming, troweling, grinding, polishing, and top-coating of cove base.
  - a. When wall surface is not concrete, concrete masonry unit, install cement board and/or exterior grade plywood at locations shown to form cove base.

### **3.6 TOLERANCE**

- A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.
- B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

### **3.7 CURING, PROTECTION AND CLEANING**

- A. Cure resinous (epoxy terrazzo) flooring in compliance with manufacturer's directions (during the application process), taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous (epoxy terrazzo) flooring materials from damage and wear during construction operation.
  1. Cover flooring with wax paper or Kraft paper.
  2. Cover paper with 1/4 inch (6.35 mm) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous (Epoxy Terrazzo) flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous (Epoxy Terrazzo) flooring manufacturer.

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**SECTION 09 68 00**

**CARPETING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 QUALITY ASSURANCE**

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Green Certified and Green Label carpet that 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. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.
- D. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.
- E. Floor moisture and Ph test results.

**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**

- A. 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**

- A. 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 140-10.....Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):
  - AATCC 16-04.....Colorfastness to Light
  - AATCC 129-10.....Colorfastness to Ozone in the Atmosphere under High Humidities
  - AATCC 134-11.....Electric Static Propensity of Carpets
  - AATCC 165-08.....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 D5116-10.....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 E648-10.....Critical Radiant Flux of Floor-Covering Systems  
Using a Radiant Heat Energy Source

E. The Carpet and Rug Institute (CRI):

CRI 104-11.....Installation of Commercial Carpet

## **PART 2 - PRODUCTS**

### **2.1 CARPET**

A. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects, with certified recycled content.
2. Manufacturers standard construction commercial carpet:
  - a. Modular Tile: 660 mm (24 inches) square tile.
3. Provide static control to permanently control static build upto 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 3.25 mm (0.10 inch).
5. Pile Fiber: Nylon with recycled content 25 percent minimum branded (federally registered trademark).
6. Pile Type: Level Loop.
7. Backing materials: Manufacturer's unitary backing designed for glue-down installation using recovered materials.
8. 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 D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
9. Tuft Bind: Minimum force of 40 N (10 lb) required to pull a tuft or loop free from carpet backing. Test per ASTM D1335.
10. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
11. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
12. Delamination Strength: Minimum of 440 N/m (2.5 lb/inch) between secondary backing.
13. Flammability and Critical Radiant Flux Requirements:
  - a. Test Carpet in accordance with ASTM E 648.
  - b. Class I: Not less than 0.45 watts per square centimeter.
  - c. Class II: Not less than 0.22 watts per square centimeter.
14. Density: Average Pile Yarn Density (APYD)

- a. Minimum APYD 4000.
- 15. VOC Limits: Use carpet and carpet adhesive that comply with the following limits for VOC content when tested according to ASTM D 5116:
  - 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.
- B. Color, Texture, and Pattern: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.2 ADHESIVE AND CONCRETE PRIMER**

- A. Waterproof, Low voc, 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 D 3278.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining.

## **2.3 SEAMING TAPE**

- A. Permanently resistant to carpet cleaning solutions, steam, and water.
- B. Recommended by carpet manufacturer.

## **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. test moisture and Ph balance.
- C. 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.
- 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. 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 prior to adhesion.
  2. Comply with indoor air quality recommendations by CRI IAQ Carpet Testing Program.
  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. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
  3. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

### **3.3 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.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
- D. Manufacturers' Certificates indicating compliance with specified requirements:
  - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.

5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
  1. Federal Specification Number, where applicable, and name of material.
  2. Surface upon which material is to be applied.
  3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

#### 1.5 MOCK-UP PANEL

- A. Before starting application, apply paint to an area, not to exceed 9 m<sup>2</sup> (100 ft<sup>2</sup>), selected by Contracting Officer's Representative.
- B. Finish and texture approved by Contracting Officer's Representative will be used as a standard of quality for remainder of work.

#### 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 basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):  
ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)  
ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):  
A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):  
D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):  
A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)  
A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):  
TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):  
No. 1-12.....Aluminum Paint (AP)  
No. 4-12.....Interior/ Exterior Latex Block Filler  
No. 5-12.....Exterior Alkyd Wood Primer

