

# FARGO VA HEALTH CARE SYSTEM

FARGO, NORTH DAKOTA

## **Volume 1- Specifications EXPAND BUILDING 1 FOR PRIMARY CARE**

### **Construction Documents**

PROJECT NO.: 437-315

November 16, 2021

**VA**



**U.S. DEPARTMENT OF  
VETERANS AFFAIRS**

Veterans' Health Administration  
*Fargo VA Health Care System*

FARGO VA HEALTH CARE SYSTEM  
DEPARTMENT OF VETERANS AFFAIRS  
FARGO, ND

EXPAND BUILDING 1 FOR PRIMARY CARE

NOVEMBER 16, 2021

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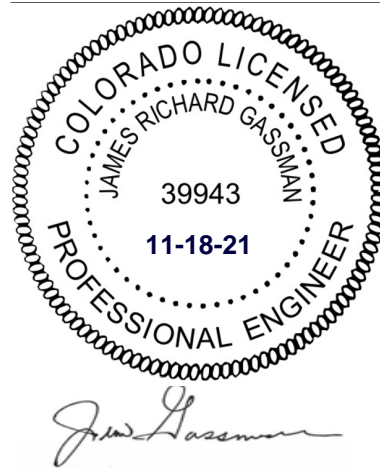
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**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS**

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

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

Reference Drawings Volume 1 - 1 of 8 (pg. 3) Drawing Index Sheet. The  
drawings listed in this index sheet accompanying this specification form  
as a part of the contract.

**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**GENERAL**

**1.1 SAFETY REQUIREMENTS**

- A. Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.
  - 1. All employees of contractor or subcontractors shall have the 10-hour (Non-Supervisory Employees) or 30-hour (Supervisory Employees) OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA.

**1.2 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for “EXPAND BUILDING 1 FOR PRIMARY CARE, Fargo VA Health Care System, Fargo, ND” as required by drawings and specifications.
  - 1. Visits to the site by Bidders will be through the Contracting Officer only. Only one organized site visit shall be conducted per FAR 52.236-27 Alternate I.
  - 2. Offices of FourFront Design Inc, 517 7<sup>th</sup> Street, Rapid City SD 57701, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
  - 3. All employees of general contractor and subcontractors shall comply with the VA security management program.

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

BID ITEM 1, GENERAL CONSTRUCTION (BASE BID): The Fargo Primary Care Addition provides approximately 16,400SF additional space and 1,500SF of remodel space to the exiting Primary Care Clinic. The project will be 2 levels, constructed to accommodate future vertical expansion. Clinical space on the upper floor will include exam rooms with general support and administrative space and the lower floor will include EMS (Facility Support/Custodial) space including storage and shops type areas. Steel Structure, Brick Veneer, Membrane Roofing and General Mechanical, Plumbing, Electrical and Fire Protection will be constructed similar to the existing building. General Site work will include utility relocation and installation, and hardscapes to coordinate with the existing site.

- A. BID ITEM 2 (DEDUCT 1): INCLUDES ALL WORK IN BID ITEM 1 WITH THE FOLLOWING  
EXCEPTIONS: Delete General Commissioning. Remove all requirements identified in  
Specification Section 01 91 00 General Commissioning Requirements.
- B. BID ITEM 3 (DEDUCT 2): INCLUDES ALL WORK IN BID ITEM 2 WITH THE FOLLOWING  
EXCEPTIONS: Delete all work associated with the security gate and bollards associated with the  
security gate as shown on the Civil & Electrical Drawings.

#### **1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. Drawings and contract documents may be obtained from the website where the solicitation is  
posted. Additional copies will be at Contractor's expense.

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

- A. Security Plan:
  - 1. The security plan defines both physical and administrative security procedures that will  
remain effective for the entire duration of the project.
  - 2. The General Contractor is responsible for assuring that all sub-contractors working on the  
project and their employees also comply with these regulations.
- B. Security Procedures:
  - 1. General Contractor's employees shall not enter the project site without the appropriate  
project identification badge as issued by the Medical Center. In addition to the appropriate  
badge, all employees will be required to carry a valid government issued, photo ID at all  
times and will present that ID and badge when requested by the appropriate VA staff. They  
may also be subject to inspection of their personal effects when entering or leaving the  
project site.
  - 2. Before starting work the General Contractor shall give three weeks' notice to the  
Contracting Officer and the Contracting Officer's Representative so that security  
arrangements can be provided for the employees. This notice is separate from any notices  
required for utility shutdown described later in this section.
  - 3. No photography of VA premises is allowed without written permission of the Contracting  
Officer. Patients and staff are not to be photographed at any time.
  - 4. VA reserves the right to close or shut down the project site and order General Contractor's  
employees off the premises in the event of a national emergency. The General Contractor  
may return to the site only with the written approval of the Contracting Officer.
- C. Key Control:

1. Contractor shall use hardware compatible with the Best Corporation 7 pin figure 8 cores in use at the Fargo VA. The cores to the doors shall be provided by VA and the Fargo VA Locksmith shall issue keys to contractors to use. Keys and cores shall be returned to the Fargo VA Locksmith when project is complete or their work on site is complete. Badges shall be returned to the VA Core or Engineering Service staff located in room BD-50. The General Contractor shall provide door hardware compatible with the Fargo VA Best Corporation 7 pin core and the VA provides the keys and cores for the door. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Motor Vehicle Restrictions

1. General Contractor and its employees will park in the shared staging and parking area east of Building 50 or off site on the street. Contractor to coordinate with COR.

**1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officers 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 Officers 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 its expense upon completion of the work.
- C. The Contractor shall, under regulations prescribed by the Contracting Officers Representative, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officers 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 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 shown on the drawings, or coordinated with COR in advance.
- E. Workers are subject to rules of Medical Center applicable to their conduct.

- F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.
- G. Execute work to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two workdays. Provide unobstructed access to Medical Center areas required to remain in operation.
- H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved.
- I. Phasing:
  - 1. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:
  - 2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR three weeks in advance of the proposed date of starting work in each specific area of site, building or

portion thereof. Arrange such phasing dates to ensure accomplishment of this work in successive phases mutually agreeable to the COR and Contractor.,

- a. Contractor to reference the Phasing Plans provided in the plan document set (Sheet G0.10). This includes information for Phases 1 and 2.

J. Building No.(s) 1 will be occupied during performance of work; but immediate areas of alterations will be vacated as shown on the plans.

- 1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. The contractor shall work with the VA COR for times when other contractors, service companies, etc. need to pass through the construction area (inside or outside) to complete their contracted work for the VA. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc. to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, seven feet minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps.. Padlocks and keys will be provided at each gate by the VA, which will be returned to the VA when the fence is taken down. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 15 inches. Bottom of fences shall extend to one inch above grade. Remove the fence when directed by COR.

L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance 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.

M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes,

or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

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 COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS for additional requirements.
  2. Contractor shall submit a request to interrupt any such services to COR, in writing, 21 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested at least 21 calendar days prior to the desired time and shall be performed as directed by the COR.
  5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed as soon as practical.
- N. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be removed back to their source. Those which are indicated to be abandoned but are not required to be entirely removed, shall be sealed, capped, or plugged at the main, branch or panel they originate from. 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.
- O. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be

- open to traffic at all times with approval. When single lane traffic is in effect, for any reason resulting from the operation of this construction, the General Contractor will provide for traffic control by trailer mounted traffic signal equipment, stationed at both sides and synchronized via radio or wire for efficient flow of traffic. When required, traffic control will be supplemented with contractor's staff as necessary. As approved by the COR, the contractor may provide manual traffic control for brief times of work.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- P. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

### 1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas of buildings and site in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
  1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
  2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
  3. Shall note any discrepancies between drawings and existing conditions at site.
  4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur, and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government.
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a



report on conditions then existing, of resilient flooring, doors, windows, walls, and other surfaces as compared with conditions of same as noted in first condition survey report:

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

D. Protection: Provide the following protective measures:

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

## 1.8 DISPOSAL AND RETENTION

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

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

## **1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (FAR 52.236-9)**

- 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 as noted on the contract drawings. and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.
- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils, and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

## **1.10 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired,

reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

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

#### **1.11 PHYSICAL DATA – SOIL CONDITIONS**

- A. Data and information furnished or referred to below 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.

- 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Northern Technologies Inc.

#### **(FAR 52.236-4)**

- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report has been attached at the end of this specification section and shall be considered part of the contract documents.
- D. Government does not guarantee that other materials will not be encountered, nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

#### **1.12 PROFESSIONAL SURVEYING SERVICES**

- A. A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

#### **1.13 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and benchmarks, indicated on the drawings, and shall be responsible for all measurements in connection with the

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

**(FAR 52.236-17)**

- B. Establish and plainly mark the addition to the existing building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities, and elevations of floor slabs:
  - 1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as footings, floor slabs, columns, walls, utilities, and other major controlling features) is placed.
- D. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
  - 1. Lines of each building and/or addition.

- 2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
- 3. Lines and elevations of sewers and of all outside distribution systems.
- E. Upon completion of the work, the Contractor shall furnish the COR one electronic copy and reproducible drawings at the scale of the contract drawings, showing the finished grade on the grid developed for constructing the work.. These drawings shall bear the seal of the registered land surveyor or registered civil engineer.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.14 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications, and clarifications. All underground services provided to the building will be dimensionally located on the plan.
- B. All variations shall be shown clearly legible and in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review and approval, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) and one hardcopy to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. All illegible, unclear, missed or incorrect entries will be brought to the attention of the Contractor, who will in turn resubmit a corrected set of drawings in a timely response.

#### **1.15 PARAGRAPHS A, B, & C SHALL ALSO APPLY TO ALL SHOP DRAWINGS.**

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

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed, and restoration performed by the Contractor at Contractor's expense. When necessary, to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridging.

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

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:

1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.
  2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations*. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal as determined by the COR shall be replaced with identical replacements, at no additional cost to the Government.
  - C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.
  - D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor's expense.

**1.17 TEMPORARY TOILETS**

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

**1.18 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract.
- B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.
- C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
  - 1. Obtain heat by connecting to Medical Center heating distribution system.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the Medical Center electrical distribution system.

Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. The Fargo VA Chief Engineer shall approve of the set up and connection point for the backflow preventer prior to installation. 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 COR discretion) of use of water from Medical Center's system.
- F. Fuel: Unavailable at this location.

**1.19 TESTS**

- A. As per specification section 23 05 93 the contractor shall provide a written testing and commissioning plan complete with component level, equipment level, sub-system level and system level breakdowns. The plan will provide a schedule and a written sequence of what will be tested, how and what the expected outcome will be. This document will be submitted for approval prior to commencing work. The contractor shall document the results of the approved plan and submit for approval with the as built documentation.
- B. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- C. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- D. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- E. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonable period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.
- F. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

**1.20 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.



- B. Manuals: Maintenance and operating manuals and one compact disc (one hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style, and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

## 1.21 PHOTOGRAPHIC DOCUMENTATION

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones.
- B. Photographic documentation elements:
  - 1. Before construction, photograph the adjacent building, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building and site shall be documented. Site work preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
  - 2. Construction progress for all trades shall be tracked, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
  - 3. As-built condition of pre-foundation utilities and site utilities shall be documented prior to pouring footers, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings
  - 4. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project.
  - 5. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing.
  - 6. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR.
  - 7. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled.

8. Monthly (29 max) exterior progressions (360 degrees around the project, all elevations and building envelope).
  9. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
  10. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
  11. Detailed Exact Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
  12. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough ins are complete, just prior to insulation and or drywall, or as directed by COR.
  13. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
- C. Upon completion of the project, final copies of the documentation (the "Permanent Record") shall be provided in an electronic media format.

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

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 CONTRACTOR'S REPRESENTATIVE:**

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

**1.3 CONTRACTOR'S CONSULTANT:**

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

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

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

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

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

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project

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

- B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
  2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised

computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

- C. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.
- D. The Complete Project Schedule shall contain the number of work activities and events that are appropriate for the project size.

#### **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 852.232 -Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.
- D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

**1.7 PROJECT SCHEDULE REQUIREMENTS**

A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:

1. Show activities/events as:

- a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
- b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
- c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
- d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
- e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.

2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.

3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.

4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.



5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
  1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.

Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COTR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

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

- A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 - Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

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

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
  2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  5. Completion percentage for all completed and partially completed activities/events.
  6. Logic and duration revisions required by this section of the specifications.
  7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project

schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COR within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.

- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

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

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
  1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
  2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.

3. Reschedule the work in conformance with the specification requirements.

- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

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

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:

1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
3. The schedule does not represent the actual prosecution and progress of the project.
4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.

- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes, and will be based on the

complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

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

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer- produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

- - - E N D - - -

**SECTION 01 33 23****SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.
- B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.
- C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

**1.2 DEFINITIONS**

- A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.
- B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.

- D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
- E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.
- I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

### **1.3 SUBMITTAL REGISTER**

- A. The VA will provide the Submittal Exchange site for the use of the General Contractors use of Construction Administration submittals.

- B. The contractor will provide a submittal register which will include a list of items, of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents, but which have been omitted from the submittal register.
- B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.
- C. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.
- D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.
- E. The Contractor shall submit formal monthly updates to the submittal register to be reviewed at the construction meeting. Each monthly update shall document actual submission and approval dates for each submittal.

#### **1.4 SUBMITTAL SCHEDULING**

- A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.
- B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.
- C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.
- D. All submittals are required to be approved prior to the start of the specified work activity.

#### **1.5 SUBMITTAL PREPARATION**

- A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements. The General Contractor will upload all submittals to the electronic exchange provider as arranged for by the VA. The General Contractor will review all submittals prior to upload, and will not upload any submittal that is incomplete, or should be rejected due to content.



- B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
- C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.
- D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain an excessive amount of irrelevant or unnecessary data will be returned without review.
- E. Provide a transmittal form for each submittal with the following information:
  - 1. VA Project Name: Expand Building 1 For Primary Care
  - 2. VA Project Number: 437-315
  - 3. Date of the drawings and revisions.
  - 4. Name, address, and telephone number of subcontractors, suppliers, manufacturers, and any other subcontractor associated with the submittal.
  - 5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
  - 6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
  - 7. Product identification and location in project.
- F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

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

#### 1.6 SUBMITTAL FORMAT AND TRANSMISSION

- A. Provide submittals in electronic format, with the exception of material samples, and providing the VA COR one hard copy submittal. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.
- B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.
- C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

- F. Provide hard copies of submittals when requested by the Contracting Officer. Additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

#### **1.7 SAMPLES**

- A. Submit two sets of physical samples showing range of variation, for each required item.
- B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.
- C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.
- D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.
- E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.
- F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

#### **1.8 OPERATION AND MAINTENANCE DATA**

- A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.
- B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

#### **1.9 TEST REPORTS**

- A. COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

#### **1.10 VA REVIEW OF SUBMITTALS AND RFIS**

- A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

- B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.
- C. Period of review for each resubmittal is the same as for initial submittal.
- D. VA review period is 21 calendar days for submittals.
- E. VA review period is 14 calendar days for RFIs.
- F. The VA will return submittals to the Contractor with the following notations:
  - 1. "Approved": authorizes the Contractor to proceed with the work covered.
  - 2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
  - 3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
  - 4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

#### **1.11 APPROVED SUBMITTALS**

- A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.
- B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.
- C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.
- D. Retain a copy of all approved submittals at project site, including approved samples.

**1.12 WITHHOLDING OF PAYMENT**

- A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

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**SECTION 01 35 26  
SAFETY REQUIREMENTS**

**1.1 APPLICABLE PUBLICATIONS:**

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

B. American Society of Safety Engineers (ASSE):

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

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

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

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

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

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of  
Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2018.....Standard for Portable Fire Extinguishers

30-2018.....Flammable and Combustible Liquids Code

51B-2019.....Standard for Fire Prevention During Welding,  
Cutting and Other Hot Work

70-2020.....National Electrical Code

70B-2019.....Recommended Practice for Electrical Equipment  
Maintenance

70E-2018 .....Standard for Electrical Safety in the Workplace

99-2018.....Health Care Facilities Code

241-2019.....Standard for Safeguarding Construction,  
Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification  
Manual

G. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1910 .....Safety and Health Regulations for General  
Industry

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

H. VHA Directive 2005-007

**1.2 DEFINITIONS:**

- A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.
- B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- C. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- D. High Visibility Accident. Any mishap which may generate publicity or high visibility.

E. Accident/Incident Criticality Categories:

1. No impact - near miss incidents that should be investigated but are not required to be reported to the VA.
2. Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than \$5000). These incidents must be investigated but are not required to be reported to the VA.
3. Moderate incident/impact - Any work-related injury or illness that results in:
  - a. Days away from work (any time lost after day of injury/illness onset)
  - b. Restricted work.
  - c. Transfer to another job.
  - d. Medical treatment beyond first aid.
  - e. Loss of consciousness.
4. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
5. Any incident that leads to major equipment damage (greater than \$5000).

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

- 1 Major incident/impact - Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than \$20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

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



**1.3 REGULATORY REQUIREMENTS:**

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

**1.4 ACCIDENT PREVENTION PLAN (APP) :**

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- B. The APP shall be prepared as follows:
1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
  2. Address both the Prime Contractors and the subcontractors work operations.
  3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
  4. Address all the elements/sub-elements and in order as follows:

- a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
- 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience).
  - 2) Plan approver (company/corporate officers authorized to obligate the company).
  - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
- b. **BACKGROUND INFORMATION.** List the following:
- 1) Contractor:
  - 2) VA Contract number: 35C26319D005
  - 3.) VA Project Number: 437-315
  - 3) VA Project Name: Expand Building 1 For Primary Care.
  - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
- c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
- d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program.
  - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts

specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

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

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

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.

**f. TRAINING.**

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

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

**g. SAFETY AND HEALTH INSPECTIONS.**

- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
- 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

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

- 1) Exposure data (man-hours worked);
- 2) Accident investigation reports;
- 3) Project site injury and illness logs.

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

- 1) Emergency response.
- 2) Contingency for severe weather.
- 3) Fire Prevention.
- 4) Medical Support.

- 5) Posting of emergency telephone numbers.
- 6) Prevention of alcohol and drug abuse.
- 7) Site sanitation (housekeeping, drinking water, toilets).
- 8) Night operations and lighting.
- 9) Hazard communication program.
- 10) Welding/Cutting "Hot" work.
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E).
- 12) General Electrical Safety.
- 13) Hazardous energy control (Machine LOTO).
- 14) Site-Specific Fall Protection & Prevention.
- 15) Excavation/trenching.
- 16) Crane Critical lift.
- 18) Respiratory protection.
- 19) Health hazard control program.
- 20) Heat/Cold Stress Monitoring.
- 21) Crystalline Silica Monitoring (Assessment).
- 22) Demolition plan (to include engineering survey).
- 23) Formwork and shoring erection and removal.
- 24) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 21 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in

accordance with FAR Clause 52.236-13, *Accident Prevention*, until the matter has been rectified.

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

#### **1.5 ACTIVITY HAZARD ANALYSES (AHAS) :**

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site.)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
  - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
  - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
  - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 21 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative.

**1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP) :**

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b) (2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has to be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO
- D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).



**1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures,

accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

#### **1.9 INSPECTIONS:**

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative
- B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
  - 1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
  - 2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
  - 3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
  - 4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

#### **1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:**

- A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental

property damage (both government and contractor) that occur on site. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, , or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.

- B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162 (or equivalent), and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.
- D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

#### **1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE) :**

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:

1. Hard Hats - unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
2. Safety glasses - unless written authorization is given by the Contracting Officer Representative in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative in circumstances of no foot hazards.
4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### **1.12 INFECTION CONTROL**

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the COR . The Infection Control Permits will be posted outside the appropriate construction area. More than one

permit may be issued for a construction project if the work is located in separate areas requiring separate classes. A sample of the required infection control precautions is as follows:

1. Class IV requirements:

a. During Construction Work:

- 1) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 2) Complete all critical barriers i.e. sheetrock, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 3) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 4) Seal holes, pipes, conduits, and punctures.
- 5) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
- 6) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. Shoe covers will be provided by the contractor and will not be provided by the VA.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.
- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
  - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
  - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
  - c. Class III & IV - Seal all penetrations in existing barrier airtight

- d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
  - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
  - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
- 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
  - 2. Barrier Doors: Self Closing One-hour fire-rated solid core wood in steel frame, painted
  - 3. Dust proof one-hour fire-rated drywall
  - 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
  - 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
  - 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
  - 7. Disinfectant: Hospital-approved disinfectant or equivalent product
  - 8. Portable Ceiling Access Module
  - 9. Provide a digital monitor that will be in operation at all times, and shall sound an alarm when the construction site is not under negative pressure.
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated

and trained in infection prevention measures established by the medical center.

- F. A dust control program will be established and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  - 1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  - 2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
  - 3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupy medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  - 4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.



5. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
6. 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 immediately. Remove and dispose of porous materials.
7. 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.

#### I. Final Cleanup:

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

#### J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either

local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

4. Contractor shall verify that no exhaust fumes or odors will be allowed to enter the medical center. The contractor will provide exhaust hoses on equipment, vehicles, etc...to move odors away from the building and HVAC intakes. The contractor shall also provide odor absorbing charcoal filters in air handling units to absorb and control odors so there will be no issues in the medical center.

#### **1.14 FIRE SAFETY**

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas, and the areas that are described in phasing requirements and adjoining areas. Construct partitions of gypsum board and metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  2. Install one-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- 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 Representative.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. In areas under construction where ceilings have been removed have sprinkler turned upright until such time, they are to be reinstalled in the ceiling system. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.
- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from COR at least 4 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative

**P. Smoking: Smoking is prohibited in all locations of the Medical Facility including outdoor locations.**

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

R. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

#### **1.15 ELECTRICAL**

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c).

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly

suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

- E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C) (2) ..

#### **1.16 FALL PROTECTION**

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
  - 1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
  - 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
  - 3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
  - 4. Fall protection while using a ladder will be governed by the OSHA requirements.

**1.17 SCAFFOLDS AND OTHER WORK PLATFORMS**

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
  - 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
  - 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
  - 3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
  - 4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
  - 1. The Competent Person's name and signature;
  - 2. Dates of initial and last inspections.

**1.18 EXCAVATION AND TRENCHES**

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeling, laying in, or stooping within the excavation is required.
- B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE - Obtain Digging Permit from COR ). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater

than 5 feet in depth. Each section of the permit shall be provided to the COR prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the COR. The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time.
2. Specific location and nature of the work.
3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
4. Indication of whether soil or concrete removal to an offsite location is necessary.
5. Indication of whether soil samples are required to determine soil contamination.
6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
7. Indication of review of site drawings for proximity of utilities to digging/drilling.

C. The second section of the permit for excavations greater than five feet in depth shall include the following:

1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT<sup>2</sup> - Type C, 0.5 Tons/FT<sup>2</sup> to 1.5 Tons/FT<sup>2</sup> - Type B, greater than 1.5 Tons/FT<sup>2</sup> - Type A without condition to reduce to Type B).
2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer

designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.

3. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.
4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

D As required by OSHA 29 CFR 1926.651(b) (1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.
2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
3. Digging will not commence until all known utilities are marked.
4. Utility markings will be maintained

E. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

F. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.



**1.19 CRANES**

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date.
- C. A detailed lift plan for all lifts shall be submitted to the COR 21 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of this document.
- D. Crane operators shall not carry loads
  - 1. over the general public or VAMC personnel
  - 2. over any occupied building unless
    - a. the top two floors are vacated
    - b. or overhead protection with a design live load of 300 psf is provided

**1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)**

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

**1.21 CONFINED SPACE ENTRY**

- A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the COR at least 21 days in advance.

**1.22 WELDING AND CUTTING**

Cutting and Welding: The contractor may not issue their own hot work permit, the VA shall issue the hot work permits and the contractor returns them to the VA when work and fire watch are complete.

**1.23 LADDERS**

- A. All ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
  - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
  - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

**1.24 FLOOR & WALL OPENINGS**

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
  - 1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
  - 2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
  - 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
  - 5. Workers are prohibited from standing/walking on skylights.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
- T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- T191-02 (R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
- T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
- A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

F3125/F3125M-15.....Standard Specification for High Strength  
Structural Bolts, Steel and Alloy Steel, Heat  
Treated, 120 ksi (830 MPa) and 150 ksi (1040  
MPa) Minimum Tensile Strength, Inch and Metric  
Dimensions

E. American Welding Society (AWS):

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

### 1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR 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 COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide 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, in compliance with AASHTO T99/T180 Method A
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 COR 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 COR. 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 per \_\_25\_\_ cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136.
- 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 COR.

### **3.2 HELICAL PIERS:**

- A. Witness load test procedure for conformance with ASTM D1143 and interpret test data to verify geotechnical recommendations for pier capacity. Submit load test report in accordance with ASTM D1143.

- B. Review Contractor's equipment, methods, and procedures prior to starting any work on site. Provide continuous inspection of pier installation. Maintain a record of all pertinent phases of operation for submittal to COR.

### **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
2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191.
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:**

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

### **3.5 CONCRETE:**

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

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR .
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.

4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. 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. Label each cylinder with an identification number. COR 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. 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 COR 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. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
  - 1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. 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 RCOR. 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. Perform sampling at fabricating plant. Take two samples from each 23 t (25 tons) or fraction thereof of each size of reinforcing steel No. 10 thru No. 57 (No. 3 thru No. 18).
- C. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- D. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- E. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

### **3.7 MASONRY:**

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

- b. Test 3 samples for each 460 m<sup>2</sup> (5000 square feet) of wall area.
- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m<sup>2</sup> (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

### **3.8 STRUCTURAL STEEL:**

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

- 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
  - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
  - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
  - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
  - i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
  - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 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 F3125 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 F3125 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

### **3.9 STEEL DECKING:**

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to COR.

### **3.10 SHEAR CONNECTOR STUDS:**

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

### **3.11 SPRAYED-ON FIREPROOFING:**

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from COR.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
  - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
  - 1. Thickness: Select one bay per floor, or one bay for each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
  - 2. Density: Take density determinations from each floor, or one test from each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever

provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.

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

- - - E N D - - -

**SECTION 01 45 35  
SPECIAL INSPECTIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This guide specification will be applicable to both new buildings and existing building rehabilitations/renovations. In addition to the Special Inspection and testing specified requirements, a registered design professional must perform structural observations during construction. All observed deficiencies will be immediately reported to the Contracting Officer. The registered design professional performing these observations will be a representative of the Designer of Record (DOR) for the building being constructed.

**1.2 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE)
1. ASCE 7 - (2016;) Minimum Design Loads for Buildings and Other Structures
- C. International Code Council (ICC)
2. ICC IBC - (2018) International Building Code

**1.3 GENERAL REQUIREMENTS**

- A. Perform Special Inspections in accordance with Chapter 17 of ICC IBC. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.
- B. Structural observations will be performed by the contractor's retained special inspector.

**1.4 DEFINITIONS**

- A. Continuous Special Inspections - The constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

- B. Periodic Special Inspections - Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed.
- C. Perform - Perform these Special Inspections tasks for each welded joint or member.
- D. Observe - Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.
- E. Special Inspector (SI) - A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.
- F. Associate Special Inspector (ASI) - A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.
- G. Third Party - A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.
- H. Special Inspector of Record (SIOR) - SIOR must be an independent third party hired directly by the Prime Contractor but is not required for this project.
- I. Contracting Officer - The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).
- J. Contractor's Quality Control (QC) Manager - An individual retained by the prime contractor and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL having the overall responsibility for the contractor's QC organization.
- K. Designer of Record (DOR) - A registered design professional is contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The DOR is also referred to as the Engineer of Record (EOR) in design code documents.

L. Special Inspections - Inspections performed by the special inspector (SI) in accordance with chapter 17 of the ICC IBC.

a. Submittals: Government approval is required for all submittals.

CQC Special Inspection reports shall be submitted under this Specification section and follow the Special Inspection naming convention. Submit the following:

- 1) SD-01 Preconstruction Submittals;
- 2) Special Inspections Project Manual;
- 3) Special Inspections Agency's Written Practices
- 4) NDT Procedures and Equipment' Calibration Records;
- 5) SD-06 Test Reports;
- 6) Special Inspections
- 7) Daily Reports;
- 8) Special Inspections; Biweekly Reports;
- 9) SD-07 Certificates;
- 10) Fabrication Plant
- 11) Certificate of Compliance;
- 12) Special Inspector of Record Qualifications;
- 13) Special Inspector Qualifications;
- 14) Qualification Records for NDT technicians;
- 15) SD-11 Closeout Submittals;
- 16) Interim Final Report of Special Inspections;
- 17) Comprehensive Final Report of Special Inspections;

b. Special Inspector Qualifications: Submit qualifications for each SI, ASI, and the SIOR (if required) from the following certifying associations: Associated Air Balance Council (AABC); American Concrete Institute (ACI); Association of the Wall and Ceiling Industry (AWCI); American Welding Society (AWS); Factory Mutual (FM); International Code Council (ICC); Nondestructive Testing (NDT); National Institute for Certification in Engineering Technologies (NICET); Precast/Prestressed Concrete Institute (PCI); Post-Tensioning Institute (PTI); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums.

**QUALIFICATIONS**

<b>Area</b>	<b>Special Inspector</b>	<b>Associated Special Inspector</b>	<b>SIOR</b>
Steel Construction and High Strength Bolting	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Welding Structural Steel (For highly complex steel use only AWS Certified Welding Inspectors)	ICC Welding Special Inspector certificate with one year of related experience or AWS Certified Welding Inspector	AWS Certified Associate Welding Inspector	
Nondestructive Testing of Welds	NDT Level II Certificate	NDT Level II Certificate plus one year of related experience	
Cold Formed Steel Framing	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or ICC Commercial Building Inspector with one year of experience; or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Concrete Construction	ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or ACI Concrete Construction Special Inspector, or NICET Concrete Technician Level III Certificate in Construction Materials Testing, or, Registered	ACI Concrete Construction Special Inspector in Training, or Engineer-In-Training with one year of related experience	

<b>Area</b>	<b>Special Inspector</b>	<b>Associated Special Inspector</b>	<b>SIOR</b>
	Professional Engineer with related experience		
Masonry Construction	ICC Structural Masonry Special Inspector Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Verification of Site Soil Condition, Fill Placement, and Load-Bearing Requirements	ICC Soils Special Inspector Certificate with one year of related experience, or NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction, or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Deep Foundations	NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or	

<b>Area</b>	<b>Special Inspector</b>	<b>Associated Special Inspector</b>	<b>SIOR</b>
	Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Sprayed Fire Resistant Manual	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Mastic and Intumescent Fire Resistant Coatings	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	
Exterior Insulation and Finish Systems (EIFS)	AWCI EIFS Inspector Certificate, or Exterior Design Institute Certificate, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Fire-Resistant Penetrations and Joints	Passed the UL Firestop Exam with one year of related experience, or Passed the FM Firestop Exam with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	



Area	Special Inspector	Associated Special Inspector	SIOR
Smoke Control	AABC Technician Certification with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	

## PART 2 - PRODUCTS

### 2.1 FABRICATORS SPECIAL INSPECTION

- A. Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with IBC special inspections tables unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the applicable certification(s) from the following list to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.
- B. The following certifications meet the requirements for fabricator approval in accordance with paragraph 1704.2.5.2 of IBC:
  1. American Institute of Steel Construction (AISC) Certified Fabrication Plant, Category STD.
  2. Precast Concrete Institute (PCI) Certified Plant, Group C
- C. At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance the construction documents.

## PART 3 - EXECUTION

### 3.1 RESPONSIBILITIES MATRIX

Inspector	Responsibility	Condition
QC Manager	a. If there is no SIOR, QC Manager must Supervise all Special Inspectors required by the contract documents and the IBC; Verify the qualifications of all of the Special Inspectors; Verify the qualifications of fabricators; Maintain a 3-ring binder for the Special Inspector's daily and biweekly reports. This file must be located	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.	
	b. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	
Special Inspectors	a. Inspect all elements of the project for which the special inspector is qualified to inspect. b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.	
	c. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: <ol style="list-style-type: none"> <li>1. The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel.</li> <li>2. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.</li> </ol> d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. e. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.	Applicable when SIOR is NOT required and when the structural design is required to follow AISC 341 for seismic design of steel structures
	f. Submit a copy of the daily reports to the QC Manager. g. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report. h. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: <ol style="list-style-type: none"> <li>1. A brief summary of the work performed during the reporting time frame</li> <li>2. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they</li> </ol>	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	<p>require seismic systems that were observed during the reporting period.</p> <p>3. Discrepancies which were resolved or corrected.</p> <p>4. A list of nonconforming items requiring resolution.</p> <p>5. All applicable test result including nondestructive testing reports.</p> <p>j. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.</p>	

### 3.2 DEFECTIVE WORK

- A. Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Government to accept such work.

-- End of Section --

**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. 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 (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Contracting Officer 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 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.
- l. Inclusion of "best management practices" and methodologies.

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

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

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the COR.

Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, landforms, 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 10 year (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.

- b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTHWORK.
  - 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 shown. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
- 6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
- 7. Manage and control spoil areas on Government property to limit spoil to areas shown and prevent erosion of soil or sediment from entering nearby water courses or lakes.
- 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
- 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
- 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
- 11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.



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

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

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

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

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

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

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

- b. Use shields or other physical barriers to restrict noise transmission.
- c. Provide soundproof housings or enclosures for noise-producing machinery.
- d. Use efficient silencers on equipment air intakes.

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

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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:
- D. Techniques to minimize waste generation.
- E. Sorting and separating of waste materials.
- F. Salvage of existing materials and items for reuse or resale.
- G. Recycling of materials that cannot be reused or sold.
- H. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inserts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywd, part. board and I-joists,etc).
  - 6. Metal products (eg, steel, wire, copper,etc).
  - 7. Sheathings
  - 8. Cardboard, paper and packaging.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

**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 25 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### 1.4 TERMINOLOGY

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

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

### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
  2. Techniques to be used to minimize waste generation.
  3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection where applicable.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
      - a) The names and locations of mixed debris reuse and recycling facilities or sites.
      - b) The names and locations of trash disposal landfill facilities or sites.
      - c) Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.
- E. Target waste diversion rate by material and an overall diversion rate.
- F. Final report documenting the results of implementation of the preconstruction waste management plan.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction.
  1. Green Building Initiative (GBI): Green Globes for New Construction 2019.

#### **1.7 RECORDS**

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



quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

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

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

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

### **3.2 DISPOSAL**

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

### **3.3 REPORT**

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

fees, manifests, invoices. Include the net total costs for each disposal.

- - - E N D - - -

**SECTION 01 91 00****GENERAL COMMISSIONING REQUIREMENTS****PART 1 - GENERAL (GENERAL CONTRACTOR TO PROVIDE COMMISSIONING AGENT)****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. The General Contractor shall provide a commissioning agent as part of this project. The General Contractor shall submit proof of qualifications of the Commissioning Agent for COR review and approval
- B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA COR and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the COR and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the COR.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing

agencies, etc.) is essential to the success of the Commissioning effort.

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

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

### **1.3 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- C. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.

- D. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- E. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- F. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
- G. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.
- H. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- I. Section 33 08 00 COMMISSIONING OF SITE UTILITIES.

#### 1.4 SUMMARY

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

#### 1.5 ACRONYMS

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

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

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

## 1.6 DEFINITIONS

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Site Observation Visit:** On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component,

equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

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

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

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

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

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

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

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

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

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

**Training Plan:** A written document that details, in outline form the expectations of the operator training. Training agendas should include

instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

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

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

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

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

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

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

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

### 1.7 SYSTEMS TO BE COMMISSIONED

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

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

Systems To Be Commissioned	
System	Description
<b>Building Exterior Closure</b>	
Foundations (excluding structural)	Standard, special, slab-on-grade, vapor barriers, air barriers
Superstructure	Floor construction, roof construction, sunshades, connections to adjacent structures
Exterior Closure	Exterior walls, exterior windows, exterior doors, louvers, grilles and sunscreens,
Roofing	Roof system (including parapet), roof openings (skylights, pipe chases, ducts, equipment curbs, etc.)
Note:	The emphasis on commissioning the above building envelope systems is on control of air flow, heat flow, noise, infrared, ultraviolet, rain penetration, moisture, durability, security, reliability, constructability, maintainability, and sustainability.
<b>Equipment</b>	
Parking Control Equipment	Barriers /Gate System
<b>Fire Suppression</b>	
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
<b>Plumbing</b>	
Domestic Water Distribution	Backflow preventers



<b>Systems To Be Commissioned</b>	
<b>System</b>	<b>Description</b>
Domestic Hot Water Systems	Heat exchangers, circulation pumps
<b>HVAC</b>	
Noise and Vibration Control	Noise and vibration levels for critical equipment such as Air Handlers, Chillers, Cooling Towers, Boilers, Generators, etc. will be commissioned as part of the system commissioning
Direct Digital Control System**	Operator Interface Computer, Operator Work Station (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. [DDC Control panels will be commissioned with the systems controlled by the panel]
HVAC Air Handling Systems	Air handling Units, humidifiers, DDC control panels
HVAC Ventilation/Exhaust Systems	General exhaust, toilet exhaust
HVAC Terminal Unit Systems	VAV Terminal Units, fin-tube radiation
Humidity Control Systems	Humidifiers, controls, interface with facility DDC
Hydronic Distribution Systems	DDC control panels, heat exchangers,
<b>Electrical</b>	
Medium-Voltage Electrical Distribution Systems	Medium-Voltage Switchgear, Medium-Voltage Switches, Underground ductbank and distribution, Pad-Mount Transformers, Medium-Voltage Load Interrupter Switches,
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Electric Power Monitoring Systems	Metering, sub-metering, power monitoring systems, PLC control systems

<b>Systems To Be Commissioned</b>	
<b>System</b>	<b>Description</b>
Electrical System Protective Device Study	Review reports, verify field settings consistent with Study
Low-Voltage Distribution System	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)
Lighting & Lighting Control** Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, theatrical dimming systems, exterior lighting and controls
<b>Communications</b>	
Grounding & Bonding System	Witness 3rd party testing, review reports
Structured Cabling System	Witness 3rd party testing, review reports
Public Address & Mass Notification Systems	Witness 3rd party testing, review reports
<b>Electronic Safety and Security</b>	
Grounding & Bonding	Witness 3rd party testing, review reports
Physical Access Control Systems	Witness 3rd party testing, review reports
Access Control Systems	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw- down test, verify system monitoring, verify interface with other systems.
<b>Site Utilities</b>	
Water Utilities	Water Service Entrance, Backflow Prevention, Pressure Control, Booster Pumps, Irrigation Systems

<b>Systems To Be Commissioned</b>	
<b>System</b>	<b>Description</b>
Sanitary Sewerage Utilities	Sanitary Connection, Waste Treatment Systems
Storm Drainage Utilities	Storm Water Connection, Site Storm Water Distribution
<b>Transportation</b>	
Active Traffic Barrier Systems	Witness 3rd party testing
<b>Integrated Systems Tests</b>	
Loss of Power Response	Loss of power to building, loss of power to campus, restoration of power to building, restoration of power to campus.
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal
<b>Table Notes</b>	
** Denotes systems that LEED requires to be commissioned to comply with the LEED Fundamental Commissioning pre-requisite.	

## 1.8 COMMISSIONING TEAM

- A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent hired by general contractor.
- 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. User: Representatives of the facility user and operation and maintenance personnel.

2. A/E: Representative of the Architect and engineering design professionals.

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

- A. 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.

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

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

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

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

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

for maintenance and component replacement or repair, and for general conformance with the Construction Documents.

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

#### **1.12 COMMISSIONING DOCUMENTATION**

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

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

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



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

1. Creating an Commissioning Issues Log Entry:

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

2. Documenting Issue Resolution:

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

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans

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

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

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

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

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

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

### **1.13 SUBMITTALS**

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

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

during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.

- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA COR with copies to the Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:

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

#### **1.14 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 31 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 31 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.15 QUALITY ASSURANCE**

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

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

#### **1.16 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.

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

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

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

**PART 3 - EXECUTION****3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES**

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

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Meetings	Construction Commissioning Kick Off meeting	L	A	A	P	O	
	Commissioning Meetings	L	A	A	P	O	
	Project Progress Meetings	P	A	A	L	O	
	Controls Meeting	L	A	A	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	A	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	A	R	O	
Schedules	Duration Schedule for Commissioning Activities	L	A	A	R	N/A	



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

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

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

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	L	S	R	P	P	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

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

Warranty Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
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 Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

### 4. Execution of Equipment Startup

- a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
- b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
- c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
- d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

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

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

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

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

### **3.4 PHASED COMMISSIONING**

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

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

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

shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the COR and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
  - 1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the COR. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the COR, prior to the execution of Systems Functional Performance Testing.
  - 2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.



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

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

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire	DO	COV	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
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
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve 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 HEX-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
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-3 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-3 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
HW Pump 1 Status	DI	COV	12 Hours	3 Days	C	Status< > command	30 Min
HW Pump 2 Status	DI	COV	12 Hours	3 Days	C	Status< > command	30 Min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 Days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 Days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station Bypass Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 Days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 Days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 Days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 Days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified

after submission shall be recorded and resubmitted to the COR and Commissioning Agent.

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

<b>SYSTEM</b>		
<b>Sensor</b>	<b>Calibration Frequency</b>	<b>O&amp;M Calibration Procedure Reference</b>
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.

<b>AIR HANDLING UNIT M-AHU085</b>				
<b>Control Reference</b>	<b>Proportional Constant</b>	<b>Integral Constant</b>	<b>Derivative Constant</b>	<b>Interval</b>
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: Expand Building 1 For Primary Care

6. Project Number: 437-315
  7. Participating parties
  8. A copy of the specification section describing the test requirements
  9. A copy of the specific sequence of operations or other specified parameters being verified
  10. Formulas used in any calculations
  11. Required pretest field measurements
  12. Instructions for setting up the test.
  13. Special cautions, alarm limits, etc.
  14. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
  15. 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.
  16. A section for comments.
  17. 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 21 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.
- K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

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

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

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

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

4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
  5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

### **3.8 DEFERRED TESTING**

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

### 3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's COR, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 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.
  - c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
  - d. Narration: Describe scenes on video recording by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - e. Submit two copies within seven days of end of each training module.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. Quality Assurance:

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

E. Training Coordination:

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

F. Instruction Program:

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
  - b. Intrusion detection systems.
  - c. Heat generation, including pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
  - d. Refrigeration systems, including condensers, pumps, and distribution piping.
  - e. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - f. HVAC instrumentation and controls.
  - g. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - h. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - i. Lighting equipment and controls.
  - j. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - k. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

----- END -----





**SECTION 02 41 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTHWORK
- B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- I. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal

construction at dust chutes to protect persons and property from falling debris.

- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
  - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR . The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and Section 01 35 26, SAFETY REQUIREMENTS.

**1.4 UTILITY SERVICES:**

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

**PART 2 - PRODUCTS (NOT USED)****PART 3 - EXECUTION****3.1 DEMOLITION:**

- A. Completely demolish and remove portions buildings, site and structures, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new utility service lines.
  - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR . When Utility

lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

**3.2 CLEAN-UP:**

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

- - - E N D - - -

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

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

**1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN**

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

**1.4 TOLERANCES**

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

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

#### **1.5 REGULATORY REQUIREMENTS**

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

#### **1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
  1. Reinforcing Steel.
  2. Cement.
- D. Manufacturer's Certificates:
  1. Abrasive aggregate.
  2. Air-entraining admixture.
  3. Chemical admixtures, including chloride ion content.
  4. Burlap or film for curing concrete.
  5. Liquid membrane-forming compounds for curing concrete.
  6. Non-shrinking grout.
  7. Liquid hardener.
  8. Expansion joint filler.
  9. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.

- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement, fly ash, ratio curves, concrete mix ingredients, and admixtures.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

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

#### **1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 117-10.....Specifications for Tolerances for Concrete Construction and Materials and Commentary
  - 211.1-91(R2009).....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
  - 214R-11(R2019).....Guide to Evaluation of Strength Test Results of Concrete
  - 301-16.....Specifications for Structural Concrete
  - 304R-00(R2009).....Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305.1-14.....Specification for Hot Weather Concreting
  - 306.1-90(R2002).....Standard Specification for Cold Weather Concreting
  - 308.1-11.....Specification for Curing Concrete
  - 309R-05.....Guide for Consolidation of Concrete
  - 318/318-19.....Building Code Requirements for Structural Concrete and Commentary
  - 347R-14.....Guide to Formwork for Concrete

- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
- A135.4-2012.....Basic Hardboard
- D. ASTM International (ASTM):
- A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
- A653/A653M-20.....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
- A706/A706M-16.....Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- A767/A767M-19.....Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement
- A775/A775M-19.....Standard Specification for Epoxy Coated Steel Reinforcing Bars
- A820/820M-16.....Standard Specification for Steel Fibers for Fiber Reinforced Concrete
- A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement
- A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- C31/C31M-19a.....Standard Practice for Making and Curing Concrete Test Specimens in the field
- C33/C33M-18.....Standard Specification for Concrete Aggregates
- C39/C39M-20.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C94/C94M-19a.....Standard Specification for Ready Mixed Concrete
- C143/C143M-20.....Standard Test Method for Slump of Hydraulic Cement Concrete
- C150C150M-20.....Standard Specification for Portland Cement
- C171-16.....Standard Specification for Sheet Materials for Curing Concrete
- C172C172M-17.....Standard Practice for Sampling Freshly Mixed Concrete



C173/C173M-16.....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Volumetric Method

C192/C192M-19.....Standard Practice for Making and Curing  
Concrete Test Specimens in the Laboratory

C231/C231M-17a.....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Pressure Method

C260/C260M-10a (2016) ....Standard Specification for Air Entraining  
Admixtures for Concrete

C309-19.....Standard Specification for Liquid Membrane  
Forming Compounds for Curing Concrete

C330/C330M-17a.....Standard Specification for Lightweight  
Aggregates for Structural Concrete

C494/C494M-19.....Standard Specification for Chemical Admixtures  
for Concrete

C618-19.....Standard Specification for Coal Fly Ash and Raw  
or Calcined Natural Pozzolan for Use in  
Concrete

C666/C666M-15.....Standard Test Method for Resistance of Concrete  
to Rapid Freezing and Thawing

C881/C881M-20.....Standard Specification for Epoxy Resin Base  
Bonding Systems for Concrete

C1107/1107M-20.....Standard Specification for Packaged Dry,  
Hydraulic-Cement Grout (Non-shrink)

C1315-19.....Standard Specification for Liquid Membrane  
Forming Compounds Having Special Properties for  
Curing and Sealing Concrete

D6/D6M-95 (2018) .....Standard Test Method for Loss on Heating of Oil  
and Asphaltic Compounds

D297-15 (2019) .....Standard Test Methods for Rubber Products  
Chemical Analysis

D412-16.....Standard Test Methods for Vulcanized Rubber and  
Thermoplastic Elastomers - Tension

D1751-18.....Standard Specification for Preformed Expansion  
Joint Filler for Concrete Paving and Structural  
Construction (Non-extruding and Resilient  
Bituminous Types)

D4263-83 (2018) .....Standard Test Method for Indicating Moisture in  
Concrete by the Plastic Sheet Method.

- E1155-20.....Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers
- F1249-20.....Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
- F1869-16a.....Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. American Welding Society (AWS):
- D1.4/D1.4M-18.....Structural Welding Code - Steel Reinforcing Bars
- F. Concrete Reinforcing Steel Institute (CRSI):
- Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
- Report On.....Concrete Sealers for the Protection of Bridge Structures
- H. U. S. Department of Commerce Product Standard (PS):
- PS 1-07.....Structural Plywood
- PS 20-20.....American Softwood Lumber Standard

## **PART 2 - PRODUCTS**

### **2.1 FORMS**

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
1. 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)

2. 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.

3. 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

G. Concrete products shall comply with following standards for biobased materials:

Material Type	Percent by Weight
Concrete Penetrating Liquid	79 percent biobased material
Concrete form Release Agent	87 percent biobased material
Concrete Sealer	11 percent biobased material

The minimum-content standards are based on the weight (not the volume) of the material.

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

## 2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I, II, or I/II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent. Do not exceed more than 25 percent total cementitious content by weight.

C. Coarse Aggregate: ASTM C33.

1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.

2. Coarse aggregate for interior slabs on grade shall conform to the following:


a. Dense or well graded aggregate.

1) Percent retained on each sieve below the top size and above the No. 100 sieve:

a) 8 to 18 percent for 1-1/2 inches (38 mm) top size.

b) 8 to 22 percent for 3/4 or 1 inch (19 or 25 mm) top size.

- 2) The above requirements may be deviated from based on locally available material.
  - a) One or two non-adjacent sieves sizes may fall outside of the limits set above.
  - b) Percent retained on two adjacent sieves sizes shall not be less than 5 percent of the above required.
  - c) Percent retained on three adjacent sieve sizes shall not be less than 8 percent of the above required.
  - d) When the percent retained on each of two adjacent sieve sizes is less than 8 percent the total percent retained on either of these sieves and the adjacent outside sieve should be at least 13 percent (for example, if both the No. 4 and No. 8 (4.75 and 2.36 mm) sieves have 6 percent retained on each item then: 1. the total retained on the 3/8 inch and No. 4 (9.5 and 4.75 mm) sieves should be at least 13 percent, and 2. the total retained on the No. 8 and No. 16 (2.36 and 1.18 mm) sieves should be at least 13 percent.
3. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
4. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150  $\mu$ m (No. 100) sieve.
- E. Mixing Water: Fresh, clean, and potable.
- F. Admixtures:
  1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
  2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
  3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water. Use of superplasticizer requires COR approval.

4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
6. Microsilica: Use only with prior review and acceptance of the COR. Use only in conjunction with high range water reducer.
7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- G. Vapor Barrier: ASTM F1249, 0.38 mm (15 mil) WVT 0.007 foot/hour.
- H. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- I. Welded Wire Fabric: ASTM A185.
- J. Reinforcing Bars to be Welded: ASTM A706.
- K. Epoxy Coated Reinforcing Bars: ASTM A775.
- L. Cold Drawn Steel Wire: ASTM A1064.
- M. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m<sup>2</sup> (1.5 pounds per square yard), or square mesh at .6Kg/m<sup>2</sup> (1.17 pounds per square yard).
- N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface. 
- R. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer. Use only on exposed slab. Do not use where floor is covered with resilient flooring, paint or other finish coating.