Establish Sunnyvale R&D Campus; 640-397

- No. 7-12.....Exterior Oil Wood Primer
- No. 8-12.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
- No. 9-12.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
- No. 10-12.....Exterior Latex, Flat (AE)
- No. 11-12.....Exterior Latex, Semi-Gloss (AE)
- No. 18-12.....Organic Zinc Rich Primer
- No. 22-12.....Aluminum Paint, High Heat (up to 590° - 1100F)  
(HR)
- No. 26-12.....Cementitious Galvanized Metal Primer
- No. 27-12.....Exterior / Interior Alkyd Floor Enamel, Gloss  
(FE)
- No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 36-12.....Knot Sealer
- No. 43-12.....Interior Satin Latex, MPI Gloss Level 4
- No. 44-12.....Interior Low Sheen Latex, MPI Gloss Level 2
- No. 45-12.....Interior Primer Sealer
- No. 46-12.....Interior Enamel Undercoat
- No. 47-12.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5  
(AK)
- No. 48-12.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
- No. 49-12.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
- No. 50-12.....Interior Latex Primer Sealer
- No. 51-12.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- No. 52-12.....Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-12.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-12.....Interior Latex, Semi-Gloss, MPI Gloss Level 5  
(LE)
- No. 59-12.....Interior/Exterior Alkyd Porch & Floor Enamel,  
Low Gloss (FE)
- No. 60-12.....Interior/Exterior Latex Porch & Floor Paint, Low  
Gloss
- No. 66-12.....Interior Alkyd Fire Retardant, Clear Top-Coat  
(ULC Approved) (FC)
- No. 67-12.....Interior Latex Fire Retardant, Top-Coat (ULC  
Approved) (FR)
- No. 68-12.....Interior/ Exterior Latex Porch & Floor Paint,  
Gloss
- No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-12.....Interior Alkyd Varnish, Semi-Gloss
- No. 77-12.....Epoxy Cold Cured, Gloss (EC)
- No. 79-12.....Marine Alkyd Metal Primer

- No. 90-12.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-12.....Wood Filler Paste
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-12.....Fast Drying Metal Primer
- No. 98-12.....High Build Epoxy Coating
- No. 101-12.....Epoxy Anti-Corrosive Metal Primer
- No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)
- No. 114-12.....Interior Latex, Gloss (LE) and (LG)
- No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-12.....Non-Cementitious Galvanized Primer
- No. 138-12.....Interior High Performance Latex, MPI Gloss Level  
2 (LF)
- No. 139-12.....Interior High Performance Latex, MPI Gloss Level  
3 (LL)
- No. 140-12.....Interior High Performance Latex, MPI Gloss Level  
4
- No. 141-12.....Interior High Performance Latex (SG) MPI Gloss  
Level 5
- H. Steel Structures Painting Council (SSPC):
  - SSPC SP 1-04 (R2004)....Solvent Cleaning
  - SSPC SP 2-04 (R2004)....Hand Tool Cleaning
  - SSPC SP 3-04 (R2004)....Power Tool Cleaning

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Cementitious Paint (CEP): TT-P-1411A [Paint, Copolymer-Resin, Cementitious (CEP)], Type 1 for exterior use, Type II for interior use.
- B. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
- C. Plastic Tape:
  - 1. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
  - 2. Pressure sensitive adhesive back.
  - 3. Widths as shown.
- D. Identity markers options:
  - 1. Pressure sensitive vinyl markers.
  - 2. Snap-on coil plastic markers.
- E. Aluminum Paint (AP): MPI 1.
- F. Interior/Exterior Latex Block Filler: MPI 4.
- G. Exterior Alkyd Wood Primer: MPI 5.

- H. Exterior Oil Wood Primer: MPI 7.
- I. Exterior Alkyd, Flat (EO): MPI 8.
- J. Exterior Alkyd Enamel (EO): MPI 9.
- K. Exterior Latex, Flat (AE): MPI 10.
- L. Exterior Latex, Semi-Gloss (AE): MPI 11.
- M. Organic Zinc rich Coating (HR): MPI 22.
- N. High Heat Resistant Coating (HR): MPI 22.
- O. Cementitious Galvanized Metal Primer: MPI 26.
- P. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
- Q. Knot Sealer: MPI 36.
- R. Interior Satin Latex: MPI 43.
- S. Interior Low Sheen Latex: MPI 44.
- T. Interior Primer Sealer: MPI 45.
- U. Interior Enamel Undercoat: MPI 47.
- V. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- W. Interior Alkyd, Gloss (AK): MPI 49.
- x. Interior Latex Primer Sealer: MPI 50.
- Y. Interior Alkyd, Eggshell: MPI 51
- Z. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- AA. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- BB. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- DD. Interior / Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE): MPI 59.
- EE. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.
- FF. Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC): MPI 66.
- GG. Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR): MPI 67.
- HH. Interior/ Exterior Latex Porch & Floor Paint, gloss: MPI 68.
- II. Epoxy Cold Cured, Gloss (EC): MPI 77.
- JJ. Marine Alkyd Metal primer: MPI 79.
- KK. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- LL. Wood Filler Paste: MPI 91.
- MM. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- NN. Fast Drying Metal Primer: MPI 95.
- OO. High Build Epoxy Coating: MPI 98.
- PP. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- QQ. High Build Epoxy Marine Coating (EC): MPI 108.
- RR. Interior latex, Gloss (LE) and (LG): MPI 114.
- SS. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- TT. Waterborne Galvanized Primer: MPI 134.
- UU. Non-Cementitious Galvanized Primer: MPI 135.
- VV. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.

WW. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

XX. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.

YY. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

## **2.2 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

## **2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE**

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.  
REMOVAL AND DISPOSAL.
  - 2. Asbestos: Materials shall not contain asbestos.
  - 3. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 4. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 5. VOC content for 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. 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.

### **3.2 SURFACE PREPARATION**

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
  1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
  3. See other sections of specifications for specified surface conditions and prime coat.
  4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete
- 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 or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
  6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.

7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
  - a. Thin filler in accordance with manufacturer's instructions for application.
  - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

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, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
  - a. This includes flat head countersunk screws used for permanent anchors.
  - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

### 3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

### 3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.

### 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. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent (WS)) is scheduled.

- b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
  - 2. Apply two coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
  - 3. Apply one coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
  - 4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
  - 5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR) to wood for fire retardant finish.
- F. Gypsum Board:
- 1. Surfaces scheduled to have MPI 53 (Interior Latex, Flat), MPI Gloss Level 1 LE), MPI 52 (Interior Latex, MPI Gloss Level 3 (LE), MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5, (Interior Latex, Gloss (LE) and (LG)) finish: Use MPI 53 (Interior Latex, MPI Gloss Level 3 (LE), MPI 52 (Interior Latex, MPI Gloss Level 3 (LE), MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE), MPI 114 (Interior Latex, Gloss (LE) and (LG)) respectively.
  - 2. Surfaces scheduled to receive vinyl coated fabric wallcovering: Use MPI 45 (Interior Primer Sealer).

### 3.6 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces as shown.
- B. Metal Work:
  - 1. Apply to exposed surfaces.
  - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
  - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
    - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
- C. Gypsum Board:
  - 1. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).

2. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level

F. Wood:

1. Sanding:
  - a. Use 220-grit sandpaper.
  - b. Sand sealers and varnish between coats.
  - c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
  - a. 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. Transparent Finishes on Wood Except Floors.
  - a. Natural Finish:
    - 1) One coat of sealer as written in 2.1 E.
    - 2) Two coats of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss (PV)).
  - b. Stain Finish:
    - 1) One coat of MPI 90 (Interior Wood Stain, Semi-Transparent (WS)).
    - 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
    - 3) One coat of sealer as written in 2.1 E.

**PAINT COLOR**

- A. Color and gloss of finish coats is as follows:
  1. Walls - low sheen.
- B. Coat Colors:
  1. Color of priming coat: Lighter than body coat.
  2. Color of body coat: Lighter than finish coat.
  3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- C. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  1. Color of Caulking, and Sealants to match the adjacent paint color.
  2. Finishes to match surrounding color.

**3.8 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

**SECTION 10 14 00**

**SIGNAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior signage for room numbers, directional signs, code required signs, hazard, telephone identification signs and temporary interior signs.
- B. This section also specifies exterior medical center identification signs, building identification signs, parking and traffic signs.
- C. Installation of Government furnished dedication plaque and VA seal.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Sign manufacturer shall provide evidence that they regularly and presently manufacture's signs similar to those specified in this section as one of their principal products.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Contracting Officer's Representative, other returned to Contractor.
  - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
  - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
  - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
  - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
  - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

### **1.5 DELIVERY AND STORAGE**

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

### **1.6 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.
- C. Federal Specifications (Fed Spec):
  - MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.
  - MIL-P-46144C.....Plastic Sheet, Polycarbonate
- D. VA Palo Alto Health Care System, Exterior and Interior Standards, May 16, 2014.

### **1.7 MINIMUM SIGN REQUIREMENTS**

- A. Permanent Rooms and Spaces:
  - 1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
  - 2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
  - 3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
  - 4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
  - 5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
  - 6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.
- B. Overhead Signs:



1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
4. Mounting Location and Height: As shown.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs shall comply with VAPAHCS Exterior and Interior Standards.
- C. Signs complete with lettering, framing and related components for a complete installation.
- D. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- E. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Contracting Officer's Representative to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- F. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

### **2.2 PRODUCTS**

- A. Aluminum:
  1. Sheet and Plate: ASTM B209.
  2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: MIL-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Electrical Signs:

1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.
2. Refer to Electrical Specifications Section, Division 26, ELECTRICAL, to verify line voltages for sign locations that require electrical signs.
3. Quality Control: Installed electrical components and sign installations are to bear the label and certification of Underwriter's Laboratories, Inc., and are to comply with National Electrical Code as well as applicable federal, state and local codes for installation techniques, fabrication methods and general product safety.

### **2.3 SIGN STANDARDS**

#### **A. Topography:**

1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
2. Arrow: See graphic standards in drawings.
3. Letter spacing: See graphic standards on drawings.
4. Letter spacing: See graphic standards on drawings.
5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.

### **2.4 SIGN TYPES**

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

1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.

#### **B. IN indicates a component construction based sign.**

1. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
2. Sign types are shown on VA Palo Alto Heath Care System, Exterior and Interior Standards, May 16, 2014.