S. Moisture Vapor Emissions & Alkalinity Control Sealer: 100 percent active colorless aqueous silicate solution concrete surface.

1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34 percent solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.

2. MVE 15-Year Warranty:

- a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

T. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

U. Adhesive Binder: ASTM C881.

V. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

W. Fibers:

1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m<sup>3</sup> (1.5 lb. per cubic yard). Product shall have a UL rating.

- X. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
- Y. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

### 2.3 CONCRETE MIXES

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
  - 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
  - 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, 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-cement -fly ash ratio, and consistency of each cylinder in terms of slump.
  - 3. Prepare a curve showing relationship between water-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. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify the COR immediately when change in source is anticipated.
  - 1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of the COR 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. The COR 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.

- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums unless noted otherwise. Use Fly Ash as an admixture with maximum of 25 percent replacement by weight in all structural work.

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

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
35 (5000)1,2	375 (630)	0.45	385 (650)	0.40
30 (4000)1,2	325 (550)	0.50	340 (570)	0.50
25 (3000)1,2	280 (470)	0.65	290 (490)	0.55
25 (3000)1	300 (500)	See 3 below	310 (520)	See 3 below

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of  $f'_c$ . For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of  $f'_c$ .
  2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
  3. Determined by Laboratory in accordance with ACI 211.1 for normal concrete.
- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in construction documents.
- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches). This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with construction documents. Determine air content by either ASTM C173 or ASTM C231.
- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive



strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see construction documents.
- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, the COR may require any one or any combination of the following corrective actions, at no additional cost to the Government:
  1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
  2. Require additional curing and protection.
  3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, the COR may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
  4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, the COR may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.

5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COR.

## 2.4 BATCHING AND MIXING

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by the COR. 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 degrees C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

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

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

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. General: in accordance with ACI 347.
- Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the COR approves their reuse.
  - Provide forms for concrete footings unless the COR determines forms are not necessary.
  - Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

- B. Treating and Wetting: Treat or wet contact forms as follows:
1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
  2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
  3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, walers and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of walers and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.

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

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

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

I. Construction Tolerances:

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

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

### 3.2 PLACING REINFORCEMENT

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

- threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of the COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs approved testing laboratory retained by the contractor will perform load test.
  - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs approved testing laboratory retained by the contractor will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the COR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

### **3.3 VAPOR BARRIER**

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
  - 1. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
  - 2. Patch punctures and tears.

### **3.4 CONSTRUCTION JOINTS**

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by the COR.

### **3.5 EXPANSION JOINTS AND CONTRACTION JOINTS**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

### 3.6 PLACING CONCRETE

#### A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by the COR before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

#### B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

##### 1. Preparing surface for applied topping:

- a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
- b. Broom clean and keep base slab wet for at least four hours before topping is applied.
- c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

#### C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of the COR.

#### D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
7. Concrete on metal deck:
  - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
    - 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.



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

### **3.7 HOT WEATHER**

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

### **3.8 COLD WEATHER**

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

### **3.9 PROTECTION AND CURING**

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

overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.

3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

### **3.10 REMOVAL OF FORMS**

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

### **3.11 CONCRETE SURFACE PREPARATION**

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

sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

### **3.12 CONCRETE FINISHES**

#### **A. Slab Finishes:**

1. **Monitoring and Adjustment:** Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to the COR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments, if approved by COR. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless the COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and

- filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
  7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
  8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
  9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
  10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by the COR from sample panel.
  11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    - a. Areas covered with carpeting, or not specified otherwise in b. below:

## 1) Slab on Grade:

- a) Specified overall value FF 25/FL 20
- b) Minimum local value FF 17/FL 15

## 2) Level suspended slabs (shored until after testing) and topping slabs:

- a) Specified overall value FF 25/FL 20
- b) Minimum local value FF 17/FL 15

## 3) 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:

## 1) Slab on grade:

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

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

- a) Specified overall value FF 30/FL 20
- b) Minimum local value FF 24/FL 15

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

## c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.

## d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

## 12. Measurements

- a. Department of Veterans Affairs approved testing laboratory retained by the contractor will take measurements as directed by the COR, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays

excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs approved testing laboratory retained by the contractor.

- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
13. Acceptance/ Rejection:
- a. If individual slab section measures less than either of specified minimum local  $F_F/F_L$  numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
  - b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall  $F_F/F_L$  numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by the COR, until a slab finish constructed within specified tolerances is accepted.

### **3.13 SURFACE TREATMENTS:**

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

**SECTION 04 05 13  
MASONRY MORTARING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

**1.2 RELATED REQUIREMENTS**

A. Mortar used in Section:

1. Section 04 05 16, MASONRY GROUTING.
2. Section 04 20 00, UNIT MASONRY.
3. Section 04 72 00, CAST STONE MASONRY.

B. Mortar Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 APPLICABLE PUBLICATIONS**

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

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

**1.4 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.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.

- 3. Mortar cement.
- 4. Hydrated lime.
- 5. Fine aggregate.
- 6. Color admixture.
- E. Qualifications: Substantiate qualifications comply with specifications.
  - 1. Testing laboratory.

#### **1.5 QUALITY ASSURANCE**

- A. Preconstruction Testing:
  - 1. Engage independent testing laboratory to perform tests and submit reports.
    - a. Deliver samples to laboratory in number and quantity required for testing.
  - 2. Test mortar and materials specified.
  - 3. Mortar:
    - a. Test for compressive strength and water retention according to ASTM C270.
    - b. Minimum Mortar compressive strengths 28 days:
      - 1) Type M: 17.2 MPa (2,500 psi).
      - 2) Type S: 12.4 MPa (1,800 psi).
  - 4. Non-Staining Cement: Test for water soluble alkali.
    - a. Water Soluble Alkali: Maximum 0.03 percent.
  - 5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

#### **1.6 DELIVERY**

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.7 STORAGE AND HANDLING**

- A. Store masonry materials under waterproof covers on planking clear of ground.
  - 1. Protect loose, bulk materials from contamination.
- B. Protect products from damage during handling and construction operations.



**1.8 WARRANTY**

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

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Hydrated Lime: ASTM C207, Type S.
- B. Aggregate for Masonry Mortar: ASTM C144 and as follows:
  - 1. Light colored sand for mortar for laying face brick.
  - 2. White plastering sand meeting sieve analysis for mortar joints for pointing and laying of structural facing tile units except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
  - 3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.
- C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.
- D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.
  - 1. Use white masonry cement whenever white mortar is specified.
- E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.
- F. Portland Cement: ASTM C150/C150M, Type I.
  - 1. Use white Portland cement wherever white mortar is specified.
- G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.
- H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

**2.2 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run .

**2.3 MIXES**

- A. Pointing Mortar for New Work:
  - 1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
  - 2. Pointing Mortar for Glazed Structural Facing Tile:

- a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.
- B. Masonry Mortar: ASTM C270.
  - 1. Admixtures:
    - a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
    - b. Do not use antifreeze compounds.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

#### **3.2 MIXING**

- A. Measure ingredients by volume using known capacity container.
- B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar Stiffened Because of Water Loss Through Evaporation:
  - 1. Re-temper by adding water to restore to proper consistency and workability.
  - 2. Discard mortar reaching initial set or unused within two hours of mixing.
- E. Pointing Mortar:
  - 1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
  - 2. Allow mortar to stand in dampened condition for 60 to 90 minutes.
  - 3. Add water to bring mortar to a workable consistency before use.

#### **3.3 MORTARING**

- A. Type M Mortar: Use for masonry below grade .
- B. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered) and setting cast stone and engineered reinforced unit masonry work.
- C. Brick Veneer Over Frame Back Up Walls: Use Type S Portland cement-lime mortar.
- D. Type N Mortar: Use for other masonry work.

E. Type N Mortar: Use for pointing items and tuck pointing specified.

**3.4 FIELD QUALITY CONTROL**

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Take and test samples during progress of work according to ASTM C780.

- - E N D - -

**SECTION 04 05 16  
MASONRY GROUTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes: Grout for filling hollow concrete masonry cores.

**1.2 RELATED WORK**

- A. Section 04 20 00, UNIT MASONRY: Grout
- B. Section 04 72 00, CAST STONE MASONRY: Grout
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Grout Color
- D. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ready-Mixed Grout.
- E. Section 09 91 00, PAINTING

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section  
American National Standards Institute (ANSI):  
A118.6-19 - .....Standard Cement Grouts for Tile Installation.
- B. ASTM International (ASTM):  
C40/C40M-20 - .....Organic Impurities in Fine Aggregates for  
Concrete.  
C150/C150M-20 - .....Portland Cement.  
C207-18 - .....Hydrated Lime for Masonry Purposes.  
C404-18 - .....Aggregates for Masonry Grout.  
C476-20 - .....Grout for Masonry.  
C595/C595M-20 - .....Blended Hydraulic Cement.  
C979/C979M-16 - .....Pigments for Integrally Colored Concrete.  
C1019-19 - .....Sampling and Testing Grout.

**1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
- C. Test Reports: Certify each product complies with specifications.
  - 1. Grout, each type.
  - 2. Cement.
  - 3. Aggregate.
- D. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.
3. Grout.
4. Hydrated lime.
5. Aggregate.
6. Color admixture.

#### **1.5 QUALITY ASSURANCE**

##### **A. Preconstruction Testing:**

1. Engage independent testing laboratory to perform tests and submit reports.
  - a. Deliver samples to laboratory in number and quantity required for testing.
2. Grout:
  - a. Test compressive strength according to ASTM C1019 standard.
3. Cement:
  - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
  - b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
4. Aggregate:
  - a. Test for deleterious substances, organic impurities, soundness and grading.

#### **1.6 DELIVERY**

- 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.

#### **1.7 STORAGE AND HANDLING**

- A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.
- B. Protect products from damage during handling and construction operations.

#### **1.8 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Grout Components:

1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
4. Portland Cement: ASTM C150, Type I.
5. Liquid Acrylic Resin:
  - a. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.
6. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

## **2.2 PRODUCTS - GENERAL**

- A. Provide each product from one manufacturer and from one production run .

## **2.3 MIXES**

- A. Grout: ASTM C476; fine grout and coarse grout.
- B. Ready-Mixed Grout: ANSI A118.8.

## **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. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.
- D. Remove debris from grout spaces.
- E. Verify reinforcement is correctly placed before placing grout.

### **3.2 MIXING**

- A. Mix grout in mechanically operated mixer.
  1. Mix grout for five minutes, minimum.
- B. Measure ingredients by volume using container of known capacity.
- C. Mix water with grout dry ingredients.
  1. Slump Range: 200 to 275 mm (8 to 11 inches).

### **3.3 GROUTING**

- A. Install grout according to Section 04 20 00, UNIT MASONRY.
- B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.
- C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).

D. Use grout for filling bond beam or lintel units.

- - E N D - -

**SECTION 04 20 00  
UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Concrete masonry unit (CMU) and Face Brick assemblies for:
1. Exterior walls.

**1.2 RELATED REQUIREMENTS**

- A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American Concrete Institute (ACI):
1. 315-99 - Details and Detailing of Concrete Reinforcement.
  2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
- C. ASTM International (ASTM):
1. A615/A615M-15a1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
  3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  4. C34-13 - Structural Clay Load-Bearing Wall tile.
  5. C55-14a - Concrete Building Brick.
  6. C56-13 - Structural Clay Nonloadbearing Tile.
  7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
  8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
  9. C90-14 - Load-Bearing Concrete Masonry Units.
  10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
  11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
  12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
  13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
  14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
  15. D2240-05(2010) - Rubber Property-Durometer Hardness.
  16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.
- D. American Welding Society (AWS):



1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.
- E. Brick Industry Association (BIA):
1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.
- F. Federal Specifications (Fed. Spec.):
1. FF-S-107C(2) - Screws, Tapping and Drive.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
  2. Special masonry shapes, profiles, and placement.
  3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
- C. Manufacturer's Literature and Data:
1. Description of each product.
  2. Installation instructions.
- D. Samples:
1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
  2. Concrete masonry units, when exposed in finish work.
  3. Anchors and Ties: Each type.
  4. Joint Reinforcing: 1200 mm (48 inches) long each type.
- E. Certificates: Certify products comply with specifications.
1. Face brick.
  2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.

#### **1.5 QUALITY ASSURANCE**

- A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.
- B. Mockups:
1. Before starting masonry, build a mockup panel minimum 1800 mm by 1800 mm (6 feet by 6 feet) with 600 mm (24 inch) 90 degree return for outside corner.
    - a. Use masonry units from random cubes of units delivered on site.
    - b. Include the use of cast stone units.

- c. Include structural backup, reinforcing, ties, and anchors.
- 2. Mockup panel approved by A/E and Contracting Officer's Representative set workmanship and aesthetic quality for masonry work.
- 3. Clean sample panel to test cleaning methods.
- 4. Remove mockup panel when directed by Contracting Officer's Representative.

#### **1.6 DELIVERY**

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.7 STORAGE AND HANDLING**

- A. Store products above grade, protected from contamination.
- B. Protect products from damage during handling and construction operations.

#### **1.8 FIELD CONDITIONS**

- A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

#### **1.9 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run .

#### **2.2 UNIT MASONRY PRODUCTS**

- A. Brick:
  - 1. Face Brick:
    - a. ASTM C216, Grade SW, Type FBS.
    - b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
    - c. Size:

- 1) Modular.
- 2. One Face Exposed: Grade S, Type I.
- B. Concrete Masonry Units (CMU):
  - 1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
    - a. Unit Weight: Normal weight
    - b. Fire rated units for fire rated partitions.
  - 2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
  - 3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
  - 4. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).

### **2.3 ANCHORS, TIES, AND REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.
- B. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951/A951M.
  - 2. Hot dipped galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
  - 6. Joint reinforcement with crimp formed drip is not acceptable.
  - 7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
  - 8. Ladder Design:
    - a. Longitudinal wires deformed 4 mm (0.16 inch).
    - b. Cross wires 2.6 mm (0.10 inch).
  - 9. Trussed Design:
    - a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.
  - 10. Multiple Wythes and Cavity Wall Ties:
    - a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.

- b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Framed Walls:

1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either loop or angle type; provide only one type throughout.
3. Loop Type:
  - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
  - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
4. Angle Type:
  - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
  - b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm (2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.

3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.
2. Adjustable Cavity Wall Ties:
  - a. Adjustable wall ties may be furnished at Contractor's option.
  - b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
  - c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
  - d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).
  - e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):

1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:

1. Form from 1.5 mm (0.06 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths to extend minimum 100 mm (4 inches) into joints of masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

## 2.4 ACCESSORIES

A. Weeps:

1. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

B. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

C. Preformed Compressible Joint Filler:

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

3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp. 1800 degrees F.
- D. Box Board:
  1. Mineral Fiber Board: ASTM C612, Type 1.
  2. 25 mm (1 inch) thickness.
  3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.
- E. Masonry Cleaner:
  1. Detergent type cleaner selected for each type masonry.
  2. Acid cleaners are not acceptable.
  3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- F. Fasteners:
  1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
  2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
  3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.
- G. Welding Materials: AWS D1.4/D1.4M, type to suit application.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings.
  1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- C. Wall Openings:
  1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  2. When items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
  1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  2. Tool while mortar is soft enough to be compressed into joints and not raked out.

3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Lintels:

1. Openings 1025 mm to 1600 mm (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units unless shown otherwise.
2. Use steel lintels, for openings greater than 1600 mm (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
3. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
4. Lintel Bearing Length: Minimum 200 mm (8 inches) at both ends.
5. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

F. Wall, Furring, and Partition Units:

1. Lay out field units to provide one-half running bond, unless indicated otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Minimum Masonry Unit Length: 100 mm (4 inches).
5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.

G. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.

H. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

I. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

J. Structural Steel Encased in Masonry:

1. Do not install spacing material where steel is bearing on masonry or masonry is bearing on steel.

K. Chases:

1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
3. Fill recess chases after installation of conduit, with mortar and finish flush.
4. When pipes or conduits, or both occur in hollow masonry unit partitions retain minimum one web of hollow masonry units.

L. Wetting and Wetting Test:

1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

M. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

N. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

O. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

### **3.2 INSTALLATION - ANCHORAGE**

A. Veneer to Framed Walls:

1. Install adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.
3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.



2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:

1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:

1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to

existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.

4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:

1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
2. Space at maximum 400 mm (16 inches) on center in both directions.

F. Anchorage to Steel Beams or Columns:

1. Use adjustable beam anchors on each flange.
2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

### 3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:

1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.
5. Wherever brick masonry is backed up with stacked bond masonry, install multiple wythe joint reinforcement in every two courses of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:

1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for

horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.

2. Bond Beams:

- a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
- b. Brake bond beams only at expansion joints and at control joints.

3. Grout openings:

- a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
- b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
- c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

**3.4 INSTALLATION - BRICK EXPANSION JOINTS**

- A. Provide brick expansion joint (EJ) where indicated on drawings.
- B. Keep joint free of mortar and other debris.
- C. Joints Occur In Masonry Walls:
  - 1. Install preformed compressible joint filler in brick wythe.
- D. Interrupt joint reinforcement at expansion and control joints.
- E. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

**3.5 INSTALLATION - BUILDING EXPANSION JOINTS**

- A. Keep expansion joints open and free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

**3.6 INSTALLATION - ISOLATION JOINT**

- A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.
- B. Insert continuous full width strip of non-combustible type compressible joint filler.

- C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

### 3.7 INSTALLATION - BRICKWORK

- A. Lay clay brick according to BIA TN 11B.
- B. Laying:
  - 1. Lay brick in one-half running bond with bonded corners, unless indicated otherwise. Match bond of existing building on alterations and additions.
  - 2. Maintain bond pattern throughout.
  - 3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
  - 4. Where length of cut brick is greater than one half length, maintain vertical joint location.
  - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
  - 6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
  - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
  - 8. Lay brick for sills with wash and drip.
  - 9. Build solid brickwork as required for anchorage of items.
- C. Joints:
  - 1. Exterior And Interior Joint Widths: Lay for three equal joints in 200 mm (8 inches) vertically, unless shown otherwise.
  - 2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
  - 3. Arches:
    - a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
    - b. Face radial arches with radial brick with center line of joints on radial lines.
    - c. Form Radial joints of equal width.
    - d. Bond arches into backing with metal ties in every other joint.
- D. Weep Holes:
  - 1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.

2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Cavity Walls:

1. Keep air space clean of mortar accumulations and debris.
2. Veneer Framed Walls:
  - a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
  - b. Keep air space clean of mortar accumulations and debris.

### 3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units . Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not install brick jambs in exposed finish work.
5. Install concrete building brick only as filler in backup material where not exposed.
6. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.

7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

### **3.9 POINTING**

- A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Tool exposed joints to smooth concave joint.
- D. At joints with existing work, match existing joint.

### 3.10 GROUTING

#### A. Preparation:

1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are installed as indicated on drawings.

#### B. Placing:

1. Place grout in grout space in lifts as specified.
2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
  - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
  - b. Grout from dam to dam on high lift method.
  - c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

#### C. Puddling Method:

1. Consolidate by puddling with grout stick during and immediately after placing.
2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

#### D. Low Lift Method:

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

#### E. High Lift Method:

1. Do not pour grout until masonry wall has cured minimum of 4 hours.
2. Place grout in 1.5 m (5 feet) maximum lifts.
3. Exception:
  - a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
  - b. Masonry has cured minimum of 4 hours.

- c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
  - d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

### **3.11 PLACING REINFORCEMENT**

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.
- C. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.
- E. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- F. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.
- H. Anchor reinforced masonry walls at intersections with non-reinforced masonry.



**3.12 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY**

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
  - 1. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
  - 2. Where horizontally reinforced beams (bond beams) are indicated on drawings, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
- E. Grouting:
  - 1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
  - 2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
  - 3. Grouting Technique: At Contractor's option, use either low-lift or high-lift grouting techniques.
- F. Low-Lift Grouting:
  - 1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
  - 2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
  - 3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.

4. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as indicated on drawings. Place grout in bond beam course before filling vertical cores above bond beam.

G. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, to suit application. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of

masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

12. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
13. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
14. Place grout in lintels or beams over openings in one continuous pour.
15. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
16. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

### **3.13 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:
- B. Maximum variation from plumb:
  1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
  2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
  3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
  1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
  1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
  2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

### **3.14 CLEANING AND REPAIR**

A. General:

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

B. Brickwork:

1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
3. Remove traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:

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

D. Glazed Structural Facing Tile or Brick Units:

1. Clean as recommended manufacturer. Protect light colored mortar joints from discoloration during cleaning.
2. Use on solid masonry walls.
3. Prepare schedule of test locations.

- - E N D - -

**SECTION 04 72 00  
CAST STONE MASONRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

**1.2 RELATED WORK**

- A. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.
- B. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.
- C. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.
- D. Section 09 06 00, SCHEDULE FOR FINISHES, Color and texture.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Samples:
  - 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
  - 2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.
- C. Shop Drawings:
  - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
  - 2. Setting drawings with setting mark.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.
- E. Submit manufacturers test results of cast stone previously made by manufacturer.
- F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.

- C. Mark production units with the identification marks as shown on the shop drawings.
- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide an itemized list of product to support the bill of lading.

#### **1.5 WARRANTY**

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

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. ASTM International (ASTM) :
  - A167-99(R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
  - A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
  - C33/C33M-18.....Standard Specification for Concrete Aggregates
  - C150/C150M-20.....Standard Specification for Portland Cement
  - C503/C503M-15.....Standard Specification for Marble Dimension Stone (Exterior)
  - C568/C568M-15.....Standard Specification for Limestone Dimension Stone
  - C615/C615M-18e1.....Standard Specification for Granite Dimension Stone
  - C616/C616M-15.....Standard Specification for Quartz-Based Dimension Stone
  - C979/C979M-16.....Standard Specification for Pigments for Integrally Colored Concrete
  - C1194-19.....Standard Test Method for Compressive Strength of Architectural Cast Stone

- C1195-19a.....Standard Test Method for Absorption of  
Architectural Cast Stone
- C1364-19.....Standard Specification for Architectural Cast  
Stone.
- D2244-16.....Standard Practice for Calculation of Color  
Differences from Instrumentally Measured Color  
Coordinates.

### **1.7 QUALITY ASSURANCE**

#### **A. The Manufacturer:**

1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
2. Must be a member of the Cast Stone Institute.
3. Must have a certified plant (certification by the Cast Stone Institute).

#### **B. Stone setter: Must have 5 years' experience setting cast or natural building stone.**

#### **C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:**

1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.
4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

### **1.8 MANUFACTURING TOLERANCES**

- A. Cross section dimensions shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.
- B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm).

Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

- C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features - On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

#### **1.9 MOCK-UP**

- A. Provide full size unit(s) for use in construction of sample wall along with other wall components. The mockup sample wall will remain on site, protected from weather and construction until the A/E and COR approves its removal. The mock-up becomes the standard of workmanship for the project.

### **PART 2 - PRODUCTS**

#### **2.1 ARCHITECTURAL CAST STONE**

- A. Comply with ASTM C 1364
- B. Physical properties: Provide the following:
  - 1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
  - 2. Absorption - ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
  - 3. Air Content - ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
  - 4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
  - 5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.
- C. Job site testing - One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 cubic meters) delivered to the job site:
  - 1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.



2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

## **2.2 RAW MATERIALS**

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
  1. ASTM C 260 for air-entraining admixtures.
  2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
  3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
  4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
  5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.
- F. Water - Potable
- G. Reinforcing bars:
  1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).
  2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.
- H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

## **2.3 COLOR AND FINISH**

- A. Match sample from approved submittal samples.

- B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.
- D. Horizontal Units will be equal in length in each common run, with units not exceeding 4'-0" in length.
- E. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
  - 1. Total color difference - not greater than 6 units.
  - 2. Total hue difference-not greater than 2 units.

#### **2.4 REINFORCING**

- A. Reinforce the units as required by the manufacturer and for safe handling and structural stress.
  - 1. Minimum reinforcing shall be 0.25 percent of the cross section area.
- B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.
- D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

#### **2.5 CURING**

- A. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

**3.2 SETTING TOLERANCES**

- A. Comply with Cast Stone Institute Technical Manual.
- B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/6 inch (1.5 mm), minus - 1/8 inch (3 mm).

**3.3 JOINTING**

- A. Joint size:
  - 1. At stone/brick joints 3/8 inch (9.5 cm).
  - 2. At stone/stone joints in vertical position 1/4 inch (6 mm) (3/8 inch (9.5 mm) optional).
  - 3. Stone/stone joint exposed on top 3/8 inch (.5 mm).
- B. Joint Materials:
  - 1. Mortar, Type N, ASTM C 270.
  - 2. Use a full bed of mortar at all bed joints.
  - 3. Flush vertical joints full with mortar.
  - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
  - 5. Leave head joints in coping and projecting components open for sealant.
- C. Location of joints:
  - 1. As shown on shop drawings.
  - 2. At control and expansion joints unless otherwise shown.

**3.4 SETTING**

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4 inch (18 mm) for pointing.
- E. Remove excess mortar from unit faces immediately after setting.
- F. Tuck point unit joints to a slight concave profile.