#### **C. Interchangeable Component System:**

1. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.

- a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
  - b. Component Sign System is comprised of the following primary components:
    - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
    - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
    - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
    - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
    - 5) Joiners and Accent Joiners connect separate Rail Backs together.
    - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
  - c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
  - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
  - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.
- D. Temporary Interior Signs:
- 1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.

2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
  - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
  - b. Replace and missing damaged or illegible signs.

## **2.5 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges,

drips, bubbles, thickness variations, foreign matter and other imperfections.

- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Contracting Officer's Representative & forwarded to contractor.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Contracting Officer's Representative for clarification.
- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Contracting Officer's Representative determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.

- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

- - - END - - -

**SECTION 10 21 13**  
**TOILET COMPARTMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies solid phenolic toilet partitions and urinal screens.

**1.2 RELATED WORK**

A. All Work listed in the Table of Contents shall be a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: 150 mm (six-inch) square of panel finish.
- 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 TOILET PARTITIONS:**

- A. Solid phenolic, water resistant; graffiti resistant; non-absorbent; contain a minimum 30 percent post consumer recycled plastic; Class C flame spread rating. Color per Section 09 06 00.
- B. Conform to Fed. CID A-A-60003, except as modified herein.
- C. Fabricate to dimensions shown or specified.

D. 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.

E. Urinal Screens:

1. Type III, Style E wall hung
  - a. With integral flanges and continuous, full height wall anchor plate. Color per Section 09 06 00.
  - b. Option: Full height heavy duty, continuous, 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.
5. Where overhead braced, secure pilasters to building walls by headrails clamped on or set into top of each pilaster.
  - a. Secure clamps to pilasters with two through-bolts to each clamp.
  - b. When headrails are set into pilasters, through-bolt them to the pilasters.
  - c. Support headrails on wall flange fittings secured to building walls with minimum of two anchor bolts to each flange fitting.
  - d. Support partition with overhead steel "C" channel. Brace steel support to building structure and install hanging rods into drilled steel channel.

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.

- - - E N D - - -



**SECTION 10 26 00**

**WALL PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies wall guards (crash rails or bumper guards), handrail/wall guard combinations, corner guards.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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. Wall Guards.
  - 2. Corner Guards.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - D256-06.....Impact Resistance of Plastics
  - D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

E84-09.....Surface Burning Characteristics of Building  
Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual

D. National Fire Protection Association (NFPA):  
80-10.....Standard for Fire Doors and Windows

E. Society of American Automotive Engineers (SAE):  
J 1545-05.....Instrumental Color Difference Measurement for  
Exterior Finishes.

F. Underwriters Laboratories Inc. (UL):  
Annual Issue.....Building Materials Directory

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

A. Stainless Steel: ASTM A167, Type 302B.

B. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6

C. Resilient Material:

1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
  - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
  - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
  - c. Rated self extinguishing when tested in accordance with ASTM D635.
  - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
  - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
  - f. Same finish on exposed surfaces.

### **2.2 CORNER GUARDS**

A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 6 mm 1/4-inch corner) formed to profile shown.

1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.

3. Flush mounted corner guards installed on any fire rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
  - a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
  - b. All exposed metal in fire rated assemblies shall have a paintable finish.
- B. Stainless Steel Corner Guards: Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.

## **2.3 WALL GUARDS**

- A. Resilient Wall Guards:
  1. Handrail/Wall Guard Combination: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
  2. Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 2.8 mm (0.110-inch) thick, shall be free-floated over 50 mm (two-inch) wide aluminum retainer clips, minimum 2.3 mm (0.090-inch) thick, anchored to wall at maximum 600 mm (24 inches) on center, supporting a continuous aluminum retainer, minimum 1.6 mm (0.062-inch) thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 2.3 (0.090-inch) thick anchored to wall at maximum 600 mm (24 inches) on center.
  3. Provide handrails and wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

## **2.4 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.

## **2.5 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. AA-C22A32

chemically etched medium matte with integrally colored anodic coating, Class II Architectural 0.4 mil thick.

- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified. Color and finish per Section 09 06 00, Schedule for Finishes.

### **PART 3 - EXECUTION**

#### **3.1 RESILIENT CORNER GUARDS**

Install corner guards on walls in accordance with manufacturer's instructions.

#### **3.2 STAINLESS STEEL CORNER GUARDS**

Mount guards on external corners of interior walls, partitions and columns as shown.

- B. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as shown on drawings.

1. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

#### **3.3 RESILIENT HANDRAIL WALL GUARD COMBINATIONS AND RESILIENT WALL GUARDS (CRASH RAIL)**

Secure guards to walls with mounting cushions and fasteners in accordance with manufacturer's details and instructions.

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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, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Combination paper towel dispenser and disposal unit.
  - 2. Toilet tissue dispenser.
  - 3. Grab Bars.
  - 4. Metal framed mirror.
  - 5. Soap dispenser.
  - 6. Toilet Seat Cover Dispenser.
- B. This section also specifies custom fabricated items used in toilets and related spaces.
- C. See drawings for VA supplied toilet accessories. Accessories supplied by VA to be installed by Contractor.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified.
  - 2. Paper towel dispenser and combination dispenser and disposal units.
  - 3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
  - 4. Grab bars, showing design and each different type of anchorage.
  - 5. Soap dispenser, showing anchorage and components.
  - 8. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.
- C. Samples:
  - 1. One of each type of accessory specified.
  - 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.
4. Mop racks.

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.

**1.4 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.

**1.5 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 or containers; labeled for identification with manufacturer's name, brand, and contents.

**1.6 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.

**1.7 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):  
A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet and Strip.



- A176-99(R2009).....Stainless and Heat-Resisting Chromium Steel  
Plate, Sheet, and Strip
- A269-10.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
- A312/A312M-09.....Seamless and Welded Austenitic Stainless Steel  
Pipes
- A653/A653M-10.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy-Coated (Galvannealed) by the Hot-Dip  
Process
- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Shapes, and Tubes
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium
- C1036-06.....Flat Glass
- C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass
- D635-10.....Rate of Burning and/or Extent and Time of  
Burning of Self Supporting Plastics in a  
Horizontal Position
- F446-85(R2009).....Consumer Safety Specification for Grab Bars and  
Accessories Installed in the Bathing Area.
- C. The National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500 Series.....Metal Finishes Manual
- 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:
  - 1. ASTM C1036, Type 1, Class 1, Quality q2.
- G. Foam Rubber: ASTM D3453, Grade BD, Type 2.
- H. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.

## **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 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS**

- A. Semi-recessed type.
- B. Dispensing capacity for 400 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.
- D. Form face frames, from one piece.
- E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.
- F. Provide removable waste receptacle approximately 40 liter (10.5 gallon) capacity, fabricated of 0.45 mm (0.018-inch) thick stainless steel.

#### **2.6 TOILET TISSUE DISPENSERS**

- A. Double roll surface mounted type.
- B. Mount on continuous backplate.
- C. Removable spindle ABS plastic or chrome plated plastic.
- D. Wood rollers are not acceptable.

#### **2.7 TOILET SEAT COVER DISPENSERS**

- A. Wall surface mounted, toilet seat cover dispenser.
- B. Fabricated of stainless steel:
  - 1. Satin Finish.
  - 2. Dispenses half folded covers.
  - 3. Fills from bottom.

#### **2.8 GRAB BARS**

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of stainless steel, use only one type throughout the project:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- 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 and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
3. Continuous weld intermediate support to the grab bar.
4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.

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. Flange for Exposed Mounting:

1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.

H. 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.

**2.9 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.
3. Use tempered glass for mirrors in Mental Health and Behavioral Nursing units.

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, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:

- a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
  - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
- 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.

#### **2.10 SOAP DISPENSER**

- A. Wall surface mounted, liquid soap dispenser.
- B. Vertical Tank:
  - 1. Satin finish stainless steel.
  - 2. 40 fluid ounce capacity.
  - 3. Soap refill window.
  - 4. Concealed wall fastening.
  - 5. Hinged top requires key to open.
- B. Complete unit shall not be adversely affected by the liquid soap, aseptic detergent, or hexachlorophene solutions.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Before starting work notify Contracting Officer's Representative in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Contracting Officer's Representative 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 and 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, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.
- 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 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**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section covers recessed fire extinguisher cabinets.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINET**

Recessed type with flat trim of size and design as specified in Section 09 06 00, Schedule for Finishes.

**2.2 FABRICATION**

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
  - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
  - 2. Design doors to open 180 degrees.
  - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

**2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

**PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

- - - E N D - - -





**SECTION 10 75 00**

**SUN SHADING DEVICE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Fixed blade extruded-aluminum exterior mounted louvered sunshades including attachment brackets and trim.
- B. The drawings show the extent of the work, the dimensioned profile and depth of the sunshade to be provided.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: For exterior sunshades and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. 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.
- D. Samples:
  - 1. Two samples of anodized aluminum of each color showing finish and maximum shade range.
- E. Structural Calculations: Submit analysis of shade connection to mounting bracket by a professional engineer considering design loads such as dead, live, snow, wind, thermal movement, and any collateral loads (e.g. light fixtures or signage) that may be mounted to sunshade.

**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 sun shading devices as one of their principal products.
- C. Finish Warranty: Furnish manufacturer's twenty (20) year limited warranty against adhesion loss, and standard ten (10) year limited warranty against gloss retention.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Design: Design sunshades, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Sunshades shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of sunshade components and mounting brackets, or permanent damage to fasteners and anchors.
  - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lb./sq. ft. (1435 Pa), acting perpendicular to sunshade surfaces.
- C. Thermal Movements: Provide sun control system that allows for thermal movements resulting from a maximum change in ambient and surface temperature as indicated without buckling, overstressing of components, failure of connections, or other detrimental effects.
  - 1. Temperature Range: 120° F (49° C) ambient and 180° F (82° C) at material surfaces.