**3.5 JOINT PROTECTION**

- A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

**3.6 REPAIR AND CLEANING**

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

**3.7 INSPECTION AND ACCEPTANCE**

- A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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**SECTION 05 12 00  
STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Structural steel shapes, plates, and bars.
  - 2. Bolts, nuts, and washers.

**1.2 RELATED REQUIREMENTS**

- A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Composite Steel Deck: Section 05 36 00, COMPOSITE METAL DECKING.
- C. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.
- D. Steel Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Painting: Section 09 91 00, PAINTING.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American Institute of Steel Construction (AISC):
  - 1. AISC Manual - Steel Construction Manual, 14th Ed.
  - 2. 303-10 - Code of Structural Steel Buildings and Bridges.
  - 3. 360-10: Specification for Structural Steel Buildings.
- C. The American Society of Mechanical Engineers (ASME):
  - 1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.
- D. American Welding Society (AWS):
  - 1. D1.1/D1.1M-15 - Structural Welding Code - Steel.
- E. ASTM International (ASTM):
  - 1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
  - 2. A36/A36M-14 - Carbon Structural Steel.
  - 3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
  - 4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
  - 6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.

7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
  9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
  10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
  11. A992/A992M-15 - Structural Shapes.
  12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
  13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
- F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.
- G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.
- H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
  2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.
- I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  1. Show size, configuration, and fabrication and installation details.
- C. Test Reports: Certify products comply with specifications.
  1. Welders' qualifying tests.
- D. Certificates: Certify each product complies with specifications.
  1. Structural steel.
  2. Steel connections.
  3. Welding materials.

- 4. Shop coat primer paint.
- E. Qualifications: Substantiate qualifications comply with specifications.
  - 1. Fabricator with project experience list .
  - 2. Installer with project experience list .
  - 3. Welders and welding procedures.
- F. Record Surveys: Signed and sealed by responsible surveyor or engineer.

## **1.5 QUALITY ASSURANCE**

- A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
  - 1. Regularly fabricates specified products.
  - 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
    - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
  - 1. Regularly installs specified products.
  - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
    - a. Project Experience List: Provide contact names and addresses for completed projects.
- C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.
- D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

## **1.6 WARRANTY**

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. W-Shapes:
  - 1. ASTM A992/A992M.
  - 2. ASTM A572/A572M; Grade 50.
- B. Channel and Angles:
  - 1. ASTM A36/A36M.
- C. Plates and Bars:

- 1. ASTM A36/A36M.
- D. Hollow Structural Sections:
  - 1. ASTM A501/A501M.
- E. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing .
  - 1. High-strength bolts, including nuts and washers: ASTM F3125.
  - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
  - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.
- F. Welding Materials: AWS D1.1, type to suit application.

## 2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

## 2.3 FABRICATION

- A. Fabricate structural steel according to Chapter M, AISC 360.
- B. Shop and Field Connections:
  - 1. Weld connections according to AWS D1.1/D1.1M. 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.
  - 2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

## 2.4 FINISHES

- A. Shop Priming:
  - 1. Prime paint structural steel according to AISC 303, Section 6.
    - a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.
- B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.
- C. Do not paint:
  - 1. Surfaces within 50 mm (2 inches) of field welded joints.
  - 2. Surfaces indicated to be encased in concrete.
  - 3. Surfaces receiving sprayed on fireproofing.



- 4. Beam top flanges receiving shear connector studs applied.
- D. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

## **2.5 ACCESSORIES**

- A. General: Shop paint steel according to AISC 303, Section 6.
- B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.
- C. Galvanizing Repair Paint: MPI No. 18.

## **PART 3 - EXECUTION**

### **3.1 ERECTION**

- A. Erect structural steel according to AISC 303 and AISC 360.
- B. Set structural steel accurately at locations and elevations indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC 303 requirements.
  - 1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.
- D. Weld and bolt connections as specified for shop connections.

### **3.2 FIELD PAINTING**

- A. After welding, clean and prime weld areas to match adjacent finish.
- B. Touch-up primer damaged by construction operations.
- C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.
- D. Finish Painting: As specified in Section 09 91 00, PAINTING.

### **3.3 FIELD QUALITY CONTROL**

- A. Record Survey:
  - 1. Engage registered land surveyor or registered civil engineer to perform survey.
  - 2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
  - 3. Identify deviations from allowable tolerances specified in 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. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories.
1. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
  2. Show openings required for work of other trades, including openings not shown on structural drawings.
  3. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying required structural characteristics.
- D. Manufacturer's written recommendations for:
1. Shape of decking section.
  2. 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 quantity, pattern, spacing and configuration of shear studs for each beam and girder.
- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, submit certification of specified fire ratings. Certify that units supplied are UL listed as a "Steel Floor and Form Unit".
- J. Manufacturers Certificates for deck units attesting compliance with specified requirements.
- K. Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories intended use.
- L. Power Actuated Tool Operator Certificates.
- M. Welders qualifications.

#### **1.4 QUALITY ASSURANCE**

- A. Fire Safety
  - 1. Underwriters' Label: Provide composite metal floor deck units listed in Underwriters' Laboratories "Building Materials Directory", with each deck unit bearing the UL label and marking for specific system detailed.
  - 2. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.
- B. Deck Units: Provide deck units and accessory products from a manufacturer engaged in the manufacture of steel decking for more than three (3) years. Submit manufacturer's certificates attesting that the decking material complies with the specified requirements.
- C. Certification of Powder-Actuated Tool Operator: Manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.
- D. Qualifications for Welding Work: Submit qualified welder qualifications in accordance with AWS D1.1/D1.1M or under an approved qualification test.

#### **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 referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):
  - S-100-16.....North American Specification for the Design of Cold-Formed Steel Structural Members

## C. ASTM International (ASTM):

- A36/A36M-19.....Standard Specification for Carbon Structural Steel
- A108-18.....Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- A653/A653M-20.....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) 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-20.....Structural Welding Code - Steel
- D1.3/D1.3M-18.....Structural Welding Code - Sheet Steel

## F. FM Global (FM):

- APP Guide.....Approval Guide
- DS 1-28-15.....Design Wind Loads

## G. Military Specifications (Mil. Spec.):

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

## H. Underwriters Laboratories (UL):

- Bld Mat Dir(Annually)...Building Materials Directory

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Steel Decking and Flashings: ASTM A653/A653M, Structural Quality suitable for shear stud weld-through techniques.
- B. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 pound/square inch) minimum, tensile strength - 400 Mpa (60,000 pounds/square inch) minimum, reduction of area 50 percent minimum.
  1. Provide studs of uniform diameter, with heads concentric and on same axis to shaft.
  2. Provide studs, after welding, free from substance or defect which would interfere with its function as a shear connector.
  3. Do not paint or galvanize studs.
  4. Provide size of studs as shown on drawings.

5. Provide studs manufactured by a company normally engaged in the manufacturer of shear studs, and can furnish equipment suitable for weld-through installation of shear studs.

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

D. Miscellaneous Steel Shapes: ASTM A36/A36M.

E. Welding Electrode: E70XX minimum.

F. Sheet Metal Accessories: ASTM A653/A653M, 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 to be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures to be limited to a total of 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, gauge, and section properties to be as shown on contract documents. 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. Deck units combined with concrete slab to be capable of supporting total design loads.
- C. Provide integral system with single point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning electrical and similar items.

1. Provide a minimum spacing pattern of 305 mm (12 inches) on centers longitudinally and 610 mm or 914 mm (24 or 36 inches) on centers transversely.
2. Provide suspension system capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at one hanger attachment point.
3. System may consist of fold-down type hanger tabs or a lip hanger.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed, and until temporary shoring, where required, has been installed.
  1. Remove 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.
  1. Do not overload deck units once placed.
  2. Replace deck units that become damaged after erection and prior to casting concrete at no additional cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units in standard widths and fabricated 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 fastened.
  1. Bring each unit to proper bearing on supporting beams.
  2. 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.
  3. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates.
- H. Ceiling hanger loops must be flattened or removed to obtain bearing of units on structural steel.

- I. Weld in conformance to AWS D1.3/D1.3M and done by qualified experienced welding mechanics.
- J. Clean and touch-up area and welds scarred during erection, and repair with zinc rich galvanizing repair paint.
  - 1. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- K. Provide metal concrete stops at edges of deck.
- L. Cutting and Fitting:
  - 1. Fabricate metal deck units to proper length 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.
  - 4. Make cuts and penetrations neat and trim using a metal saw, drill or punchout device; cutting with torches is prohibited.
  - 5. Do not make cuts in the metal deck that are not shown on the approved metal deck drawings.
  - 6. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and 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 Representative (COR). Provide additional reinforcing or framing required for the opening at no additional cost to the Government.
  - 7. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- M. Install shear connector studs through previously installed metal deck in conformance to AWS D1.1/D1.1M, Section 7.
 

Exception: Install studs with automatically timed welding equipment and as specified below:

  - 1. Do not place welded wire reinforcing or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.

2. Clean steel deck sheets free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Clean and dry surface to which stud is to be welded.
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. Provide ferrules specially developed for the weld-through technique, and appropriate for size of studs installed. Remove ferrules after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1/D1.1M, Appendix K.

### **3.2 CLEANING**

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

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

1. Exterior non-load-bearing steel stud curtain wall.

**1.2 RELATED WORK**

- A. Section 05 12 00, STRUCTURAL STEEL FRAMING: Structural steel framing.  
B. Section 09 22 16, NON-STRUCTURAL METAL FRAMING: Non-load-bearing metal stud framing assemblies.  
C. Section 09 29 00, GYPSUM BOARD: Gypsum board assemblies.

**1.3 DESIGN REQUIREMENTS**

- A. Structural Performance: fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.
1. Install framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).
2. Install framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Iron and Steel Institute (AISI): Specification and Commentary for the Design of Cold-Formed Steel Structural Members (2016)
- C. ASTM International (ASTM):
  - A36/A36M-19.....Standard Specification for Carbon Structural Steel
  - A123/A123M-17.....Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A153/A153M-16a.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - A307-14e1.....Standard Specifications for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
  - A653/A653M-20.....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
  - C955-18e1.....Standard Specification for Cold Formed Steel Structural Framing Members
  - C1107/1107M-20.....Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
  - E488/E488M-18.....Standard Test Methods for Strength of Anchors in Concrete Elements
  - E1190-11 (2018).....Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
- D. American Welding Society (AWS):
  - D1.3/D1.3M-18.....Structural Welding Code-Sheet Steel
- E. Military Specifications (Mil. Spec.):
  - MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing Repair
- F. VA Physical Security and Resiliency Design Manual October 1, 2020.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

- B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

## 2.2 WALL FRAMING

- A. Steel Studs: Complying with ASTM C 955. Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
  - 1. Minimum Base-Steel Thickness (uncoated): 1.37 mm (0.0538 inch)
  - 2. Flange Width: 1-5/8 inches
  - 3. Web: Punched.
- B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
  - 1. Design Uncoated-Steel Thickness: Matching steel studs.
  - 2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

## 2.3 FRAMING ACCESSORIES

- A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Gusset plates.
  - 5. Deflection track and vertical slide clips.
  - 6. Stud kickers and girts.
  - 7. Reinforcement plates.

## 2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.

- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

## **2.5 REQUIREMENTS**

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

## **PART 3 - EXECUTION**

### **3.1 FABRICATION**

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
  - 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - 2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

### **3.2 ERECTION**

- A. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- B. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.

- C. 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.
- D. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- E. Install headers in all openings that are larger than the stud spacing in that wall.
- F. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows 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.

### 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. Loose Lintels
  - 2. Ladders
  - 3. Railings:
  - 4. Metal Stairs
  - 5. Steel Pipe Bollards
  - 6. All other Metal Fabrications exposed to view.

**1.2 RELATED WORK**

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.
- D. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. 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. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- D. Design Calculations for specified live loads including dead loads.

- E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

#### **1.4 QUALITY ASSURANCE**

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

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):  
B18.2.2-87(R2010).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):  
A36/A36M-14.....Structural Steel  
A48-03(R2012).....Gray Iron Castings  
A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless  
A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products  
A240/A240M-15.....Standard Specification for Chromium and  
Chromium-Nickel Stainless Steel Plate, Sheet  
and Strip for Pressure Vessels and for General  
Applications.  
A269-15.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service  
A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI  
Tensile Strength  
A391/A391M-07(R2015)....Grade 80 Alloy Steel Chain  
A786/A786M-15.....Rolled Steel Floor Plate

- B221-14.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B456-11.....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-13.....Packaged Dry, Hydraulic-Cement Grout  
(Nonshrink)
- D3656-13.....Insect Screening and Louver Cloth Woven from  
Vinyl-Coated Glass Yarns
- F436-16.....Hardened Steel Washers
- F468-06 (R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head  
Cap Screws and Studs for General Use
- F593-13.....Stainless Steel Bolts, Hex Cap Screws, and  
Studs
- F1667-15.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
- D1.1-15.....Structural Welding Code Steel
- D1.2-14.....Structural Welding Code Aluminum
- D1.3-18.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP 521-01 (R2012).....Pipe Railing Manual
- AMP 500-06.....Metal Finishes Manual
- MBG 531-09 (R2017).....Metal Bar Grating Manual
- MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective  
Coatings:
- SP 1-15.....No. 1, Solvent Cleaning
- SP 2-04.....No. 2, Hand Tool Cleaning
- SP 3-04.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
- RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the  
following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any  
point.



**2.2 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- C. Steel Pipe (Bollard): ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- D. Primer Paint: As specified in Section 09 91 00, PAINTING.
- E. Paint: As specified in Section 09 91 00 PAINTING and 09 06 00 SCHEDULE OF FINISHES.
- F. Grout: ASTM C1107, pourable type.

**2.3 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
  - 2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.
- B. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
    - c. ASTM F468 for nonferrous bolts.
    - d. ASTM F593 for stainless steel.
  - 2. Screws: ASME B18.6.1.
  - 3. Washers: ASTM F436, type to suit material and anchorage.
  - 4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

**2.4 FABRICATION GENERAL**

- A. Material
  - 1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named, or its standard of quality not specified.
  - 2. Use material free of defects which could affect the appearance or service ability of the finished product.
- B. Size:
  - 1. Size and thickness of members as shown.

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

#### C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

#### D. Fasteners and Anchors

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

## E. Workmanship

### 1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- 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 AMP 500 Metal Finishes Manual.
- 2. Steel and Iron: NAAMM AMP 504.
  - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
  - b. Surfaces exposed in the finished work:
    - 1) Finish smooth rough surfaces and remove projections.
    - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
  - c. Shop Prime Painting:
    - 1) Surfaces of Ferrous metal:
      - a) Items not specified to have other coatings.
      - b) Galvanized surfaces specified to have prime paint.
      - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
      - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
      - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
    - 2) Nonferrous metals: Comply with MAAMM-500 series.

G. Protection:

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

## 2.5 SUPPORTS

### A. General:

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

### C. For Wall Mounted Items:

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

### E. For Cubical Curtain Track:

1. Fabricate assembly of steel angle.
2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.

## 2.10 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Furnish Loose Lintels as described in the Structural Drawings lintel schedule.

## 2.11 LADDERS

### A. Steel Ladders:

1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.

3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.

## **2.12 RAILINGS**

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
  1. Provide continuous welded joints, dressed smooth and flush.
  2. Standard flush fittings, designed to be welded, may be used.
  3. Exposed threads will not be approved.
  4. Form handrail brackets to size and design shown.
- C. Handrails:
  1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
  2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
  1. Fabricate of steel pipe with welded joints.
  2. Number and space of rails as shown.
  3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
  4. Form handrail brackets from malleable iron.
  5. Fabricate removable sections with posts at end of section.
  6. Removable Rails:
    - a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
    - b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
    - c. Continuously weld brackets to post.
    - d. Provide slotted bolt holes in rail bracket.
    - e. Weld bolt heads flush with top of rail.
    - f. Weld flanged fitting to post where posts are installed in sleeves.

## **2.13 STEEL PIPE BOLLARD**

- A. Provide bollard in accordance with ASTM A53 with dimensions as shown in standard detail SD320523-04. Anchor posts in concrete and fill solidly with concrete with a minimum compressive strength of 17 MPa 2500psi.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

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

### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.

3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.

4. Secure steel plate or hat channels to studs as detailed.

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.

### **3.5 DOOR FRAMES**

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

### **3.6 OTHER FRAMES**

A. Set frame flush with surface unless shown otherwise.

B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

C. Set in formwork before concrete is placed.

### **3.7 GUARDS**

A. Channel Guard at Top Edge of Concrete Platforms:

1. Install in formwork before concrete is placed.

2. Set channel flush with top of the platform.

### **3.8 STEEL LINTELS**

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.



### 3.9 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. Ladder Rungs:
  - 1. Set step portion of rung 150 mm (6 inches) from wall.
  - 2. Space rungs approximately 300 mm (12 inches) on centers.
  - 3. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

### 3.10 RAILINGS

- A. Steel Posts:
  - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
  - 2. Install sleeves in concrete formwork.
  - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
  - 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
  - 5. Secure sliding flanged fittings to posts at base with set screws.
  - 6. Secure fixed flanged fittings to concrete with expansion bolts.
  - 7. Secure posts to steel with welds.
- C. Anchor to Walls:
  - 1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
    - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
    - b. Anchor steel plate to hollow masonry with toggle bolts.
  - 2. Anchor flanged fitting with toggle bolt to steel support in frame walls.
- G. Handrails:
  - 1. Anchor brackets for metal handrails as detailed.
  - 2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
  - 3. Expansion bolt to concrete or solid masonry.

4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

### **3.11 INSTALLATION OF STEEL PIPE BOLLARD**

- A. Set bollards vertically in concrete piers. Compressive strength of concrete piers shall be 21MPa 3000psi.

### **3.12 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.

- - - E N D - - -

**SECTION 05 51 00**  
**METAL STAIRS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel stairs with railings.
- B. Types:
  - 1. Closed riser stairs with concrete filled treads and platforms.

**1.2 RELATED WORK**

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete fill for treads and platforms.
- B. Section 05 50 00, METAL FABRICATIONS: Wall handrails and railings for other than steel stairs.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
  - 1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
- C. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.
- D. Fabrication qualifications.
  - a. Installer qualifications.
  - b. Calculations.
- E. Welding qualifications.

**1.4 QUALITY ASSURANCE**

- A. Fabricator: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit fabricator qualifications.
- B. Installer: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit installer qualifications.
- C. Calculations: Provide professionally prepared calculations and certification of performance of this work, signed and sealed by a Professional Engineer registered in the state where the work is located. Perform structural design of the stair including supports for the metal stair frame. Indicate how Design Criteria as specified have been incorporated into the design.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.3/D1.3M.

### 1.5 APPLICATION PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

B18.2.1-12.....Square, Hex, Heavy Hex, and Askew Head Bolts  
and Hex, Heavy Hex, Hex Flange, Lobed Head, and  
Lag Screws (Inch Series)

B18.2.3.8M-81(R2005)....Metric Heavy Lag Screws

B18.6.1-81(R2008).....Wood Screws (Inch Series)

B18.6.3-13.....Machine Screws, Tapping Screws, and Metallic  
Drive Screws (Inch Series)

B18.6.5M-10.....Metric Thread Forming and Thread Cutting  
Tapping Screws

B18.6.7M-10.....Metric Machine Screws

B18.22M-81(R2010).....Metric Plain Washers

C. ASTM International (ASTM):

A36/A36M-19.....Structural Steel

A47/A47M-99e1R2018).....Ferritic Malleable Iron Castings

A48/A48M-03(R2016).....Gray Iron Castings

A53/A53M-20.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated  
Welded and Seamless

A123/A123M-17.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

A153/A153M-16a.....Zinc Coating (Hot-Dip) on Iron and Steel  
Hardware

A307-14e1.....Carbon Steel Bolts, Studs and Threaded Rod  
60,000 PSI Tensile Strength

A653/A653M-20.....Steel Sheet, Zinc Coated (Galvanized) or Zinc  
Alloy Coated (Galvannealed) by the Hot-Dip  
Process

A786/A786M-15.....Rolled Steel Floor Plates

A1008/A1008M-20.....Steel, Sheet, Cold-Rolled, Carbon, Structural,  
High-Strength, Low-Alloy

A1011/A1011M-18.....Steel, Sheet and Strip, Strip, Hot-Rolled  
Carbon, Structural, High-Strength, Low-Alloy

## D. American Welding Society (AWS):

D1.1/D1.1M-15.....Structural Welding Code-Steel

D1.3/D1.3M-18.....Structural Welding Code-Sheet Steel

## E. The National Association of Architectural Metal Manufacturers (NAAMM)

Manuals:

MBG 531-17.....Metal Bar Gratings

AMP521-01(R2012).....Pipe Railing Manual, Including Round Tube

## F. American Iron and Steel Institute (AISI):

S100-12.....Design of Cold-Formed Steel Structural Members

## G. National Fire Protection Association (NFPA):

101-18.....Life Safety Code

## H. Society for Protective Coatings (SSPC):

Paint 25(1997; E 2004)..Zinc Oxide, Alkyd, Linseed Oil Primer for Use  
Over Hand Cleaned Steel, Type I and Type II

**PART 2 - PRODUCTS****2.1 DESIGN CRITERIA**

A. Design stairs to support live load of 4.79 kN/square meter (100 pound force/ square feet) and a concentrated load of 1.33 kN (300 pound force) applied on an area of 2580 square mm (4 square inch).

1. Uniform and concentrated loads need not be assumed to act concurrently.

2. Provide stair framing capable of withstanding stresses resulting from railing loads in addition to the loads specified above. Limit deflection of treads, platforms, and framing members to L/360 or 6.4 mm (1/4 inch), whichever is less.

B. Provide structural design, fabrication, and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design handrails and top rails of guards to support uniform load of not 0.73 kN/meter (50 pound force/feet) applied in any direction and a concentrated load of 0.89 kN (200 pound force) applied in any direction. Uniform and concentrated loads need not be assumed to act concurrently.

D. Infill of guards to support concentrated load of 0.22 kN (50 pound force) applied horizontally on an area of 0.093 square meter (one square feet).

E. Design fire stairs to conform to NFPA 101.

## 2.2 MATERIALS

- A. Steel Pipe: ASTM A53/A53M, Standard Weight, zinc coated.
- B. Sheet Steel: ASTM A1008/A1008M.
- C. Structural Steel: ASTM A36/A36M.
- D. Steel Decking: Form from zinc coated steel conforming to ASTM A653/A653M, with properties conforming to AISI S100 Specification for the Design of Cold-Formed Steel Structural Members.
- E. Steel Plate: ASTM A1011/A1011M.
- F. A47M.
- G. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

## 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.
  - 3. Galvanized zinc-coated fasteners in accordance with ASTM A153/A153M and used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.
  - 4. Standard/regular hexagon-head bolts and nuts be conforming to ASTM A307, Grade A.
  - 5. Square-head lag bolts conforming to ASME B18.2.3.8M, ASME B18.2.1.
  - 6. Machine screws cadmium-plated steel conforming to ASME B18.6.7M, ASME B18.6.3.
  - 7. Plain washers, round, general-assembly-grade, carbon steel conforming to ASME B18.22M, ASME B18.21.1.
  - 8. Lock washer helical spring, carbon steel conforming to ASME B18.2.1, ASME B18.2.3.8M.
- B. Welding:
  - 1. Structural steel, AWS D1.1/D1.1M, and sheet steel, AWS D1.3/D1.3M.
  - 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: Shop prime steelwork with red oxide primer in accordance with SSPC Paint 25.
- G. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 0.8 mm (1/32 inch), and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
- H. Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind smooth exposed welds and flush to match and blend with adjoining surfaces.
- I. Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.
- J. Provide and coordinate anchorage of the type indicated with the supporting structure. Fabricate anchoring devices, space as indicated and required to provide adequate support for the intended use of the work.
- K. Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

#### **2.4 RAILINGS**

- A. Fabricate railings, including handrails, from steel pipe.
  - 1. Connections may be standard fittings designed for welding or coped or mitered pipe with full welds.
  - 2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.
- B. Return ends of handrail to wall and close free end.
- C. Provide standard terminal castings where fastened to newel.
- D. Space intermediate posts not over 1828 mm (6 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.
- B. Fabricate pans for treads and platforms, and risers from sheet steel.
- C. Form risers with sanitary cove.
- D. Fabricate stringers, headers, and other supporting members from structural steel.
- E. Construct newel posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

**PART 3 - EXECUTION****3.1 STAIR INSTALLATION**

- A. Provide columns, 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.
- E. Provide steel closure plate to fill gap between the stringer and surrounding wall. Weld and apply primer, ready to accept paint finish.

**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 3658 mm (1/8-inch in 12 feet).
- D. Set posts plumb and aligned to within 3 mm in 3658 mm (1/8-inch in 12 feet).

**3.3 FIELD PRIME PAINTING**

- A. Touch-up abraded areas with same primer paint used for shop priming.
- B. Touch up abraded galvanized areas.

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**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

A. This section specifies wood blocking, furring, nailers.

**1.2 RELATED WORK:**

A. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

**1.3 SUBMITTALS:**

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
2. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Shop Drawings showing details, fasteners, connections and dimensions.

D. Manufacturer's Literature and Data:

1. Submit data for lumber, hardware and adhesives.
2. Submit data for wood-preserved treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

E. Manufacturer's certificate for unmarked lumber.

**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.

- D. Locate stacks on well drained areas, supported at least 152 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 QUALITY ASSURANCE:**

- A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

#### **1.6 GRADING AND MARKINGS:**

- A. Any unmarked lumber for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

#### **1.7 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):  
NDS-15.....National Design Specification for Wood Construction
- D. American Society of Mechanical Engineers (ASME):  
B18.2.1-12 (R2013).....Square and Hex Bolts and Screws  
B18.2.2-10.....Square and Hex Nuts  
B18.6.1-81 (R2008).....Wood Screws
- E. American Plywood Association (APA):  
E30-11.....Engineered Wood Construction Guide
- F. ASTM International (ASTM):  
A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process  
C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness  
C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

- D198-14.....Test Methods of Static Tests of Lumber in  
Structural Sizes
- D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer  
Matrix Composite Materials and Their Laminates
- F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for  
General Use
- F1667-13.....Nails, Spikes, and Staples
- G. American Wood Protection Association (AWPA):  
AWPA Book of Standards
- H. Commercial Item Description (CID):  
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self  
Threading Anchors)
- I. Forest Stewardship Council (FSC):  
FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest  
Stewardship
- J. Military Specification (Mil. Spec.):  
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):  
40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products
- M. U.S. Department of Commerce Product Standard (PS)  
PS 20-10.....American Softwood Lumber Standard

## **PART 2 - PRODUCTS**

### **2.1 LUMBER:**

- A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

C. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

D. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
  - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
  - b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

E. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

F. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking,
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

**2.3 ROUGH HARDWARE AND ADHESIVES:****A. Washers**

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

**B. Screws:**

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

**C. Nails:**

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

**PART 3 - EXECUTION****3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:****A. Conform to applicable requirements of the following:**

1. AFPA WCD1 for nailing and framing unless specified otherwise.

**B. Fasteners:**

1. Nails.
  - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
  - b. Use special nails with framing connectors.
  - d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
  - e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.

2. Bolts:
  - a. Fit bolt heads and nuts bearing on wood with washers.
  - b. Countersink bolt heads flush with the surface of nailers.
  - c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
  - d. Provide toggle bolts to hollow masonry or sheet metal.
  - e. Provide 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 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
  - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
- D. Cut notch, or bore in accordance with AFPA WCD1 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. Provide longest lengths practicable.
  3. Provide 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 610 mm (24 inches) between ends.
    - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

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**SECTION 07 21 13  
THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Thermal insulation.
  - a. Board or block insulation at foundation perimeter.
  - b. Blown in Blanket insulation at exterior framed walls.
  - c. Board insulation at brick/framed walls. .
  - d. Loose Rock Wool Insulation for packing rated wall and floor connection.
2. Acoustical insulation.
  - a. Batt and blanket insulation at interior framed partitions

**1.2 RELATED WORK**

- A. Section 04 20 00, UNIT MASONRY: Insulation for Cavity Face of Masonry.
- B. Section 07 84 00, FIRESTOPPING

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
  - C553-13(2019).....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.
  - C591-20.....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - C612-14(2019).....Mineral Fiber Block and Board Thermal Insulation.
  - C665-17.....Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - C728-17a.....Perlite Thermal Insulation Board.
  - C954-18.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.



C1002-18.....Steel Self-Piercing Tapping Screws for  
 Application of Gypsum Panel Products or Metal  
 Plaster Bases to Wood Studs or Steel Studs.  
 D312/D312M-16a.....Asphalt Used in Roofing.  
 E84-20.....Surface Burning Characteristics of Building  
 Materials.  
 F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  - 1. Show insulation type, thickness, and R-value for each location.
- C. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Adhesive indicating manufacturer recommendation for each application.
- D. Sustainable Construction Submittals:
  - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
  - 2. Low Pollutant-Emitting Materials: Show volatile organic compound types and quantities.

#### **1.5 DELIVERY**

- 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.

#### **1.6 STORAGE AND HANDLING**

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

#### **1.7 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 INSULATION - GENERAL**

- A. Insulation Thickness:
  - 1. Provide thickness required by R-value shown on drawings.

2. Provide thickness indicated when R-value is not shown on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

C. Sustainable Construction Requirements:

1. Insulation Recycled Content:

a. Polyisocyanurate/polyurethane rigid foam: 9 percent recovered material.

b. Polyisocyanurate/polyurethane foam-in-place: 5 percent recovered material.

c. Phenolic rigid foam: 5 percent recovered material.

d. Rock wool material: 75 percent recovered material.

2. Low Pollutant-Emitting Materials: Comply with VOC limits.

a. Non-Flooring Adhesives and Sealants.

## 2.2 THERMAL INSULATION

A. Perimeter Insulation In Contact with Soil:

1. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX.

2. Cellular Glass Block: ASTM C552, Type I or IV.

B. Exterior Framing Insulation:

1. Blown in Batt Insulation

C. Masonry Cavity Wall Insulation:

1. Polystyrene Board: ASTM C578, Type X.

D. Interior Wall Insulation:

1. Acoustical Batt Insulation.

## 2.3 ACOUSTICAL INSULATION

A. Semi Rigid, Batts and Blankets:

1. Widths and lengths to fit tight against framing.

2. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semi rigid unfaced .

a. Density: nominal 4.5 pound.

3. Mineral Fiber Batt or Blankets: ASTM C665 unfaced .

4. Maximum Surface Burning Characteristics: ASTM E84.

a. Flame Spread Rating: 25.

b. Smoke Developed Rating: 450.

## 2.4 ACCESSORIES

A. Fasteners:

1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.

2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
  - a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
  - b. Adhesive: Type recommended by manufacturer to suit application.
- B. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.
- C. Tape: Pressure sensitive adhesive on one face.

### **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. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

#### **3.2 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings.
  1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.
- C. Install board insulation with joints close and flush, in regular courses, and with end joints staggered.
- D. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.
- E. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

#### **3.3 THERMAL INSULATION**

- A. Perimeter Insulation in Contact with Soil:
  1. Vertical insulation:
    - a. Fill joints of insulation with same material used for bonding.
    - b. Bond polystyrene board to surfaces with adhesive.
- B. Exterior Framing Insulation:
  1. General:

a. Open voids are not acceptable.

C. Inside Face of Exterior Wall Insulation:

1. Location: Masonry Cavity Wall.
2. Bond insulation to solid vertical surfaces with adhesive. Fill joints with adhesive cement.
3. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings maximum 300 mm (12 inches) on center. Stagger fasteners at board joints. Install fasteners at each corner.

D. Masonry Cavity Wall Insulation:

1. Install insulation on masonry cavity walls.
2. Bond polystyrene board to surfaces with adhesive.
3. Bond polyurethane or polyisocyanurate board, and perlite board to surfaces with adhesive.
4. Fill insulation joints with same material used for bonding.

### 3.4 ACOUSTICAL INSULATION

A. General:

1. Install insulation without voids.
2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
3. Pack behind outlets, around pipes, ducts, and services encased in walls.
4. Hold insulation in place with pressure sensitive tape.
5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
6. Do not compress insulation below required thickness except where embedded items prevent required thickness.

B. Semi Rigid, Batts and Blankets:

1. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedment's.

a. Metal Framing:

- 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
- 2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.
- 3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

**3.5 CLEANING**

- A. Remove excess adhesive before adhesive sets.

**3.6 PROTECTION**

- A. Protect insulation from construction operations.
- B. Repair damage.

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
- B. Roof and deck insulation, substrate board, and cover board on existing concrete substrates ready to receive roofing or waterproofing membrane.
- C. Repairs and alteration work to existing roof insulation.

**1.2 RELATED WORK**

- A. Section 06 10 00, ROUGH CARPENTRY: Wood Cants, Blocking, and Edge Strips.
- B. Section 07 53 23 EPDM Roofing

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American Society of Civil Engineers
  - ASCE 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- C. ASTM International (ASTM):
  - C208-12(2017)e2.....Cellulosic Fiber Insulating Board.
  - C552-17e1.....Cellular Glass Thermal Insulation.
  - C726-17.....Mineral Fiber Roof Insulation Board.
  - C728-17a.....Perlite Thermal Insulation Board.
  - C1177/C1177M-17.....Glass Mat Gypsum Substrate for Use as Sheathing.
  - C1278/C1278M-17.....Fiber-Reinforced Gypsum Panel.
  - C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - C1396/C1396M-17.....Gypsum Board.
  - D41/D41M-11 (2016).....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - D312/D312M-16a.....Asphalt Used in Roofing.
  - D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  - D2178/D2178M-15a.....Asphalt Glass Felt Used in Roofing and Waterproofing.
  - D2822/D2822M-05(2011)e1.Asphalt Roof Cement, Asbestos Containing.

- D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.
- E84-20.....Surface Burning Characteristics of Building Materials.
- F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.
- D.National Roofing Contractors Association (NRCA):
- Manual-15.....The NRCA Roofing Manual: Membrane Roof Systems-2019.
- E.UL LLC (UL):
- Listed Online Certifications Directory.
- F.U.S. Department of Agriculture (USDA):
- USDA BioPreferred Program Catalog.
- G.U.S. Department of Commerce National Institute of Standards and Technology (NIST):
- DOC PS 1-19.....Structural Plywood.
- DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

#### 1.4 SUBMITTALS

- A.Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B.Submittal Drawings:
  - 1. Show size, configuration, and installation details.
    - a. Nailers, cants, and terminations.
    - b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.
- C.Manufacturer's Literature and Data:
  - 1. Description of each product.
- D.Samples:
  - 1. Roof insulation, each type.
  - 2. Fasteners, each type.
- E.Sustainable Construction Submittals:
  - 1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
  - 2. Biobased Content:
    - a. Show type and quantity for each product.
  - 3. Low Pollutant-Emitting Materials:
    - a. Show volatile organic compound types and quantities.
    - b. Certify each composite wood and agrifiber product contain no added urea formaldehyde.

F. Qualifications: Substantiate qualifications meet specifications.

1. Installer.

#### **1.5 QUALITY ASSURANCE**

A. Installer Qualifications: Same installer as Division 07 roofing section installer.

#### **1.6 DELIVERY**

A. Comply with recommendations of NRCA Manual.

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

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

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

#### **1.7 STORAGE AND HANDLING**

A. Comply with recommendations of NRCA Manual.

B. Store products indoors in dry, weathertight facility.

C. Protect products from damage during handling and construction operations.

#### **1.8 FIELD CONDITIONS**

A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

#### **1.9 WARRANTY**

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

B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM PERFORMANCE**

A. Insulation Thermal Performance:

a. Overall Average R-Value: RSI-57 (R-33), minimum.

B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.

C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:

1. UL Listed.

2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.

a. Flame Spread Rating: 75 maximum.



- b. Smoke Developed Rating: 150 maximum.

## **2.2 PRODUCTS - GENERAL**

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:

1. Insulation Recycled Content:

- a. Mineral Fiber: 75 percent total recycled content, minimum.
- b. Fiberglass: 20 percent total recycled content, minimum.
- c. Cellulose: 75 percent post-consumer recycled content, minimum.
- d. Perlite Composite Board: 23 percent post-consumer recycled content, minimum.
- e. Rigid Foam: 9 percent total recycled content, minimum.
- f. Glass Fiber Reinforced Rigid Foam: 6 percent total recycled content, minimum.

## **2.3 ADHESIVES**

A. Primer: ASTM D41/D41M.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

D. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

## **2.4 ROOF AND DECK INSULATION**

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. Cellulosic Fiber Board Insulation: ASTM C208, Type II, Grade 2 for single-ply roofing .

D. 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).

## **2.5 INSULATION ACCESSORIES**

A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.

B. Cants and Tapered Edge Strips:

1. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
2. Tapered Edge Strips: 1/12 (1 inch per 12 inches wide).
  - a. Cellulosic Fiberboard: ASTM C208.
  - b. Mineral Fiberboard: ASTM C726.

C. Vapor Retarder:

1. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).

D. Cover Board:

1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 13 mm (1/2 inch) thick, factory primed.

## **2.6 ACCESSORIES**

A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.

B. Nails: ASTM F1667; type to suit application.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

A. Comply with requirements of Division 07 roofing section.

### **3.2 PREPARATION**

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

### **3.3 INSTALLATION - GENERAL**

A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with requirements of UL for insulated steel roof deck.

C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

### **3.4 VAPOR RETARDER INSTALLATION**

A. Vapor Retarder Installation, General:

1. Install continuous vapor retarder on roof decks where indicated.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.

### **3.5 INSULATION INSTALLATION**

B. Insulation Installation, General:

1. Cant Strips: Install at junctures of roofing system with vertical construction.

C. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascia's and similar items.
4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
  - a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
5. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.

D. Lay insulating units with close joints, in regular courses and with end joints staggered.

1. Stagger joints between layers minimum 150 mm (6 inches).

E. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.

F. Cut to fit tightly 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 uniform application of full-spread insulation adhesive.

### **3.6 COVER BOARD INSTALLATION**

- A. Install cover boards over insulation with long joints in continuous straight lines with staggered end joints.
- B. Offset cover board joints from insulation joints 150 mm (6 inches), minimum.
- C. Secure cover boards according to "Adhered Insulation" requirements.

- - E N D - -

**SECTION 07 27 27**  
**FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR RETARDING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Fluid-applied vapor-retarding air barrier at exterior above grade wall assemblies.
2. Connection to adjacent air barrier components providing a durable, continuous, full building air barrier.

**1.2 RELATED REQUIREMENTS**

- A. General Quality Assurance and Quality Control Requirements: Section 01 45 29 TESTING LABORATORY SERVICES.
- B. Commissioning of Building Envelope Components: Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Flashing Components of Factory Finished Roofing and Wall Systems Air Barriers Requiring Air Barrier Transitions: Division 07 roofing and wall system sections.
- D. Metal Flashing Requiring Air Barrier Transitions: Section 07 60 00 FLASHING AND SHEET METAL.
- E. Joint Sealants: Section 07 92 00 JOINT SEALANTS.
- F. Exterior Wall Openings Requiring Air Barrier Transitions: Division 08 sections for aluminum-framed entrances and storefronts, aluminum windows, blast resistant aluminum windows, glazed aluminum curtain walls, louvers and vents .
- G. Wall Sheathings Air Barrier Substrates: Section 09 29 00 GYPSUM BOARD.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. Air Barrier Association of America (ABAA):  
Quality Assurance Program.
- C. ASTM International (ASTM):  
C920-18.....Elastomeric Joint Sealants.  
C1193-16.....Use of Joint Sealants.  
D412-16.....Vulcanized Rubber and Thermoplastic  
Elastomers-Tension.  
E84-20.....Surface Burning Characteristics of Building  
Materials.

E96/E96M-16.....Water Vapor Transmission of Materials.  
 E162-16.....Surface Flammability of Materials Using a  
                     Radiant Heat Energy Source.  
 E783-02(2018).....Field Measurement of Air Leakage Through  
                     Installed Exterior Windows and Doors.  
 E1186-17.....Air Leakage Site Detection in Building  
                     Envelopes and Air Barrier Systems.  
 E2178-13.....Air Permanence of Building Materials.  
 E2357-18.....Determining Air Leakage of Air Barrier  
                     Assemblies.

D. U.S. Environmental Protection Agency (EPA):

40 CFR 59, Subpart D National Volatile Organic  
 Compound Emission Standards for Consumer and  
 Commercial Products.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,  
 AND SAMPLES.
  - 1. Indicate size, configuration, and fabrication and installation  
 details.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Installation instructions.
- C. Sustainable Construction Submittals:
  - 1. Low Pollutant-Emitting Materials:
    - a. Show volatile organic compound types and quantities.
- D. Test reports:
  - 1. Submit field inspection and test reports.
- E. Certificates: Certify each product complies with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
  - 1. Manufacturer with project experience list .
  - 2. Installer with project experience list .
    - a. Certify installer approval by air barrier manufacturer.
- G. Installation Audit:
  - 1. Submit audit report.

#### **1.5 QUALITY ASSURANCE**

- A. Coordinate work with adjacent and related work to provide continuous,  
 unbroken, durable air barrier system.
- B. Manufacturer Qualifications:

1. Regularly and presently manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

C. Installer Qualifications:

1. Regularly and presently installs specified products.
2. Approved by manufacturer.
3. Applicators trained and certified by manufacturer of air barrier system.
4. Full time on-site field supervisor has completed three projects of similar scope within last year.

D. Testing Agency Qualifications:

1. Accredited by International Accreditation Service, Inc. or American Association for Laboratory Accreditation.
2. Staff experienced in installation of specified system and qualified to perform observation and inspection specified and determine compliance with project requirements.

#### **1.6 DELIVERY**

- 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.

#### **1.7 STORAGE AND HANDLING**

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

#### **1.8 FIELD CONDITIONS**

- A. Environment:
  1. Work Area Ambient Temperature Range: 4 to 32 degrees C (40 to 90 degrees F) continuously, beginning 48 hours before installation.
- B. Surface Requirements: visibly dry, and complying with manufacturer's instructions.

#### **1.9 WARRANTY**

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

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM PERFORMANCE**

- A. Air-Barrier Assembly Air Leakage: Maximum 0.2 L/s/square meter (0.04 cfm/square feet) of surface area at 75 Pa (1.57 psf) differential pressure when tested according to ASTM E2357.
- B. Provide full system of compatible materials under conditions of service and application required. Compatibility based on testing by material manufacturer.
- C. Perform as continuous vapor retarding air barrier and moisture drainage plane.
- D. Transition to adjacent flashings and discharge water to building exterior.
- E. 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.

### **2.2 PRODUCTS - GENERAL**

- A. Provide air barrier system components from one manufacturer.
- B. Sustainable Construction Requirements:
  - 1. Low Pollutant-Emitting Materials for the following products:
    - a. Non-Flooring Adhesives and Sealants.

### **2.3 AIR BARRIER**

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier:
  - 1. Elastomeric, modified bituminous or synthetic polymer membrane.
  - 2. Air Permeance: ASTM E2178: 0.02 L/s/square meter (0.004 cfm/square feet) of surface area at 75 Pa (1.57 psf) differential pressure.
  - 3. Vapor Permeance: ASTM E96/E96M: Maximum 5.8 ng/Pa/s/square meter (0.1 perms).
  - 4. Elongation: Ultimate, ASTM D412, Die C: 500 percent, minimum.
  - 5. Thickness: Minimum 1.0 mm (40 mils) dry film thickness, applied in single continuous coat.
  - 6. Surface Burning Characteristics: When tested according to ASTM E84S.
    - a. Flame Spread Rating: 25 maximum.
    - b. Smoke Developed Rating: 450 maximum.

### **2.4 ACCESSORIES**

- A. Primer: Waterborne primer complying with VOC requirements, recommended air barrier manufacturer to suit application.



- B. Substrate Patching Material: Manufacturer's standard trowel-grade filler material.
- C. 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.
- D. Joint Sealant: ASTM C920, 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 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Correct substrate deficiencies:
  - 1. Remove projections and excess materials and fill voids with substrate patching material.
  - 2. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Prepare and treat substrate joints and cracks according to ASTM C1193 and membrane air barrier manufacturer's instructions.

#### **3.2 INSTALLATION - AIR BARRIER**

- A. Install products according to manufacturer's instructions and approved submittals drawings.
  - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Apply primer.
- C. Install transition strips and accessory materials.
- D. Seal air barrier to adjacent components of building air barrier system.
- E. Install flexible opening transition at each opening perimeter. Extend transition onto each substrate minimum 75 mm (3 inches).
  - 1. Fill gaps at perimeter of openings with sealant.
- F. At penetrations, seal transition strips around penetrating objects with termination mastic.
  - 1. Fill gaps at perimeter of penetrations with sealant.
- G. At top of through-wall flashings, seal with continuous transition strip of manufacturer's recommended material to suit application.

- H. Apply air barrier in full contact with substrate to produce continuous seal with transitions.
- I. Apply fluid membrane in thickness recommended by manufacturer, and minimum specified thickness.
- J. Leave air barrier exposed until tested and inspected and tested by Contracting Officer's Representative.

### **3.3 FIELD QUALITY CONTROL**

- A. Field Inspections and Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
  - 1. Perform inspections and tests before concealing air barrier with subsequent work.
- B. Inspections:
  - 1. Compatibility of materials within air barrier system and adjacent materials.
  - 2. Suitability of substrate and support for air barrier.
  - 3. Suitability of conditions under which air barrier is applied.
  - 4. Adequacy of substrate priming.
  - 5. Application and treatment of joints and edges of transition strips, flexible opening transitions, and accessory materials.
  - 6. Continuity and gap-free installation of air barrier, transition strips, and accessory materials.
- C. Submit inspection and test reports to Contracting Officer's Representative within seven calendar days of completing inspection and test.
- D. Defective Work: Correct deficiencies, make necessary repairs, and retest as required to demonstrate compliance with specified requirements.

### **3.4 CLEANING**

- A. Remove masking materials.
- B. Clean spills and overspray using cleaning agents recommended by manufacturers of affected construction.

### **3.5 PROTECTION**

- A. Protect air barrier from construction operations.
- B. Protect air barrier from exposure to UV light exposure exceeding manufacturer's recommendation.
- C. Replace overexposed materials and retest.

- - E N D - -

**SECTION 07 53 23**  
**ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

1. Section Includes:

- a. Ethylene Propylene Diene Monomer (EPDM) sheet roofing fully adhered to insulation over a concrete roof deck.

**1.2 RELATED WORK**

- 1. Section 07 22 00, ROOF AND DECK INSULATION: Substrate Board, Vapor Retarder, Roof Insulation, and Cover Board.
- 2. Section 09 06 00, SCHEDULE FOR FINISHES: Roof Membrane Color.

**1.3 APPLICABLE PUBLICATIONS**

- 1. Comply with references to extent specified in this section.
- 2. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
  - FX-1-16.....Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- 3. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
  - 7-16.....Minimum Design Loads for Buildings and Other Structures.
- 4. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
  - 90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.
- 5. ASTM International (ASTM):
  - A276/A276M-17.....Stainless Steel Bars and Shapes.
  - B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate.
  - B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - C67-20.....Sampling and Testing Brick and Structural Clay Tile.
  - C140/C140M-20a.....Sampling and Testing Concrete Masonry Units and Related Units.
  - C936/C936M-20.....Solid Concrete Interlocking Paving Units.
  - C1371-15.....Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

- C1549-16.....Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
- D751-19.....Standard Test Methods for Coated Fabrics.
- D1248-16.....Polyethylene Plastics Extrusion Materials for Wire and Cable.
- D1876-08(2015)e1.....Peel Resistance of Adhesives (T-Peel Test).
- D2103-15.....Polyethylene Film and Sheeting.
- D2240-15e1.....Rubber Property-Durometer Hardness.
- D3884-09(2017).....Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method).
- D4263-83(2018).....Indicating Moisture in Concrete by the Plastic Sheet Method.
- D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.
- D4637/D4637M-15.....EPDM Sheet Used In Single-Ply Roof Membrane.
- E96/E96M-16.....Water Vapor Transmission of Materials.
- E408-13(2019).....Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
- E1918-16.....Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
- E1980-11(2019).....Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
- G21-15.....Resistance of Synthetic Polymeric Materials to Fungi.
- B. Cool Roof Rating Council (CRRC):
- 1-20.....Product Rating Program.
- C. Federal Specifications (Fed. Spec.):
- UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant).
- D. Florida Department of Business and Professional Regulation (FL):
- Approved Product Approval.
- E. National Roofing Contractors Association (NRCA):
- Manual-19.....The NRCA Roofing Manual: Membrane Roof Systems.
- F. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog.
- G. UL LLC (UL):
- 580-06..... Tests for Uplift Resistance of Roof Assemblies.

- 1897-20.....Uplift Tests for Roof Covering Systems.
- H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
- DOC PS 1-19.....Structural Plywood.
- DOC PS 2-18.....Performance Standard for Wood-Based  
Structural-Use Panels.
- I. U.S. Environmental Protection Agency (EPA):
- Energy Star.....ENERGY STAR Program Requirements for Roof  
Products Version 3.0.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Roofing membrane layout.
- C. Manufacturer's Literature and Data:
1. Description of each product.
  2. Installation instructions.
  3. Warranty.
- D. Sustainable Construction Submittals:
1. Solar Reflectance Index (SRI) for roofing membrane.
  2. Low Pollutant-Emitting Materials:
    - a. Show volatile organic compound types and quantities.
  3. Energy Star label for roofing membrane.
- E. Samples:
1. Roofing Membrane: 150 mm (6 inch) square.
  2. Base Flashing: 150 mm (6 inch) square.
  3. Fasteners: Each type.
  4. Roofing Membrane Seam: 300 mm (12 inches) square.
- F. Certificates: Certify products comply with specifications.
1. Fire and windstorm classification.
- G. Qualifications: Substantiate qualifications comply with specifications.
1. Installer, including supervisors with project experience list .
  2. Manufacturer's field representative with project experience list .
- H. Field quality control reports.
- I. Temporary protection plan. Include list of proposed temporary materials.
- J. Operation and Maintenance Data:
1. Maintenance manuals.