### 1.6 DELIVERY, STORAGE AND HANDLING:

- A. Deliver aluminum material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.
- B. Store aluminum material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

### 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):
  - B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - 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 Architectural Manufacturer's Association (AAMA):
  - 2604-10.....High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
  - D1.2-08.....Structural Welding Code Aluminum

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum Extrusion Blades: ASTM B211, Alloy 6063-T5.
- B. Aluminum Plate ASTM B211, Alloy 6061-T6.
- C. Fasteners: Fasteners shall be stainless steel. Provide types, gauges and lengths to suit unit installation conditions.
- D. Anchors and Inserts: Use non-Ferrous metal or hot dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or zinc galvanized expansion bolt devices for drill-in place anchors.

### **2.2 FABRICATION**

- A. Provide fixed Sunshades and accessories of design, material, sizes, depth, arrangement, and thickness as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.
- B. Include supports, anchorage, and accessories required for complete assembly, including all attachment clips and necessary hardware for attachment to structure.
- C. No blade fasteners shall be visible after installation of sections. Provide cover plates at each outrigger end to conceal fasteners. Only mounting hardware shall be visible after installation.

### **2.3 FIXED, EXTRUDED-ALUMINUM EXTERIOR SUNSHADES**

- A. Airfoil Profile Blade Louvered Sun Control System
  - 1. Frame Depth: 6 inches (152 mm)
  - 2. Trim Profile: Rectangular tube
  - 3. Blade Profile: Airfoil, see drawings.
  - 4. Blade Angle: 35°
  - 5. Blade Spacing: 6 inches (152 mm) on center
  - 6. Outrigger Thickness: Not less than 0.125 inch (2.54 mm) for structural shapes, not less than 0.25 inch (6.35 mm) for flat materials.
  - 7. Frame and Blade Thickness: Not less than 0.080 inch (2.03 mm).

### **2.4 SUNSHADE CONSTRUCTION**

- A. Components
  - 1. All fascia and blades shall be 6063-T5 aluminum-extruded members.
    - a. Blade infill shall be custom designed with integral screw boss that is hidden from view visible after installation. Size and spacing is to be as shown on the architectural details. Blade infill shall be airfoils, rectangle or tubular sections.

- b. Blades to be miter cut and fitted to outrigger plates at mitered corner conditions.
- 2. Outrigger components shall be 6061-T6 aluminum plates.
  - a. Outriggers shall be tapered or shaped aluminum flat plates, screwed to aluminum extrusion blades via countersunk fastener holes. Connections of aluminum extrusions to outriggers should be flush with no protruding fasteners visible after installation. Outriggers are pre-drilled for mounting to the structural sunshade clip tab via stainless steel expansion slip connection to compensate for thermal expansion.
- 3. Clip brackets shall be of carbon steel.
  - a. Connection of sunshade to building shall be friction type with the ability to properly level the shade during installation.
- 4. Outrigger cover plates shall be furnished of 6061-T6 aluminum plates at each end of sunshade run to cover extrusion fasteners.
- B. Assembly: Components to be shop assembled in large practical sections to allow for immediate installation. Sections indicated on shop drawings to be assembled and shipped as units with cover plates and support arms, if required, shipped loose.
  - 1. Fasteners shall be bagged in groups clearly identifying bolt locations and bag contents for easy installation. Manufacturer to provide anti-seize compound for any field bolted stainless hardware to facilitate proper erection.

## **2.5 ALUMINUM FINISH FOR SHADES**

- A. NAAMM "Metal Finishes Manual" Chapter 1 NAIMM-2604-05. Apply finishes in factory after product assembly. Remove scratches and blemishes from exposed surfaces, which will be visible after completing finishing process.
- B. Factory applied super durable powder coating. Finish shall have enhanced resistance to fading, chalking, gloss retention that meets or exceeds AAMA 2604.
- C. Pretreatment
  - 1. Manufacturer to pre-sand, sandblast, or timesave all surfaces to be painted in a linear direction.
  - 2. Applicator to pretreat the aluminum with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by an optional chrome phosphate conversion coating - at minimum 30mg/ft<sup>2</sup> - to ensure adhesion of paint to the aluminum (AAMA 6.0).
- D. Application: One primer coat, one color coat, for a minimum of 1.2 mils of dry film thickness.
- E. Color: Selected by COR from standard colors.