### **1.5 QUALITY ASSURANCE**

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

- a. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
- b. Regularly installs specified products.
- c. Installed specified products with satisfactory service on five similar installations for minimum five years.
- 1) Project Experience List: Provide contact names and addresses for completed projects.
- d. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.

#### **2. Manufacturer's Field Representative:**

- a. Manufacturer's full-time technical employee or independent roofing inspector.
- b. Individual certified by Roof Consultants Institute as Registered Roof Observer.

### **1.6 DELIVERY**

- 1. Deliver products in manufacturer's original sealed packaging.
- 2. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.
- 3. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

### **1.7 STORAGE AND HANDLING**

- 1. Comply with NRCA Manual storage and handling requirements.
- 2. Store products indoors in dry, weathertight facility.
- 3. Store adhesives according to manufacturer's instructions.
- 4. Protect products from damage during handling and construction operations.
- 5. Products stored on the roof deck must not cause permanent deck deflection.

### **1.8 FIELD CONDITIONS**

#### **1. Environment:**

- a. Product Temperature: Minimum 4 degrees C (40 degrees F) and rising before installation.
- b. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

### **1.9 WARRANTY**

1. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
2. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.
  - a. Warranty Period: 10 years.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

1. Roofing System: Adhered roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards.

### **2.2 SYSTEM PERFORMANCE**

1. Design roofing system meeting specified performance:
  - a. Load Resistances indicated on Drawings.
    - 1) See Uplift plans in Structural Drawings.
2. Energy Performance:
  - a. Reflectance tested in according to ASTM C1549 or ASTM E1918, and minimum 0.75 thermal emittance tested in according to ASTM C1371 or ASTM E408.
    - 1) Where tested aged values are not available:
      - a) Calculate compliance adjusting initial solar reflectance according to ASHRAE 90.1.
      - b) Provide roofing system with minimum 64 three-year aged Solar Reflectance Index calculated according to ASTM E1980 with 12 watts/square meter/degree K  
(2.1 BTU/hour/square foot) convection coefficient.

### **2.3 PRODUCTS - GENERAL**

1. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
2. Provide roof system components from one manufacturer.

### **2.4 EPDM ROOFING MEMBRANE**

- A. EPDM Sheet: ASTM D4637/D4637M, Type II - internally reinforced
  1. Thickness: 1.5 mm (60 mils) No fabric backing.
  2. Color: See Section 09 06 00, SCHEDULE OF FINISHES.
- B. Additional Properties:

PROPERTY	TEST METHOD	REQUIREMENT
Shore A Hardness	ASTM D2240	55 to 75 Durometer
Water Vapor Permeance	ASTM E96/E96M	Minimum 8 ng/Pa/s/sq. m (0.14 perms) Water Method
Fungi Resistance	ASTM G21	After 21 days, no sustained growth or discoloration.

1. Use fire retardant membrane when not protected by ballast or pavers. Verify for UL or approval.

## **2.5 MEMBRANE ACCESSORY MATERIALS**

1. Sheet roofing manufacturer's specified products.
2. Flashing Sheet: Manufacturer's standard; same material, and color as roofing membrane.
  - a. Self-curing EPDM flashing adaptable to irregular shapes and surfaces.
  - b. Minimum Thickness: 1.5 mm (0.060 inch).
3. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.
4. Splice Adhesive or Tape: Manufacturer's standard for roofing membrane and flashing sheet.
5. Splice Lap Sealant: Liquid EPDM rubber for exposed lap edge.
6. Bonding Adhesive: Manufacturer's standard, solvent based, to suit substrates.
7. Termination Bars: Manufacturer's standard, stainless steel or aluminum, 25 mm wide by 3 mm thick (1 inch wide by 1/8 inch thick) factory drilled for fasteners.
8. Battens: Manufacturer's standard, galvanized or galvanized steel, 25 mm wide by 1.3 mm thick (1 inch wide by 0.05 inch thick), factory punched for fasteners.
9. Pipe Compression Clamp:
  - a. Stainless steel drawband.
  - b. Worm drive clamp device.
10. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.
11. Fastener Sealer: One-part elastomeric adhesive sealant.
12. Temporary Closure Sealers (Night Sealant): Polyurethane two-part sealer.



13. Primers, Splice Tapes, Cleaners, and Butyl Rubber Seals: As specified by roof membrane manufacturer.

14. Asphalt Roof Cement: ASTM D4586/D4586M.

## **2.6 ACCESSORIES**

1. Temporary Protection Materials:

a. Expanded Polystyrene (EPS) Insulation: ASTM C578.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

1. Examine and verify substrate suitability for product installation with roofing installer and roofing inspector present.

a. Verify roof penetrations are complete, secured against movement,

b. Verify roof deck is adequately secured to resist wind uplift.

c. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

2. Correct unsatisfactory conditions before beginning roofing work.

### **3.2 PREPARATION**

1. Complete roof deck construction before beginning roofing work:

a. Curbs, blocking, edge strips, and other components to which roofing and base flashing is attached in place ready to receive insulation and roofing.

b. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.

c. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

2. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

3. Broom clean roof decks. Remove dust, dirt and debris.

4. Remove projections capable of damaging roofing materials.

5. Concrete Decks, except Insulating Concrete:

a. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.

b. Prime concrete decks. Keep primer back 100 mm (four inches) from precast concrete deck joints.

- c. Allow primer to dry before application of bitumen.

### **3.3 TEMPORARY PROTECTION**

1. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.
2. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.
3. Temporarily seal exposed insulation surfaces within roofing membrane.
  - a. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
  - b. Direct water away from work. Provide drainage, preventing water accumulation.
  - c. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.
4. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.
5. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.
6. Remove sandbags and store for reuse.

### **3.4 INSTALLATION, GENERAL**

1. Install products according to manufacturer's instructions and approved submittal drawings .
  - a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
  - b. Comply with NRCA Manual installation requirements.
  - c. Comply with structural uplift plan.
  - d. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with EPDM.

**3.5 ROOFING INSTALLATION**

1. Install membrane perpendicular to long dimension of insulation boards.
2. Begin membrane installation at roof low point and work towards high point. Lap membrane shingled in water flow direction.
3. Position membrane free of buckles and wrinkles.
4. Roll membrane out; inspect for defects as membrane is unrolled.

Remove defective areas:

- a. Allow 30 minutes for membrane to relax before proceeding.
  - b. Lap edges and ends minimum 75 mm (3 inches). Clean lap surfaces.
  - c. Install seam adhesive or tape, unless furnished with factory applied adhesive strips. Apply pressure to develop full adhesion.
  - d. Check seams to ensure continuous adhesion and correct defects.
  - e. Finish seam edges with beveled bead of lap sealant.
  - f. Finish seams same day as membrane is installed.
  - g. Anchor membrane perimeter to roof deck and parapet wall as indicated on drawings.
5. Adhered System Installation:
- a. Apply bonding adhesive in quantities required by roofing membrane manufacturer.
  - b. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
  - c. After adhesive has set according to adhesive manufacturer's instructions, roll roofing membrane into adhesive minimizing voids and wrinkles.
  - d. Repeat for other half of sheet.
  - e. Cut voids and wrinkles to lay flat. Clean and patch cut area.

**3.6 FLASHING INSTALLATION**

1. Install flashings on same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.
2. Flashing Roof Drains:
  - a. Install roof drain flashing according to roofing membrane manufacturer's instructions.

- 1) 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 roof cement to contact EPDM roofing membrane.
- c. Adhere roofing membrane to metal flashing with bonding adhesive.
- d. Turn metal drain flashing and roofing membrane down into drain body. Install clamping ring and strainer.
3. Installing Base Flashing and Pipe Flashing:
4. Install flashing sheet to pipes, walls and curbs to minimum 200 mm (8 inches) height above roof surfaces and extend roofing manufacturer's standard lap dimension onto roofing membranes.
  - a. Adhere flashing with bonding adhesive.
  - b. Form inside and outside corners of flashing sheet according to NRCA Manual. Form pipe flashing according to NRCA Manual.
  - c. Lap ends roofing manufacturer's standard dimension.
  - d. Adhesively splice flashing sheets together, and adhesively splice flashing sheets to roofing membranes. Finish exposed edges with lap sealant.
5. Anchor top of flashing to walls and curbs with fasteners spaced maximum 150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
6. Apply sealant to top edge of flashing.
7. Install Building Expansion Joints.
8. Install base flashing on curbs as specified.
9. Coordinate installation with roof expansion joint system .
10. Install flexible tubing 1-1/2 times width of joint centered over joint. Cover tubing with flashing sheet adhered to base flashing and lapping base flashing roofing manufacturer's standard dimension. Finish edges of laps with lap sealant.
11. Repairs to Membrane and Flashings:
  - a. Remove sections of roofing membrane or flashing sheet that are creased, wrinkled, or fish mouthed.
  - b. Cover removed areas, cuts and damaged areas with patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Adhesively splice patch to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

### **3.7 FIELD QUALITY CONTROL**

1. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

- a. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.
- b. Probe seams to detect marginal bonds, voids, skips, and fishmouths.
- c. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
- d. Cut one sample for every 450 meter (1500 feet) of seams.
- e. Cut samples perpendicular to seams.
- f. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.
- g. Repair areas where samples are taken and where marginal bond, voids, and skips occur.
- h. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

2. Manufacturer Services:

- a. Inspect initial installation, installation in progress, and completed work.
- b. Issue supplemental installation instructions necessitated by field conditions.
- c. Prepare and submit inspection reports.
- d. Certify completed installation complies with manufacturer's instructions and warranty requirements.

### **3.8 CLEANING**

- 1. Remove excess adhesive before adhesive sets.
- 2. Clean exposed roofing surfaces. Remove contaminants and stains to comply with specified solar reflectance performance .

### **3.9 PROTECTION**

- 1. Protect roofing system from traffic and construction operations.
  - a. Protect roofing system when used for subsequent work platform, materials storage, or staging.
  - b. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

2. Loose lay temporary insulation board overlaid with plywood or OSB.

a. Weight boards to secure against wind uplift.

3. Remove protection when directed by Contacting Officer's  
Representative .

B. Repair damage.

- - E N D - -

**SECTION 07 60 00  
FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

**1.2 RELATED WORK**

- A. Section 07 53 23 ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING Membrane base flashings and stripping.
- B. Section 07 92 00, JOINT SEALANTS: Joint Sealants.
- C. Section 09 06 00, SCHEDULE FOR FINISHES: Color of factory coated exterior architectural metal and anodized aluminum items.
- D. Section 09 91 00, PAINTING: Paint materials and application.
- E. Division 22, PLUMBING: Integral flashing components of manufactured roof specialties and accessories or equipment.
- G. Division 23 HVAC: Integral flashing components of manufactured roof specialties and accessories or equipment.

**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/Factory Mutual (ANSI/SPRI/FM):  
4435/ES-1-11.....Wind Design Standard for Edge Systems Used with  
Low Slope Roofing Systems
- C. ASTM International (ASTM):  
A240/A240M-20.....Standard Specification for Chromium and  
Chromium-Nickel Stainless Steel Plate, Sheet  
and Strip for Pressure Vessels and for General  
Applications.  
A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc  
Alloy Coated (Galvanized) by the Hot- Dip  
Process  
B32-08(2014).....Solder Metal

D412-16.....Vulcanized Rubber and Thermoplastic Elastomers-  
Tension

D1187/D1187M-97(2018)...Asphalt Base Emulsions for Use as Protective  
Coatings for Metal

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from  
Vinyl-Coated Glass Yarns

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos Free

D. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Architectural Sheet Metal Manual.

E. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual

F. Federal Specification (Fed. Spec):  
A-A-1925A.....Shield, Expansion; (Nail Anchors)

G. International Code Commission (ICC): International Building Code,  
Current Edition

#### **1.4 PERFORMANCE REQUIREMENTS**

A. Wind Uplift Forces: See Uplift Resistance Plan in Structural Document.

B. Wind Design Standard: Fabricate and install copings, roof-edge  
flashings tested per ANSI/SPRI/FM ES-1 to resist design pressure  
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. Expansion joints
4. Fascia-cant

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing
2. Thru wall flashing
3. Expansion joint cover, each type
4. Bituminous coated copper
5. 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.
- B. Galvanized Sheet: ASTM, A653.

## **2.2 FLASHING ACCESSORIES**

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Bituminous Paint: ASTM D1187, Type I.
- C. Fasteners:
  - 1. Use stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
  - 2. Nails:
    - a. Minimum diameter for aluminum nails 3 mm (0.105 inch).
    - b. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - c. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  - 4. Expansion Shields: Fed Spec A-A-1925A.
- D. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- E. Roof Cement: ASTM D4586.

## **2.3 SHEET METAL THICKNESS**

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
  - 1. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
  - 1. Aluminum
- D. Thickness of aluminum or galvanized steel is specified with each item.

## **2.4 FABRICATION, GENERAL**

- A. Jointing:
  - 1. Joints shall conform to following requirements:
    - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.

- b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
  - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
- 2. Flat and lap joints shall be made in direction of flow.
- 3. Soldering:
  - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
  - b. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
  - c. Completely remove acid and flux after soldering is completed.
- B. Expansion and Contraction Joints:
  - 1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
  - 2. Space joints as shown or as specified.
  - 3. Space expansion at intervals not exceeding 7200 mm (24 feet).
  - 4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet.)
  - 5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
  - 6. Fabricate joint covers of same thickness material as sheet metal served.
- C. Cleats:
  - 1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
  - 2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
  - 3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
  - 4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.
- D. Continuous Cleats:
  - 1. Fabricate where shown and specified to secure loose edges of the sheet metal work.

2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting 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. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

## 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. Aluminum:
    - a. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte,

integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.

b. Fluorocarbon Finish: AAMA 620, high performance organic coating.

## **2.6 THROUGH-WALL FLASHINGS**

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
  - 1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
  - 2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
  - 1. Either copper, stainless steel, or copper clad stainless steel.
  - 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  - 3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
  - 1. Use same metal and thickness as counter flashing.
  - 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  - 3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. For Flashing at Stone Panels.
  - 1. Use plan flat sheet of stainless steel.
  - 2. Form exposed portions with drip as specified or receiver.
- E. Windowsill Flashing and Lintel Flashing:
  - 1. Use either nonreinforced elastomeric sheeting, bituminous coated copper, .
  - 2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
  - 3. Turn up back edge as shown.
  - 4. Form exposed portion with drip as specified or receiver.

## **2.7 BASE FLASHING**

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
  - 1. Use either copper, or stainless steel, thickness specified unless specified otherwise.

2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use either copper, or stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
  1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
  2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
  3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
    - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
    - b. Allow for loose fit around and into the pipe.
  4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
    - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
    - b. Allow for loose fit around pipe.

## **2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. Either copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
  1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
  2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
  3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.

4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:

1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.

4. Use stainless steel bolt on draw band tightening assembly.
  5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.
- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

## **2.9 INSULATED EXPANSION JOINT COVERS**

- A. Either type optional, use only one type throughout.
- B. Types:
1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
  2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.
- C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.
- D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
  2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.

3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:



- a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
  - b. Paint dissimilar metal with a coat of bituminous paint.
  - c. Apply an approved caulking material between aluminum and dissimilar metal.
- 15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
  - 16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

### **3.2 THROUGH-WALL FLASHING**

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

- 1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
- 2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
- 3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
- 4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
- 5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
- 6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
- 7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
- 8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
- 9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
- 10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.

11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
  - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
  - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).
- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.
- C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.
- E. Flashing at Veneer Walls:
  1. Install near line of finish floors over shelf angles or where shown.
  2. Turn up against sheathing.
  3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
  4. At concrete backing, extend flashing into reglet as specified.
  5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- F. Lintel Flashing when not part of shelf angle flashing:
  1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.

2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:

1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

### **3.3 BASE FLASHING**

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into metal studs.

4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

### **3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. General:
  1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
  2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
  3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
  4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
  5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
  6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
  1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
  2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
  3. Where flashing is surface mounted on flat surfaces.
    - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      - 1) Locate fasteners in masonry mortar joints.

- 2) Use screws to sheet metal or wood.
- b. Fill joint at top with sealant.
- 4. Where flashing or hood is mounted on pipe.
  - a. Secure with draw band tight against pipe.
  - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
  - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
  - 1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  - 2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturers' instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  - 3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

### **3.5 REGLETS**

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
  - 1. Coordinate reglets for anchorage into concrete with formwork construction.
  - 2. Coordinate reglets for masonry to locate horizontally into mortar joints.

### **3.6 COPINGS**

- A. General:
  - 1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.

2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. 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.

C. Stainless steel Copings:

1. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

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**SECTION 07 72 00  
ROOF ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies roof hatches.

**1.2 RELATED WORK**

- A. Section 07 21 13, THERMAL INSULATION: General insulation.
- B. Section 07 22 00, ROOF AND DECK INSULATION: Rigid insulations for roofing.
- C. Section 07 92 00, JOINT SEALANTS: Sealant material and installation.

**1.3 QUALITY ASSURANCE**

- A. Provide roof accessories that are the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. For each accessory type provide the same product made by the same manufacturer.
- C. Assemble each accessory to the greatest extent possible before delivery to the site.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Submit representative sample panel of color anodized aluminum not less than 101 x 101 mm (4 x 4 inches). For extrusions, submit width not less than section to be installed. Show coating with integral color and texture and include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

**1.5 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. ASTM International (ASTM):  
A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process

- B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate
- B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate  
(Metric)
- B221-14.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes (Metric)
- C726-17.....Mineral Wool Roof Insulation Board
- C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal  
Insulation Board
- D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective  
Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06 Series.....Metal Finishes Manual
- D. American Architectural Manufacturers Association (AAMA):
- 2603-20.....Performance Requirements and Test Procedures  
for Pigmented Organic Coatings on Aluminum  
Extrusions and Panels (with Coil Coating  
Appendix).
- 2605-20.....Performance Requirements and Test Procedures  
for Superior Performing Organic Coatings on  
Architectural Extrusions and Panels (with Coil  
Coating Appendix).
- 611-14.....Anodized Architectural Aluminum
- 621-02.....High Performance Organic Coatings on Coil  
Coated Architectural Hot Dipped Galvanized  
(HDG) and Zinc-Aluminum Coated Steel Substrates
- E. American Society of Civil Engineers (ASCE):  
ASCE/SEI 7-16.....Minimum Design Loads and Associated Criteria  
for Buildings and Other Structures
- F. U.S. Occupational Safety and Health Standards (OSHA):  
29 CFR 1910 Subpart D... Walking-Working Surfaces (1910.21-1910.30)

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221M (B221).
- B. Aluminum Sheet: ASTM B209M (B209).
- C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.



D. Asphalt Coating: ASTM D1187/D1187M, Type I, quick setting.

## **2.2 ROOF HATCH (SCUTTLE)**

### **A. Performance Characteristics:**

1. Cover to be reinforced to support a minimum live load of 195 kilogram per square meter (40 pounds per square foot) with a maximum deflection of 1/150th of the span or 97 kilogram per square meter (20 pounds per square foot) wind uplift.
2. Operation of the Cover: Smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the Cover: Not affected by temperature.
4. Entire Hatch: Weathertight with fully welded corner joints on cover and curb.

### **B. Shop fabricate from aluminum with mill finish.**

### **C. Curb and Cover:**

1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum with mill finish.
2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
3. Minimum of 50 mm (2 inch) thick polyisocyanurate insulation (ASTM C1289) with a U-value = 0.47 W/mK (R-value = 12) between facings of cover and over exterior face of curb.
4. Form exterior curb facing with an integral 76 mm (3 inch) wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
5. Make curb 12 inches) above finish roof surface.
6. Form cover to lap curb and cap flashing.
7. Size opening as shown on construction documents.

### **D. Hardware:**

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long. Bolt hardware into heavy gauge channel reinforcement welded to the underside of the cover and concealed within the insulation space.
2. Provide heavy duty pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Latch Strike: Stamped component bolted or welded to the curb assembly.
5. Automatically lock in the open position at not less than 70 degrees.

6. Provide weather stripping at cover closure.
7. Galvanize all hardware items.

E. Assembly:

1. Shop assemble roof scuttle.
2. Weld joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.

F. Safety Accessories:

1. Ladder Assist Post: Provide a telescoping tubular section that locks automatically when fully extended. Control upward and downward movement by a stainless steel spring balancing mechanism. Provide unit completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.
2. Safety Railing: Provide a fixed, attached to the roof hatch railing assembly including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; complying with 29 CFR 1910.23 requirements.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install roof specialties where indicated on construction documents.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
  1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
  2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
  3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).
- F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

**3.2 PROTECTION OF ALUMINUM**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

**3.3 ADJUSTING**

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

**3.4 PROTECTION**

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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**SECTION 07 81 00  
APPLIED FIREPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies spray-applied mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Installer qualifications.
- D. Testing laboratory accreditations.
- E. Manufacturer's Literature and Data:
  - 1. Manufacturer's complete and detailed application instructions and specifications.
  - 2. Manufacturer's repair and patching instructions.
- F. Certificates:
  - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
    - a. List thickness and density of material required to meet fire ratings.
    - b. Accompanied by complete test report and test record.
  - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- G. Miscellaneous:
  - 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
  - 2. Manufacturer's written approval of completed installation.
  - 3. Manufacturer's written approval of the applicators of fireproofing material.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Deliver to jobsite in sealed containers marked and labeled to show manufacturer's name and brand and UL certification markings of compliance with the specified requirements.
- B. Remove damaged or opened containers from the site.

- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

**1.4 FIELD CONDITIONS:**

- A. Temperature: Do not apply fireproofing when substrate or ambient temperature is below 4 degrees C (40 degrees F) unless temporary protection and heat are provided to maintain temperature at or above stated value during application and for 24 hours before and after application.
- B. Humidity: Maintain relative humidity levels within limits recommended by fireproofing manufacturer.
- C. Ventilation: Provide ventilation to properly dry the fireproofing after application. Provide a minimum of four (4) air exchanges per hour by forced air circulation. When permitted by Contracting Officer Representative (COR), ventilate by natural circulation.

**1.5 QUALITY ASSURANCE:**

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. Submit manufacturer's certification that each installer is trained and qualified to install the specified fireproofing. Submit evidence that each installer has a minimum of three (3) years' experience and a minimum of four (4) installations using the specified fireproofing.
- B. Testing Laboratory Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority. Submit a copy of the Certificate of Accreditation and Scope of Accreditation.
- C. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- D. Manufacturer's inspection and approval of surfaces to receive fireproofing.
- E. Manufacturer's approval of fireproofing applications.
- F. Manufacturer's approval of completed installation.

- G. Manufacturer's representative is to observe and advise at the commencement of application and is required to visit the site as required thereafter for the purpose of ascertaining proper application.
- H. Pre-Application Test Area.
  - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
    - a. Apply to one (1) column.
    - b. Apply for the hourly ratings required in the construction documents.
  - 2. Install in location selected by the COR and the testing agency, for approval by the representative of the fireproofing material manufacturer and the COR.
  - 3. Perform Bond test for cohesive and adhesive strength in accordance with ASTM E736 for each applied fireproofing design used.
  - 4. Perform density test in accordance with ASTM E736 for each applied fireproofing design used.
  - 5. Do not proceed in other areas until installation of test area has been completed and approved.
  - 6. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
  - C841-03(R2013).....Installation of Interior Lathing and Furring
  - C847-14.....Metal Lath
  - E84-14.....Surface Burning Characteristics of Building Materials
  - E119-12a.....Fire Tests of Building Construction and Materials
  - E605-93(R2011).....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members
  - E736-00(R2011).....Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

- E759-92 (R2011) .....The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
- E760-92 (R2011) .....Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
- E761-92 (R2011) .....Compressive Strength of Fire-Resistive Material Applied to Structural Members
- E859-93 (R2011) .....Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
- E937-93 (R2011) .....Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
- E1042-02 (R2014) .....Acoustically, Absorptive Materials Applied by Trowel or Spray.
- G21-13 .....Determining Resistance of Synthetic Polymeric Materials to Fungi
- C. Underwriters Laboratories, Inc. (UL):  
Fire Resistance Directory...Latest Edition including Supplements
- D. Warnock Hersey (WH):  
Certification Listings..Latest Edition
- E. Factory Mutual System (FM):  
Approval Guide.....Latest Edition including Supplements
- F. Environmental Protection Agency (EPA):  
40 CFR 59 (2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

## **PART 2 - PRODUCTS**

### **2.1 SPRAYED-ON FIREPROOFING:**

- A. ASTM E1042, Class (a), Category A. Thickness as required for 2 Hour Protection/Rating
1. Type I, factory mixed cementitious materials with approved aggregate.
  2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg per cubic meter (15 lb. per cubic feet) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.
- B. Materials containing asbestos are not permitted.
- C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3 m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf per sq. ft.) for protected areas. 19.15 kPa (400 lbf per sq. ft.) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27 gm per sq. meter (0.025 gm per sq. ft.).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000 psf).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

## 2.2 ADHESIVE:

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

## 2.3 SEALER:

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant.
- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.



E. VOC content: Product to comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.

#### **2.4 WATER:**

- A. Clean, fresh, and free from organic and mineral impurities.
- B. pH of 6.9 to 7.1.