## **2.6 STEEL CLIP FINISH**

- A. General: Comply with NAAMM "Metal Finishes Manual" Chapter 4. Apply finishes in factory after product assembly. Remove scratches and blemishes from exposed surfaces, which will be visible after completing finishing process.
- B. Factory applied super durable powder coating. Finish shall have enhanced resistance to fading, chalking, and loss of gloss that meets or exceeds AAMA 2604.
- C. Pretreatment:
  - 1. Manufacturer to degrease parts to remove any dirt, oils, or other debris.
  - 2. Applicator to pretreat with a chrome phosphatate conversion coating - at minimum 30mg/ft<sup>2</sup> - to ensure proper adhesion to metal surface (AAMA 6.0).
- D. Application: One coat epoxy zinc rich primer, one color coat, for a minimum 1.2 mills of dry film thickness.
- E. Color: Provide color as indicated to match sunshade.
- F. Finish Warranty: Furnish manufacturer's twenty (20) year limited warranty against adhesion loss, and standard ten (10) year limited warranty against gloss retention.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation of the work.
- B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated, and fitted to the structure.
- C. Anchor Sunscreen to building substructure as indicated on the sunshade shop drawings. Use concealed anchorages where possible, with locations as directed by manufacturer instructions.
- D. Erection Tolerances:
  - 1. Clips or Mounting Brackets:
    - a. Elevation clip Variation from level: 1/8" maximum in any column to column space or 20'-0" runs, non-cumulative.
    - b. Offsets in projection of clips front leading edge 1/16" +/-.
    - c. Veneer or Wall construction tolerance around clip projection. 1/4"+ outward.
    - d. Clip Plumbness: 1/16" in 6"
    - e. Clip projection level: 1/16" in 12"

2. Shade Sections

- a. Projection Level: 1/8" in 4'-0"
- b. Horizontal Level: 1/8" max in any column to column space or in 20'-0" runs, non-cumulative.
- c. Shade section to section variation 1/32" at adjoining sections.
- E. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- F. Set units level, plumb and true to line, with uniform joints.

**3.2 CLEANING**

- A. Clean exterior sunshades surfaces to prevent buildup of dust and debris. Clean sunshades as outlined in AAMA 609/610-02, *"Cleaning and Maintenance Guide for Architecturally Finishes Aluminum"* or NAAM Metal Finishes Manual "Cleaning Procedures" 1-13/1-14.
- B. 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.

**3.3 PROTECTION**

- A. Protect Sunshade materials after installation to prevent damage by other trades. Special attention shall be taken to ensure no equipment or personell stands on top of sunshade system, nor sunshade system is used to hang any type of tarp or similar barricade or signage other than the design intent.

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**SECTION 12 24 00**

**BLINDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

CLOTH SHADES, VERTICAL BLINDS ARE SPECIFIED IN THIS SECTION. WINDOW SHADES SHALL BE FURNISHED COMPLETE, INCLUDING BRACKETS, FITTINGS AND HARDWARE.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**1.3 QUALITY CONTROL**

Manufacturer's Qualification: Blind manufacturer shall provide evidence that the manufacture of blinds are a major product, and that the blinds have performed satisfactorily on similar installations.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Shade cloth, each type, 600 mm (24 inch) square, including cord and ring, showing color, finish and texture.
  2. Vertical blind slats, 300 mm (12 inches) long, including chain and supporting channels, showing color and finish.
- C. Manufacturer's literature and data; showing details of construction and hardware for:
- Cloth and window shades
- Vertical blinds

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- AA-V-00200B.....Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories
- C. American Society for Testing and Materials (ASTM):
- A167-99(R2009).....Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- B221/B221M-08.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

- D635-10.....Rate of Burning and/or Extent and Time of  
Burning of Self-Supporting Plastics in a  
Horizontal Position
- D648-07.....Deflection Temperature of Plastics Under  
Flexural Load in the Edgewise Position
- D1784-08.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly (Vinyl Chloride) (CPVC)  
Compounds

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - ROLLER BLINDS**

- A. Shade Cloth: translucent.
- B. Staples (For Cloth Window Shades): Nonferrous metal or zinc-coated steel.
- C. Stainless Steel: ASTM A167
- D. Cords for Blinds: No. 4 braided nylon or No. 4-1/2 braided cotton having not less than 80 Kg (175 pounds) breaking strength.
- E. Extruded Aluminum: ASTM B221/B221M.
- F. Colors; See Section 09 06 00, SCHEDULE FOR FINISHES.

### **2.2 MATERIALS - BLACK-OUT SHADES**

- A. Shade Cloth: Fabricate for a crackproof and fadeproof material that will remain soft and pliable at all times under temperature changes. Shade cloth shall conform to fire resistant requirement of Fed. Spec. A-A-59517, and shall be same color on both sides.
- B. Cords for Shades: No. 4 braided nylon, or No. 4 1/2 braided cotton having not less than 80 Kg (175 pounds) breaking strength.
- C. Fastenings: Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

<b>Type of Fastening</b>	<b>Structural Material</b>
Tap Screw	Metal
Toggle bolts	Hollow blocks, wallboard plaster