#### **2.5 MECHANICAL BOND MATERIAL:**

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg per square meter (1.7 pounds per square yard) or as required, according to fire-resistance designs indicated and fire proofing manufacturer's written instructions.
- B. Fasteners: ASTM C841.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachments.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION:**

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. When applied in conjunction with roof structures or roof decks, verify that roofing, installation of rooftop HVAC equipment, and other related work are complete.
- F. Verify temperature and enclosure conditions required by fire-proofing material manufacturer.

- G. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond. Submit test report.

### 3.2 APPLICATION:

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.
- C. Cover other work and exterior openings subject to damage from fallout or overspray of fireproofing materials during application.
- D. Application of Metal Lath:
  - 1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
  - 2. Apply to beam flanges 305 mm (12-inches) or more in width.
  - 3. Apply to column flanges 406 mm (16-inches) or more in width.
  - 4. Apply to beam or column web 406 mm (16-inches) or more in depth.
  - 5. Tack weld or mechanically fasten-on maximum of 305 mm (12-inch) center.
  - 6. Lap and tie lath member in accordance with ASTM C841.
- E. Mix and apply in accordance with manufacturer's instructions.
  - 1. Mechanically control material and water ratios.
  - 2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
  - 3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
  - 4. Minimum ASTM E605 applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purlin or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms to be as follows:
    - a. Type I - 350 kg per cubic meter (22 lb. per cubic ft.).
    - b. Type II - 240 kg per cubic meter (15 lb. per cubic ft.).
    - c. Provide materials with higher density of 640 kg per cubic metric (40 lb. per cubic feet) in mechanical rooms and parking garages.
- F. Complete application is to be completed in one area. Inspection and approval by COR is required before removal of application equipment and proceeding with further work.

**3.3 FIELD TESTS:**

- A. The applied fireproofing to be tested by a COR approved independent testing laboratory and paid for by the Contractor. Submit test reports documenting results of tests on the applied material in the project.
- B. COR will select area to be tested in specific bays on each floor using a geometric grid pattern. Apply test sample every 929 square meters (10,000 square feet) of floor area or two (2) for each floor, whichever produces the greatest number of test areas.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test are not acceptable.
- D. Areas showing less than required fireproofing characteristics are not suitable for the following field tests.
  - 1. Test for cohesion/adhesion: ASTM E736.
  - 2. Test for bond impact strength: ASTM E760.

**3.4 PATCHING AND REPAIRING:**

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material manufacturer's recommendations.
  - 1. Respray areas requiring additional fireproofing material to provide the required thickness and replace dislodged or removed material.
  - 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
  - 3. Do not hand mix material.
- C. Repair:
  - 1. Respray test and rejected areas.
  - 2. Patch fireproofing material which is removed or disturbed after approval.
- D. Perform final inspection of sprayed areas after patching and repair.

**3.6 SCHEDULE:**

- A. Apply fireproofing material on interior structural steel members and on underside of interior steel floor and roof decks and as per Life Safety Plan.

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**SECTION 07 84 00  
FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

**1.2 RELATED WORK**

- A. Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES: Expansion and seismic joint firestopping.
- B. Section 07 81 00, APPLIED FIREPROOFING: Spray applied fireproofing.
- C. Section 07 92 00, JOINT SEALANTS: Sealants and application.
- D. Section 23 37 00, AIR OUTLETS AND INLETS: Fire damper assemblies in ductwork.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Installer qualifications.
- C. Inspector qualifications.
- D. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- E. List of FM, UL, or WH classification number of systems installed.
- F. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- G. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

**1.5 QUALITY ASSURANCE**

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

- B. **Installer Qualifications:** A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.
- C. **Inspector Qualifications:** Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. **ASTM International (ASTM):**
  - E84-20.....Surface Burning Characteristics of Building Materials
  - E699-16.....Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components
  - E814-13a(2017).....Fire Tests of Penetration Firestop Systems
  - E2174-20a.....Standard Practice for On-Site Inspection of Installed Firestop Systems
  - E2393-20.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- C. **FM Global (FM):**
  - Annual Issue Approval Guide Building Materials
  - 4991-13.....Approval of Firestop Contractors
- D. **Underwriters Laboratories, Inc. (UL):**
  - Annual Issue Building Materials Directory
- E. **Annual Issue Fire Resistance Directory**
  - 723-Edition 11(2018)....Standard for Test for Surface Burning Characteristics of Building Materials
  - 1479-04(2015).....Fire Tests of Penetration Firestops
- F. **Intertek Testing Services - Warnock Hersey (ITS-WH):**

Annual Issue Certification Listings

G. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission

Standards for Consumer and Commercial Products

**PART 2 - PRODUCTS**

**2.1 FIRESTOP SYSTEMS**

- A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross-sectional area.
- C. Firestop sealants used for firestopping to have the following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Release no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
  - 5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
    - a. Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
- D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
  - 1. Classified for use with the particular type of penetrating material used.

2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
- E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.
- F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
- H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
  3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

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

### **3.3 INSTALLATION**

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

### **3.4 CLEAN-UP**

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



deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

### **3.5 INSPECTIONS AND ACCEPTANCE OF WORK**

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

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**SECTION 07 92 00  
JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):**

- B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- C. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.
- D. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Glazed Aluminum Curtain Wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- G. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.
- H. Mechanical Work:  
  - Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
  - Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**1.3 QUALITY ASSURANCE:**

- A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
- B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify COR seven (21) days in advance of dates and times when test joints will be erected.
  4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

#### **1.4 CERTIFICATION:**

- A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:

1. Primers

2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

**1.6 PROJECT CONDITIONS:**

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:

a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).

b. When joint substrates are wet.

B. Joint-Width Conditions:

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

C. Joint-Substrate Conditions:

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

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

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

**1.8 DEFINITIONS:**

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

**1.9 WARRANTY:**

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

#### 1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):
- C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material
  - C612-14.....Mineral Fiber Block and Board Thermal Insulation
  - C717-14a.....Standard Terminology of Building Seals and Sealants
  - C734-06 (R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering
  - C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - C919-12.....Use of Sealants in Acoustical Applications.
  - C920-14a.....Elastomeric Joint Sealants.
  - C1021-08 (R2014).....Laboratories Engaged in Testing of Building Sealants
  - C1193-13.....Standard Guide for Use of Joint Sealants.
  - C1248-08 (R2012).....Test Method for Staining of Porous Substrate by Joint Sealants
  - C1330-02 (R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
  - C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
  - D217-10.....Test Methods for Cone Penetration of Lubricating Grease
  - D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
  - E84-09.....Surface Burning Characteristics of Building Materials
- C. Sealant, Waterproofing and Restoration Institute (SWRI).  
The Professionals' Guide
- D. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

- A. All Sealants will be paintable.
- B. Exterior Sealants:
  - 1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT, M, A, and O.
  - 2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
  - 3. Provide location(s) of exterior sealant as follows:
    - a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
    - b. Metal to metal.
    - c. Masonry or stone to metal
    - c. Masonry to masonry or stone.
    - e. Cast stone to cast stone.
    - f. Masonry expansion and control joints.
    - i. Voids where items penetrate exterior walls.
- B. Floor Joint Sealant:
  - 1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
  - 2. Provide location(s) of floor joint sealant as follows.
    - a. Seats of metal thresholds exterior doors.
    - b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.
- C. Interior Sealants:
  - 1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
    - a. Architectural Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
  - 2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
  - 4. Provide location(s) of interior sealant as follows:

- a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
  - b. Perimeter of door, window frames, which adjoin wall or partition surfaces.
  - c. Interior surfaces of exterior wall penetrations.
  - d. Joints at masonry walls, concrete walls or exterior walls.
  - e. Perimeter of windows and gypsum wallboard walls.
  - g. Joints between fixtures and ceramic tile; joints formed where nonplanar tile surfaces meet.
  - h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
  - i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.
- D. Acoustical Sealant:
- 1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
  - 2. Provide location(s) of acoustical sealant as follows:
    - a. Exposed acoustical joint at sound rated partitions.
    - b. Concealed acoustic joints at sound rated partitions.
    - c. Joints where item pass-through sound rated partitions.

## **2.2 COLOR:**

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent concrete.
- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.
- D. All sealants will be paintable.

## **2.3 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## **2.5 FILLER:**

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

## **2.6 PRIMER:**

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

## **2.7 CLEANERS-NON POROUS SURFACES:**

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

# **PART 3 - EXECUTION**

## **3.1 INSPECTION:**

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.



**3.2 PREPARATIONS:**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
    - a. Metal.
    - b. Glass.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
  - 1. Apply primer prior to installation of back-up rod or bond breaker tape.

2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

### **3.3 BACKING INSTALLATION:**

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

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

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

### **3.5 INSTALLATION:**

- A. General:
  1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
  2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
  3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
  4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  5. Avoid dropping or smearing compound on adjacent surfaces.
  6. Fill joints solidly with compound and finish compound smooth.
  7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant

and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.

8. Finish paving or floor joints flush unless joint is otherwise detailed.
  9. Apply compounds with nozzle size to fit joint width.
  10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
  11. Replace sealant which is damaged during construction process.
- B. Weeps: Place vents in joints where moisture may accumulate, including at base of cavity walls, at all flashing, and as indicated on construction documents.
1. Space weeps formed from vent panels not more than 406 mm (16 inches) o.c.
- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
  2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
  3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
  4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
  5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL:**

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
- a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
  - b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
- 1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  - 3. Whether sealants filled joint cavities and are free from voids.
  - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

**3.7 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
- B. Leave adjacent surfaces in a clean and unstained condition.

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**SECTION 07 95 13  
EXPANSION JOINT COVER ASSEMBLIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Prefabricated floor and wall expansion joint assemblies.
    - a. Metal plate covers at floor and wall joints.
    - b. Elastomeric joint covers at ceiling joints.
    - c. Preformed elastomeric sealant joint at interior floor control joints.
    - d. Exterior wall joints.

**1.2 RELATED WORK**

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Color of Elastomer Inserts, Filler Strips, Exterior Wall Seals and Metal Finishes.
- B. 09 22 16 Non-Structural Metal Framing
- C. 09 29 00 Gypsum Board
- D. 09 51 00 Acoustical Ceilings
- E. 09 65 13 Resilient Base and Accessories
- F. 09 65 16 Resilient Sheet Flooring
- G. 09 65 19 Resilient Tile Flooring
- H. 09 68 00 Carpeting
- I. 09 91 00 Painting

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this Section.
- B. American Society of Civil Engineers (ASCE):
  - ASCE/SEI 7-10 - Minimum Design Loads For Buildings and Other Structures.
- C. ASTM International (ASTM):
  - A36/A36M-19 - Structural Steel.
  - A240/A240M-20 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
  - A283/A283M-18 - Low and Intermediate Tensile Strength Carbon Steel Plates.
  - A786/A786M-15 - Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
  - B36/B36M-18 - Brass, Plate, Sheet, Strip, and Rolled Bar.

- B121/B121M-16 - Lead Brass Plate, Sheet, Strip and Rolled Bar.
- B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- B455/B455M-20 - Copper-Zinc-Lead Alloy (Lead-Brass) Extruded Shapes.
- C864-05(2019) - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D1187/D1187M-97(2018) - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- E1399/E1399M-97(2017) - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
- E1966-15(2019) - Standard Test Method for Fire-Resistive Joint Systems.
- D. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06 - Metal Finishes Manual.
- E. UL LLC (UL):  
2079-15 - Standard for Tests for Fire Resistance of Building Joint Systems.

#### 1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  - a. Include large-scale details indicating profiles of each type of expansion joint cover, splice joints between joint sections, transitions to other assemblies, terminations, anchorages, fasteners, and relationship to adjoining work and finishes.
  - b. Show size, configuration, and fabrication and installation details.
  - c. Include composite drawings showing work specified in other Sections coordinated with expansion joints.
- C. Manufacturer's Literature and Data:
  - a. Description of each product specified.
  - b. Show movement capability of each cover assembly and suitability of material used in exterior seals for ultraviolet exposure .
  - c. Description of materials and finishes.

- d. Installation instructions.
- D. Samples: Submit 300 mm (12 inch) long samples.
  - a. Each type and color of metal finish for each required thickness and alloy.
  - b. Each type and color of flexible seal.
- E. Qualifications: Substantiate qualifications comply with specifications.
  - a. Installer with project experience list .
- F. Certificates: Indicate products comply with specifications.
  - a. Fire rated expansion joint cover assemblies.
- G. Operation and Maintenance Data:
  - a. Care instructions for each exposed finish product.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Regularly installs specified products.
  - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
    - a. Project Experience List: Provide contact names and addresses for completed projects.

#### **1.6 DELIVERY**

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.7 STORAGE AND HANDLING**

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

#### **1.8 FIELD CONDITIONS**

- A. Field Measurements: Verify field conditions affecting expansion joint cover assembly fabrication and installation. Show field measurements on Submittal Drawings.
  - 1. Coordinate field measurement and fabrication schedule to avoid delay.

#### **1.9 WARRANTY**

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



## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Provide joint cover assemblies that permit unrestrained movement of joint without disengagement of cover, and, where applicable, maintain moisture, watertight and fire-rated protection.
- B. Provide templates to related trades for location of support and anchorage items.

### **2.2 SYSTEM PERFORMANCE**

- A. Design expansion joint cover assemblies complying with specified performance.
- B. Joint Movement: ASTM E1399.
  - a. Nominal Joint Width: 1 1/2 inches.
  - b. Minimum Movement Capability: 25 percent.
  - c. Movement Type: Thermal and wind
- C. Floor Joints: Live loads, including rolling loads.
  - a. Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.
  - b. Maximum Deflection: 1/360 of span, maximum.

### **2.3 MATERIALS**

- A. Stainless Steel: ASTM A240/A240M, Type 302 or 304.
- B. Structural Steel Shapes: ASTM A36/A36M.
- C. Steel Plate: ASTM A283/A283M, Grade C.
- D. Rolled Steel Floor Plate: ASTM A786/A786M.
- E. Aluminum:
  - a. Extruded: ASTM B221M (ASTM B221), alloy 6063-T5, 6063-T6, or 6061-T6.
  - b. Plate and Sheet: ASTM B209M (ASTM B209), alloy 6061-T6.
- F. Elastomeric Sealant: As specified in Section 07 92 00, JOINT SEALANTS.
- G. Elastomeric Seals:
  - a. Flexible extruded polyvinyl chloride, meeting a Shore A hardness of 75 with UV stabilizer. Manufacturer's standard colors.
- H. Thermoplastic Rubber:
  - a. ASTM C864.
  - b. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.

- I. Compression Seals: Pre-compressed secondary sealant using preformed expanding foam sealant; open-cell polyurethane foam impregnated with polymer-modified acrylic adhesive.
- J. Vinyl Invertor Sealant Waterstops: Manufacturer's standard shapes and grade.
- K. Flexible Membrane: 1.5 mm (60 mil) EPDM sheet, with manufacturer's standard support foam.
- L. Butyl Caulk Tape: Self adhering double sided butyl rubber sealant tape with easy-release silicone coated paper.

#### **2.4 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.
  - a. Provide ceiling and wall expansion joint cover assemblies design matching floor to wall and floor to floor expansion joint cover design.
  - b. Provide expansion joint cover assembly designs, profiles, materials and configuration indicated, as required to accommodate joint size variations in adjacent surfaces, and anticipated movement.
- C. Sustainable Construction Requirements:
  - a. Aluminum Recycled Content: 80 percent total recycled content, minimum.
  - b. Low Pollutant-Emitting Materials: Maximum VOC content by weight.
    - 1) Non-Flooring Adhesives and Sealants.

#### **2.5 FABRICATION**

- A. Fabricate Expansion Joint Cover Assemblies:
  - a. As complete assembly ready for installation.
  - b. In longest practicable lengths to minimize number of end joints.
  - c. With factory mitered corners where joint changes directions or abuts other materials.
    - 1) With closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
  - d. Joints within enclosed spaces such as chase walls, include 1 mm (0.04 inch) thick galvanized steel cover where conventional expansion joint cover is not used.
  - e. Seal Strip: Factory-formed and bonded to metal frames and anchor members.

- f. Compression Seals: Fabricate from expanding foam as secondary seal and elastomeric sealant to sizes and profiles shown.
- B. Floor-to-Floor Metal Plate Joints:
  - a. Frames: Metal, continuous on both sides of joint designed to support cover plate.
    - 1) Flush Design: Seating surface and raised floor rim to accommodate adjacent flooring.
    - a) Anchorage: Concealed bolt and steel anchors for embedment in concrete.
  - b. Cover Plate: Metal, matching frames where exposed.
    - 1) Supported Load: 19.2 MPa (400 psf), minimum.
    - 2) Rattle-free due to traffic.
  - c. Fillers: Resilient material between raised rim of frame and edge of cover plate, where shown.
    - 1) No gaps or bulges over full design range joint movement.
  - d. Water Stop: Manufacturer's standard, continuous, full length of joint.
  - e. Finishes: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Floor-to-Wall Metal Plate Joints:
  - a. Frames: Metal, continuous on floor side of joint only.
    - 1) Provide wall side frame where required by manufacturer's design.
  - b. Cover Plates: Angle cover plates with countersunk flat-head exposed fasteners for securing cover plate to wall unless shown otherwise.
    - 1) Fastener Spacing: As recommended by manufacturer.
  - c. Joint Design: Match adjacent floor to floor design.
  - d. Fire Barrier: As required for fire resistance rating.
  - e. Water Stop: Manufacturer's standard, continuous, full length of joint.
  - f. Finishes: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Exterior Wall Joint Assemblies:
  - a. Design seal for variable movement and prevention of water and air infiltration.
  - b. Frame: Metal, concealed, for fastening to wall on one side of joint.

- c. Cover Plate: Metal, surface mounted, lap both sides of joint, permitting free movement on one side.
    - 1) Fabricate with concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
    - 2) Use angle cover plate at intersecting walls.
  - d. Water Seal: Vinyl seal strip as secondary seal behind primary seal.
  - e. Finish: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Extruded Thermoplastic Rubber Joint Assemblies:
- a. Frames: Aluminum, both sides of joint.
  - b. Primary Seal: Flexible rubber on exposed face after frame installation with factory welded watertight miters and transitions.
  - c. Anchor spaced at ends and not over 600 mm (24 inches).
    - 1) Variable movement extruded rubber primary seal designed to remain in aluminum frame, throughout movement of joint.
  - d. Flush mounted seal minimum 3 mm (0.12 inch) thick with dual movement grooves designed for plus or minus 50 percent, movement of joint width.
  - e. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12 inches) wide and greater.
  - f. Secondary Seal: Continuous vinyl sheet seal.
  - g. Finishes: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- F. Ceiling and Soffit Assemblies:
- a. Frames: Metal, continuous on both sides of joint, flush mounted with no exposed fasteners.
  - b. Flexible Insert: Variable movement semi-rigid vinyl locked into frame.
    - 1) Face Style: Flush or accordion, as shown, to span joint width without sagging.
  - c. Finishes: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- G. Preformed Sealant Joint: Factory installed elastomeric sealant between extruded aluminum angle frame both sides.
- a. Frames: Extruded aluminum angle on both sides of joint.

- b. Filler: Elastomeric sealant.
- c. Anticipated movement: 25 percent maximum.
- d. Finishes: As specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.6 FINISHES**

- 1. Carbon Steel: NAAMM AMP 500, Galvanized G90.
- 2. Stainless Steel: NAAMM AMP 500, No. 2B bright finish.
- 3. Aluminum Anodized Finish: NAAMM AMP 500.
  - a. Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
- 4. Aluminum Paint Finish:
  - a. Fluorocarbon Finish: AAMA 2605; 70 percent fluoropolymer resin, 2-coat system.
  - b. Fluorocarbon Finish: AAMA 605; 70 percent fluoropolymer resin, 2-coat system.

## **2.7 ACCESSORIES**

- A. General: Manufacturer's standard anchors, fasteners, set screws, spaces, protective coating, and filler materials, adhesive and other accessories required for installation.
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Adhesives: Low pollutant-emitting, water-based type recommended by adhered product manufacturer for each application.
- D. Fasteners: Type and size recommended by expansion joint cover assembly manufacturer.
  - 1. Exterior Applications: Stainless steel.
  - 2. Fasteners for Aluminum: Stainless steel.
  - 3. Other Applications: Galvanized steel or stainless steel.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
  - 1. Provide items embedded in concrete and masonry in time for building into work without delaying work.
- B. Protect existing construction and completed work from damage.
- C. Apply barrier coating to aluminum steel surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

### 3.2 INSTALLATION

- A. Install products according to manufacturer's instructions and approved submittal drawings .
  - a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install anchorage devices and fasteners for securing expansion joint assemblies to in-place construction where anchors are not embedded in concrete and masonry.
  - a. Secure with metal fasteners, type and size to suit application.
- C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
- D. Install joint cover assemblies aligned and positioned in correct relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
  - a. Allow for thermal expansion and contraction of metal to avoid buckling.
  - b. Accommodate joint opening size at time of installation.
- E. Set floor covers at elevations flush with adjacent finished flooring, unless shown otherwise.
- F. Grout floor frames set in prepared recesses.
- G. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Secure with required accessories.
- H. Locate anchors at interval recommended by manufacturer, but minimum 75 mm (3 inches) from each end, and, maximum 600 mm (24 inches) on centers.
- I. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
- J. Cut and fit ends to accommodate thermal expansion and contraction of metal to avoid buckling of frames and cover plates.
- K. Flush Metal Cover Plates:
  - a. Secure flexible filler between frames to allow compression and expansion.
  - b. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- L. Fire Barriers:
  - a. Install in compliance with tested assembly.

- b. Install at joints in floors and in fire rated walls.
  - c. Use fire barrier sealant furnished with expansion joint assembly.
- M. Apply sealant where required to prevent water and air infiltration.
- N. Vertical Exterior Extruded Thermoplastic Rubber.
  - a. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with secondary seal.
  - b. Install primary seals retained in extruded aluminum side frames.
- O. Extruded Thermoplastic Rubber or Seals:
  - a. For straight sections, install preformed seals in continuous lengths.
  - b. Vulcanize or heat-seal field spliced joints to provide watertight joints as recommended by manufacturer.
- P. Preformed Elastomeric Sealant Joint:
  - a. Locate joint directly over joints in wall and floor substrates.
  - b. Fasten full length to substrate using construction adhesive.
  - c. Install flush or slightly below finish material.

### **3.3 CLEANING**

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed metal surfaces. Remove contaminants and stains.

### **3.4 PROTECTION**

- A. Cover floor joints with plywood where wheel traffic occurs before Substantial completion.
- B. Remove protective covering when adjacent work areas are completed. Clean exposed surfaces in compliance with manufacture's printed instructions.

- - E N D - -

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Hollow metal doors hung in hollow metal frames at interior locations with PLAM wood doors
2. Glazed openings in hollow metal doors.

**1.2 RELATED WORK**

- A. Section 08 34 53, SECURITY DOORS AND FRAMES: Forced Entry and Blast Resistant doors.
- B. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum frames entrance work.
- C. Section 08 71 00, DOOR HARDWARE: Door Hardware:
- D. Section 08 80 00, GLAZING: Glazing.
- E. Card Readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American National Standard Institute (ANSI):  
A250.8-2014.....Standard Steel Doors and Frames
- C. ASTM International (ASTM):  
A240/A240M-15b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications  
A653/A653M-15.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip  
A1008/A1008M-15.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable  
B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate  
B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)  
B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes  
B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)



D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from  
Vinyl Coated Glass Yarns

E90-09.....Laboratory Measurement of Airborne Sound  
Transmission Loss of Building Partitions and  
Elements

D. Federal Specifications (Fed. Spec.):

L-S-125B.....Screening, Insect, Nonmetallic

E. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

G. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Other Opening Protectives

H. UL LLC (UL):

10C-09.....Positive Pressure Fire Tests of Door Assemblies

1784-15.....Air Leakage Tests of Door Assemblies and Other  
Opening Protectives

I. Department of Veterans Affairs

VA Physical Security and Resiliency Design Manual October 1, 2020

#### 1.4 SUBMITTALS

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

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.

2. Include schedule showing each door and frame requirements fire label  
and smoke control label for openings.

3. Installation instructions.

D. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list .

E. Blast Design Calculations.

1. Submit calculations for review and approval prepared by qualified  
blast consultant, with a minimum of 5 years of experience in design  
of blast resistant door systems, verifying door assembly including  
anchors comply with specified blast resistance performance. The  
magnitudes of the design threats W1, W2 and GP1, GP2 are defined in  
the Physical Security and Resiliency Design Standards Data

Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need-to-know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant doors to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

#### **1.5 QUALITY ASSURANCE**

##### **A. Manufacturer Qualifications:**

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
  - a. Project Experience List: Provide contact names and addresses for completed projects.

#### **1.6 DELIVERY**

- A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.
- B. Deliver products in manufacturer's original sealed packaging.
- C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

#### **1.7 STORAGE AND HANDLING**

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

#### **1.8 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM PERFORMANCE**

- A. Design hollow metal doors and frames complying with specified performance:
  1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.

- a. Fire Ratings: See drawings.
- 2. Thermal Resistance: 2.4 R-value, minimum at exterior doors.
- 3. Blast Resistant Doors: Door, Frame and Anchorage:
  - a. Standoff Distance: 25 feet (Life Safety Protected)
  - b. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with GP1 threat for Life Safety Protected buildings
  - c. Frame Rotation not to exceed L/20 (Life Safety Protected) while experiencing design level pressure and impulse.
  - d. Glazing: Glazing shall meet the blast requirements shown in Specification 08 80 00.
  - e. Minimum gauge of metal used on blast resistant doors shall be 14 gauge.