### **2.3 FABRICATION - BLACK-OUT SHADES**

- A. Lightproof shades shall be metal head housing, deep side guides, sill light lock members, continuous metal jamb and head anchor section, operating bars, and shall be complete with roller assembly, one piece lightproof shade cloth, and metal disappearing type horizontal braces (two each shade).
- B. Light traps shall be shop fabricated, and shall consist of a head box to house the shade roller, and steel channels U-shape in cross section to serve as guides for the shade along the sides, and to receive the bottom edge of the shade along the sill. Make light trap of sheet steel having a minimum thickness of 0.38 mm (0.015). Legs of the U-shaped channels shall be, not less than 45 mm (1-3/4 inches) long and separated by minimum distance that will permit free operation of the shade. Edges of light trap coming into contact with the shade cloth shall be rounded or beaded. Exposed face of the head box shall be hinged, or removable for access to the shade roller. Design entire assembly to prevent light from entering the room when the shade is drawn. Interior or unexposed surfaces of the light trap shall have a finish coat of flat black enamel. Exposed portions of the light trap shall have a factory applied pyroxylin lacquer, or baked on enamel finish in color to match adjoining wood or metal work.
- C. Rollers shall be of aluminum or stainless steel of sufficient diameter to support the shade, and provided with spindles, bearings and coil springs. Provide rollers with a groove and metal spline with aluminum, or stainless steel machine screws spaced not over nine inches on centers, for attaching the shade cloth.
- D. Shades not finished with a selvage shall have vertical edges bound or hemmed to prevent raveling. Sewing shall be double or triple stitched, using a high-grade thread. Make needle holes lightproof by applying a suitable filler.
- E. Stiffen the shade by transverse steel bars of size and weight to hold the shade in the channel guides. Space bars approximately 450 mm (18 inches) on centers and conceal in pockets in the shade. Fit bottom edge of the shade with a steel operating bar designed to engage the sill channel of the light trap. Paint bars with flat black enamel.
- F. Cords: Fit operating bar with pull cord.

### **2.4 FABRICATION - ROLLER SHADES**

- A. Fabricate shades to fit measurements of finished openings obtained at site.
- B. Cloth Window Shades: Rolling type, constructed of shade cloth mounted on rollers. Shade cloth shall have plain sides, and with hem at bottom to

accommodate wood slat. Separate shades are required for each individual sash within opening. Length of shades shall exceed height of window approximately 300 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:

1. Provide rollers with spindles, nylon bearings, tempered steel springs, and all other related accessories required for positive action. Provide rollers of diameter recommended by shade manufacturer. Staple shade cloth to wood rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade will hang plumb. Space staples not over 90 mm (3-1/2 inches) on centers. Use of tacks is prohibited.
2. Wood slats shall be smooth, tapered, and inserted in the bottom hem of the shade cloth.
3. Eyelets shall have clear openings large enough to accommodate cords. Edges of eyelets shall not cut into cloth when set.
4. Cords shall be of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Cloth Window Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.
  1. Locate rollers in level position as high as practicable at heads of windows to prevent infiltration of light over rollers.
  2. Where extension brackets are necessary, on mullions or elsewhere, for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
  3. Place brackets and rollers so that shades will not interfere with window and screen hardware.
  4. Shade installation methods not specifically described, are subject to approval of COR.
  5. Install one roller shade per curtain wall lite and per interior vertically glazed lite. Except spandrel glass.
- B. Black-out Shades:
  1. Install lightproof shades level at a height that will permit proper operation of the shades, and prevent outside light from infiltrating into the room. Light traps shall be closely fitted to the adjacent construction, and the connection shall be rigid and light-tight.

Shades shall not be installed until after the room painting and finishing operations are complete.

2. Install one black-out shade at each exterior glass lite at conference rooms and team rooms, 122, 123, 222, and 223.

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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: suspended ceiling.
  - 2. Electrical Elements: Power and lighting systems; selector and controller panels; fire protection and alarm systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; roof drainage piping; sprinkler systems.

**1.2 RELATED WORK**

- A. All Sections listed in the Table of Contents are a Condition of this Section.

**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 California.
  - 2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in California
- 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: Permanent equipments and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7, and shall comply with section 13.2.6 of ASCE 7.

#### 1.4 SUBMITTALS

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

- E. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.

#### **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 Society of Civil Engineers (ASCE 7) Latest Edition.
- C. International Building Code (IBC) Latest Edition
- D. VA Seismic Design Requirements, H-18-8, February 2011
- E. National Uniform Seismic Installation Guidelines (NUSIG)
- F. 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, current edition.
- 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 piping less than 2 ½ inches inside diameter.
  - 4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
  - 5. All other piping less than 2 ½ 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 ½ 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**

Not Used

**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.

**3.2 EQUIPMENT RESTRAINT AND BRACING**

- A. See drawings for equipment to be restrained or braced.

**3.3 MECHANICAL DUCTWORK AND PIPING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; conduits and cable trays; and telecommunication wires and cable trays 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. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 CEILINGS 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.

**3.5 FACADES**

- A. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

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