## **2.2 MATERIALS**

- A. Sheet Steel: ASTM A1008/A1008M, cold-rolled.
- B. Galvanized Sheet Steel: ASTM A653.

## **2.3 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide hollow metal doors and frames from one manufacturer.
- C. Sustainable Construction Requirements:
  - 1. Steel Recycled Content: 30 percent total recycled content, minimum.

## **2.4 HOLLOW METAL DOORS**

- A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.
  - 1. Interior Doors: Level 2 and Physical Performance Level B, heavy duty; Model 2, seamless.
- B. Door Faces:
  - 1. Interior Doors: Sheet steel prime coating.
- C. Door Cores:
  - 1. Interior Doors: Kraft paper honeycomb.
  - 2. Exterior Doors: polyurethane.
  - 3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.

## **2.5 HOLLOW METAL FRAMES**

- A. Hollow Metal Frames: ANSI A250.8; face welded . See drawings for sizes and designs.
  - 1. Interior Frames:
    - a. Level 2 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.

B. Frame Materials:

1. Interior Frames: Sheet steel prime coating .

## 2.6 FABRICATION

- A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Fire Doors:

1. Close top and vertical edges flush.
2. Apply steel astragal to active leaf at pair and double egress doors.
  - a. Exception: Where vertical rod exit devices are specified for both leaves swinging in same direction.
3. Fire Door Clearances: NFPA 80.

4. Frame Anchors:

a. Floor anchors:

- 1) Provide extension type floor anchors to compensate for depth of floor fills.
- 2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
- 3) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
- 4) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
  - a) Space floor bolts 50 mm (24 inches) on center.

b. Jamb anchors:

- 1) Place anchors on jambs:
  - a) Near top and bottom of each frame.
  - b) At intermediate points at maximum 600 mm (24 inches) spacing.
- 2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.
- 3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
  - a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.

- b) T-Shape type.
  - c) Strap and stirrup type: Corrugated or perforated sheet steel.
- 4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
    - a) Welded type.
    - b) Lock-in snap-in type.
  - 5) Anchors for frames set in prepared openings:
    - a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.
    - b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.
    - c) Two-piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
  - 6) Anchors for observation windows and other continuous frames set in stud partitions.
    - a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
    - b) Space maximum 600 mm (24 inches) on centers.
  - 7) Modify frame anchors to fit special frame and wall construction.
  - 8) Provide special anchors where shown on drawings and where required to suit application.

## **2.7 FINISHES**

- A. Steel and Galvanized Steel: ANSI A250.8; shop primed.
- B. Finish exposed surfaces after fabrication.

## **2.8 ACCESSORIES**

- A. Primers: ANSI A250.8.
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
- D. Clips Connecting Members and Sleeves: Match door faces.
- E. Fasteners: stainless steel.
  1. Metal Framing: Steel drill screws.
  2. Masonry and Concrete: Expansion bolts and power actuated drive pins.
- F. Anchors: stainless steel.
- G. Galvanizing Repair Paint: MPI No. 18.

H. Insulation: Unfaced mineral wool.

### **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. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

#### **3.2 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings .
  - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
  - 2. Install fire doors and frames according to NFPA 80.

#### **3.3 FRAME INSTALLATION**

- A. Apply barrier coating to concealed surfaces of frames built into masonry.
- B. Plumb, align, and brace frames 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 when shipping spreader is removed.
  - 3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
  - 4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.
- C. Floor Anchors:
  - 1. Anchor frame jambs to floor with two expansion bolts.
    - a. All Frames: Use 6 mm (1/4 inch) diameter bolts.
  - 2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.
- D. Jamb Anchors:
  - 1. Masonry Walls:
    - a. Embed anchors in mortar.
    - b. Fill space between frame and masonry with grout or mortar as walls are built.

2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
3. Prepared Masonry and Concrete Openings:
  - a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
  - b. Subframe or Rough Buck Securement:
    - 1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
    - 2) Power activated drive pins on 600 mm (24 inches) centers.
  - c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.
- E. Touch up damaged factory finishes.
  1. Repair galvanized surfaces with galvanized repair paint.
  2. Repair painted surfaces with touch up primer.

### **3.4 DOOR INSTALLATION**

- A. Install doors plumb and level.
- B. Adjust doors for smooth operation.
- C. Touch up damaged factory finishes.
  1. Repair galvanized surfaces with galvanized repair paint.
  2. Repair painted surfaces with touch up primer.

### **3.5 CLEANING**

- A. Clean exposed door and frame surfaces. Remove contaminants and stains.

### **3.6 PROTECTION**

- A. Protect doors and frames from traffic and construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

- - - E N D - - -

**SECTION 08 14 00  
INTERIOR WOOD DOORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Interior flush wood doors PLAM finish.
  - 2. Sliding Door Systems

**1.2 RELATED WORK**

- A. Section 08 71 00, DOOR HARDWARE: Door Hardware including hardware location (height).
- B. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Installation of Doors.
- C. Section 08 71 00, DOOR HARDWARE: Installation of Door Hardware.
- D. Section 09 06 00, SCHEDULE FOR FINISHES: Door Finish.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA):
  - 1. I.S. 1A-13 - Architectural Wood Flush Doors.
- C. ASTM International (ASTM):
  - 1. E90-09(2016) - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.
- D. National Fire Protection Association (NFPA):
  - 1. 80-16 - Fire Doors and Other Opening Protectives.
  - 2. 252-12 - Fire Tests of Door Assemblies.
- E. UL LLC (UL):
  - 1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
- F. Window and Door Manufacturers Association (WDMA):
  - 1. TM 7-14 - Cycle-Slam Test.
  - 2. TM 8-14 - Hinge Loading Test.
  - 3. TM 10-14 - Screw Holding Capacity.

**1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  - 1. Show size, configuration, and fabrication and installation details.
  - 2. Include details of glazing



3. Indicate project specific requirements not included in Manufacturer's Literature and Data submittal.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Fire rated doors showing conformance with NFPA 80 .

D. Samples:

1. PLAM sample 200 mm by 275 mm (8 inch by 11 inch) showing specified finish.

E. Sustainable Construction Submittals:

1. Low Pollutant-Emitting Materials:
  - a. Show volatile organic compound types and quantities.

F. Test Reports: Indicate each product complies with specifications.

1. Screw Holding Capacity Test.
2. Cycle-Slam Test.
3. Hinge-Loading Test.

G. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

## **1.5 QUALITY ASSURANCE**

A. Manufacturer Qualifications:

1. Regularly and presently manufactures specified products.
2. Manufactures specified products with satisfactory service on five similar installations for minimum five years.

## **1.6 DELIVERY**

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

1. Minimum 0.15 mm (6 mil) polyethylene bags or cardboard packaging to remain unbroken during delivery and storage.

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

1. Identify door opening corresponding to Door Schedule.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging. The General Contractor will retain packaging for door protection after installation and remove packing preceding the final inspection.

## **1.7 STORAGE AND HANDLING**

A. Store products indoors in dry, weathertight conditioned facility.

1. Store doors according to ANSI/WDMA I.S. 1A.

B. Protect products from damage during handling and construction operations.

**1.8 FIELD CONDITIONS****A. Environment:**

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
4. Comply with door manufacturer's instructions for relative humidity.

**1.9 WARRANTY****A. Construction Warranty:** FAR clause 52.246-21, "Warranty of Construction."**B. Manufacturer's Warranty:** Warrant interior factory finished flush PLAM wood doors against material and manufacturing defects.

1. Warranty Period: Lifetime of original installation.

**PART 2 - PRODUCTS****2.1 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.
- C. Sustainable Construction Requirements:
  1. Paints and coatings.

**2.2 FLUSH WOOD DOORS****A. General:**

1. ANSI/WDMA I.S. 1A, Extra Heavy Duty.
2. Adhesive: Type II.
3. Core: Structural composite lumber, except when mineral core is required for fire rating.
4. Thickness: 44 mm (1-3/4 inches) unless otherwise shown or specified.

**B. Faces:**

1. ANSI/WDMA I.S. 1A.
2. PLAM finishes as selected by Architect.

**C. Fire-Rated Wood Doors:**

1. Fire Resistance Rating:
  - a. B Label: 1-1/2 hours.
  - b. C Label: 3/4 hour.
2. Labels:

- a. Comply with NFPA 252, UL 10C, and labeled by qualified testing and inspection agency showing fire resistance rating.
  - 1) Metal labels with raised or incised markings.
- 3. Hardware Reinforcement:
  - a. Provide fire rated doors with hardware reinforcement blocking.
  - b. Size of lock blocks as required to secure hardware specified.
  - c. Top, Bottom and Intermediate Rail Blocks: Minimum 125 mm (5 inches) by full core width.
  - d. Reinforcement blocking in compliance with labeling requirements.
    - Mineral material similar to core is not acceptable.
- 4. Other Core Components: Manufacturer's standard as allowed by labeling requirements.
- 5. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
- 6. Astragal: Steel type for pairs of doors.
- 7. Astragal: Steel type for pairs of doors, including double egress doors.

### **2.3 SLIDING DOOR SYSTEMS**

#### **General:**

- A. Surface mounted door, frame and hardware system.
- B. Flush Wood Door
  - a. 35 STC Rating w/3-sided sound seal system.
  - b. PLAM finish as selected by Architect.
  - c. Thickness: 44mm (1 ¾")
- C. Door Hardware as provided by the manufacturer:
  - 1. HD, Color Anodized track system, surface mounted, color as selected by Architect.
  - 2. Quiet nylon roller system; soft close option.
  - 3. Bottom door guide.
  - 4. Aluminum cased open frame to match wall thickness, shroud valance. Color anodized as selected by architect.
  - 5. Privacy Dead Lock (ADA Thumb turn) with 12" Ladder Pull with Occupancy Indicator.

### **2.4 FABRICATION**

- A. Factory machine interior wood doors to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
  - 1. Factory fit fire rated doors according to NFPA 80.
- B. Rout doors for hardware using templates and location heights specified in Section 08 71 00, DOOR HARDWARE.

- C. Factory fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness undercut where shown .
- D. Clearances between Doors and Frames and Floors:
  - 1. Fire Rated Doors: Comply with NFPA 80.
    - a. Doors with Automatic Bottom Seal: Maximum clearance 10 mm (3/8 inch) at threshold.
    - b. Other Door Bottoms: 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. Door Jambs, Heads, and Meeting Stiles: Maximum 3 mm (1/8 inch).
- E. Provide cutouts for glazed openings.
- F. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- G. Identify each door on top edge.
  - 1. Mark with stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, date of manufacture and quality.
  - 2. Mark door or provide separate certification including name of inspection organization.
  - 3. Identify door manufacturing standard, including glue type.
  - 4. Identify PLAM veneer and quality certification.
  - 5. Identification of preservative treatment for stile and rail doors.

## **2.5 FINISHES**

- A. Field Finished Doors: Seal top and bottom edges of doors with two coats of catalyzed polyurethane or water-resistant sealer.
- B. Factory PLAM Finish:
  - 1. Factory PLAM finish flush wood doors.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
  - 1. Verify door frames are properly anchored.
  - 2. Verify door frames are plumb, square, in plane, and within tolerances for door installation.
- B. Protect existing construction and completed work from damage.
- C. Install astragal on active leaf of pair of smoke doors and one leaf of double egress smoke doors.

**3.2 INSTALLATION**

- A. Install products according to manufacturer's instructions and approved submittal drawings .
  - 1. Install fire rated doors according to NFPA 80.
  - 2. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

**3.3 PROTECTION**

- A. After installation, place shipping container over door and tape in place.
  - 1. Do not apply tape to door faces and edges.
- B. Provide protective covering over exposed hardware in addition to covering door.
- C. Maintain covering in good condition until removal is directed by Contracting Officer's Representative.

- - E N D - -

**SECTION 08 34 53**  
**SECURITY DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The extent of forced-entry resistant (FE) door assemblies required for the Project is indicated on Contract Drawings, and in Door/Frame/Hardware schedules, including construction, profiles, swing, sizes, hardware, accessories, devices, and locations.

**1.2 RELATED WORK**

- A. Division 3, CONCRETE.
- B. Division 4, MASONRY.
- C. Division 5, METALS for steel supports.
- D. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Doors and frames not designated for special security performances.
- E. Section 08 14 00, INTERIOR WOOD DOORS: Doors and frames not designated for special security performances.
- F. Section 08 56 53, BLAST RESISTANT WINDOWS: Windows and frames of a forced entry/ballistic resistant rated.
- G. Section 08 71 00, DOOR HARDWARE: Door Hardware.
- H. Section 08 80 00, GLAZING: Glazing and ballistic rated glazing.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
  - A153/A153M-16a.....Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - A240/A240M-20.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and General Applications
  - A653/A653M-20.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - A1008/A1008M-20.....Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved

Formability, Solution Hardened, and Bake  
Hardenable

A1011/A1011M-18a.....Standard Specification for Steel, Sheet and  
Strip, Hot-Rolled, Carbon, Structural, High-  
Strength Low-Alloy, High-Strength Low-Alloy  
with Improved Formability, and Ultra-High  
Strength

D1044-19.....Standard Test Method for Resistance of  
Transparent Plastics to Surface Abrasion.

C. American National Standards Institute (ANSI):

ANSI A156.115 (2014)....Hardware Preparation in Steel Doors and Steel  
Frames

ANSI/SDI A250.8 (2014)..Specifications for Standard Steel Doors and  
Frames

ANSI/SDI A250.11 (2012).Recommended Erection Instructions for Steel  
Frames.

D. American Welding Society (AWS):

D1.1/D1.1M (2010).....Structural Welding Code - Steel

E. National Fire Protection Association (NFPA):

NFPA 80 (2013).....Standard for Fire Doors and Other Opening  
Protectives

NFPA 252(2013).....Standard Methods of Fire Tests of Door  
Assemblies

F. Society for Protective Coatings (SSPC):

SSPC-SP 2 - 2004.....Hand Tool Cleaning

SSPC-SP 3 - 2004.....Power Tool Cleaning

G. Underwriters Laboratories, Inc. (UL):

UL 752-2005.....Bullet Resisting Equipment

H. United States Department of State Bureau of Diplomatic Security (DS):

SD-STD-01.01-1993(R2004).....Certification Standard for Forced Entry  
and Ballistic Resistance of Structural Systems

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Fabricate and install FE door assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, and hardware. Security attacks shall be unable to penetrate through closed/locked security door assemblies in manner described; it is recognized that such attacks may

damage units beyond repair and reuse, requiring replacement of work by Government:

1. Forced-Entry (FE) resistant assemblies: Where door assembly is shown or scheduled as FE, provide door manufacturer's material and fabrication for panels, inserts, hardware, devices, and framing of units. Provide rated units where shown or scheduled:
2. Provide resistance of 5 minutes for forced entry, using basic hand tools.
3. UL 752 Level 3.

#### **1.5 SUBMITTALS**

- A. General: For each security door assembly, submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  1. Product data for each element of work, whether purchased from other manufacturers or provided as door Fabricator's standard production. Include data substantiating that products comply with requirements of these specifications.
  2. Manufacturer's standard color chart.
  3. Certificates: Letter from manufacturer indicating the products have been certified to meet the specified ratings.
  4. Shop drawings showing each dimensioned details of each door assembly, including performance rating, swing, hardware set, and adjacent construction. Provide drawings on B-size 11 in x 17 inch (300 mm x 430 mm) sheets. Show typical door exterior elevations at not less than  $\frac{1}{4}$  inch = 1 foot (1:50) scale. After final modifications and corrections have been incorporated into the drawings, submit drawings as AutoCAD files with DWG extension. Show the following:
    - a. Unit information:
      - 1) Model Number.
      - 2) Marks (window no.).
      - 3) Door/frame finish.
      - 4) Door type.
    - b. Elevation Drawings:
      - 1) Rough opening.
      - 2) Door opening.
      - 3) Frame opening.
      - 4) Vision opening.



- 5) Finished floor.
- 6) Sill condition.
- 7) Undercut for carpet.
- 8) Weather-stripping.
- 9) Reference numbers for primer and finish paint, including number of coats applies.
- 10) Door class rating: rated or non-rated.
- 11) Door and frame gauge thickness.
- c. Plan drawings:
  - 1) Relate to elevation on drawing.
  - 2) Identify "Attack" and "Protected" sides.
  - 3) Identify door swing (i.e., RH, LH, RHRB, LHRB).
  - 4) Provide key on drawings.
  - 5) Indicate room space numbers taken from Contract Drawings.
- d. Details: Show section at not less than  $\frac{3}{4}$  inch = 1 ft (1:20) scale of members indicating construction, size, and thickness of components, frame profile, location of conduit entry, threshold configuration, vision panel together with connections, fastenings, and means of separating dissimilar metals.
- e. Breakdown of Product Line Items:
  - 1) If Manufacturer produces one contract line item as several parts (door with transom and sidelights), they shall breakout items on drawings. Each item shall be a subdivision of that product line item number.
  - 2) Installation instructions shall cite all anchorage components, including complete description of expansion anchor as well as installation criteria such as torque requirements, minimum embedment, and minimum edge distance, and shall include alert to installers to avoid cutting of rebar during concrete anchor installation.

## 1.6 QUALITY ASSURANCE

- A. Testing Laboratory Qualifications: For compliance with non-security performance requirements (such as fire ratings, resistance to deterioration from moisture, accessibility to persons with disabilities, or sound attenuation) on security door assemblies of this Section, use only those testing laboratories which have successfully demonstrated to Project Manager that they have experience and capabilities needed to satisfactorily conduct required tests.

- B. Provide products that have been certified by Bureau of Diplomatic Security (DS) in accordance with DS/PSD SD-STD-01.01.

### **1.7 IDENTIFICATION SYSTEMS**

- A. Identify each assembly to provide VA with ready reference to original manufacturer to facilitate reorders, replacement parts, service, resolution of complaints, and inventory. The label shall be typically embossed/printed metal plate or metallic foil with adhesive backing for permanent identification. Locate label so that it is readily visible and convenient for identification by Project Manager after installation of assembly. The label shall be approximately 1½ inch x 3 inch (40 x 75 mm) and shall cite:
  - 1. Manufacturer's name/city/state.
  - 2. Contract number.
  - 3. Month/Year of manufacture.
  - 4. Mark number.

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

- A. Deliver each assembly project site with fabrication, finishing, and assembly of primary panels, inserts, and frames completed and prepared for installation and connection with security systems. Disassemble hardware for shipping only to extent hardware interferes with shipping.
- B. Provide removable spreader bar between jambs during fabrication, delivery, and installation and to include mullions of each frame assembly, except where integral threshold is required and serves same purpose. Do not mar finishes of assembly with installation or removal of spreader bars.
- C. Provide protection of pre-finished units, such as pre-finished with baked enamel or stainless steel, using self-adhesive paper.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Certified units: provide units, including frames and sub-frames which are produced by manufacturer who has previously produced, within last 10 years, units of similar security attack resistance of equivalent size and resistance ratings.

### **2.2 MATERIALS, GENERAL**

- A. Hot-Rolled Steel Sheets and Strips: ASTM A1011, commercial quality, pickled and oiled, except as otherwise indicated.
- B. Cold-Rolled Steel Sheets: ASTM A1008, commercial quality, except as otherwise indicated.

- C. Galvanized Steel Sheets: ASTM A653 with G90 zinc coating, mill phosphatized; commercial quality, except as otherwise indicated.
- D. Supports and Anchors: Fabricate to endure required performances, but of not less than 1/16 inch (1.5 mm) sheet steel. For exterior wall assemblies, hot-dip zinc coat support/anchor units after fabrication in compliance with ASTM A 153, Class B.
- E. Inserts, Bolts, Fasteners: Standard units of strengths required to endure performances; hot-dip zinc coated where used in exterior wall assemblies in compliance with ASTM A 153, Class C/D.
- F. Vision Lights General: Fabricate vision lights of sizes shown and scheduled with same performance capabilities as specified/shown for door assembly where installed. Where applicable, achieve performances and combined performances through lamination of transparent sheets, films, and screens of standard manufactured/tested products. Comply with applicable provisions of Division 8, Section 08 80 00, GLAZING.
  - 1. Forced-Entry (FE) Resistance: Where assembly is indicated for forced-entry resistance rating (FE), provide light of size shown or scheduled in accordance with certification.
  - 2. Vision light faces general: Except as otherwise shown, where forced-entry is required, provide face of light exposed on exterior (to the "attack") as glass surface, and where unit is of laminated construction, provide face exposed on interior ("safe") as polycarbonate surface. Provide exposed polycarbonate surfaces to include an abrasion-resistant coating for 3 percent maximum haze increase for 100 revolutions on 500g Taber abraser, ASTM D1044.

## **2.3 HARDWARE**

- A. General: Provide special units of door hardware to achieve performances, and as shown and scheduled. Standard units for each security door assembly are specified to be furnished as work of Section 08 71 00, DOOR HARDWARE; see Project "Finish Hardware Schedule" and "Data Sheets," and provisions of this Section, as well as notes on door-and-frame schedule.

## **2.4 FABRICATION AND ASSEMBLY**

- A. General: Fabricate, test, and preassemble security door assemblies with hardware at factory; disassemble hardware only to extent necessary for handling, packaging, shipment, and installation at Project. Fabricate metal work to comply with performance requirements. Fabrications shall be rigid, neat, and free from warp/buckle/similar defects, with eased

edges and continuously welded joints, ground where exposed, to produce smooth, flush, invisible joints. Weld in accordance with AWS D1.1, Structural Welding Code for Steel:

1. Prepare panels and frames of each assembly to receive hardware, devices, and accessory units as shown and scheduled. Reinforce work for hardware and devices and cut work for mortised or concealed units; comply with ANSI A156.115, working from templates supplied by unit manufacturers and suppliers:
  - a. Locate hardware, devices, and accessories as required by Section Section 08 71 00, DOOR HARDWARE.
  - b. Locate hardware, devices, and accessories as shown and scheduled (including on approved shop drawings) or, if not otherwise indicated: 1) in accordance with ANSI A156.115 and A156.115W Recommended Locations for Builder's Hardware or, 2) in accordance with security device manufacturer's recommendation for optimum responses, but 3) in any case, as required to achieve required assembly performances.
  - c. Except where assembly is equipped with door-seal stripping at jambs and head, provide neoprene door silencers on stops; three at strike jamb for single door, and four at head for double door.
  - d. Except as otherwise indicated, pre-fabricate and preassemble security door assemblies to include full extent of required conduit-protected electrical/electronic power-and-control wiring placed and supported to avoid conflicts with other elements and subsequent drilling/cutting-in of work during installation of units. Provide access ports as required to support 1 inch (25 mm) conduit.
  - e. Clearances: Not more than 1/8 inch (3 mm) at jambs and heads, except not more than 1/4 inch (6 mm) between fire-rated pair of doors. Nor more than 1/4 inch (6 mm) at bottom. Undercut for carpets are not permitted where doors are used in corridors. Fabricate frames with horizontally slotted bolt holes.
2. Provide removable glazing stops and similar moldings on interior or "safe" side of assemblies. Glazing shall be removable without removing door from frame.
3. Shop Painting: Provide basecoat, factory-applied painting of ferrous metal elements of assemblies excluding other specified exposed-

finish surfaces of stainless steel, aluminum, bronze, and similar metals not intended for painting.

- a. Clean steel and zinc-coated steel surfaces of mill scale, rust, oil, grease, dirt and other substances, immediately before finish application.
- b. Apply pretreatment of cold phosphate solution (SSPC-SP 2) or basic zinc chromate/vinyl-butyl solution (SSPC-SP 3).
- c. Apply paint coat specified for shop application and bake on within time limits recommended by manufacturer of pretreatment. Apply in a uniform, smooth coat to result in dry film thickness of not less than 0.002 inch (0.05 mm).

4. Vision panels:

- a. The transparencies shall be enclosed and cushioned within core of door for continuous perimeter bite of not less than  $\frac{3}{4}$  inch (20 mm) on each side and 1/4-inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Glazing shall be installed by manufacturer with no raw metal edges evident or in contact with glass in door vision openings. Vision opening edges shall be cushioned and trimmed neatly to provide acceptable appearance.
- b. If external frames are used to either side or to both faces of door, frame(s) shall not exceed 1-9/16 inch (40 mm) in width and shall be configured internally to cushion all perimeter edges and faces of glazing and provide minimum bite of 3/4 inch (20 mm) and 1/4 inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Frame shall not produce pinch point with hardware. All external bolts to attach frame shall be flush mounted. Alternatively, protruding bolt heads shall be covered with additional trim frame and flush mounted screws.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. General: Install security door assemblies in accordance with approved shop drawings, manufacturer's data and instructions, and requirements of these specifications. Install as required to achieve specified performances, and to comply with recommendations of related industry association or testing agency sponsoring standards for required non-security performances. Install door assemblies' plumb and level:
  1. Install assemblies in compliance with recommendations and instructions of ANSI A250.8 and ANSI A250.11.

2. At fire-rated door openings, comply with NFPA Standard No. 80.
  3. Properly hang and align FE/BR doors so that pull open exertion does not exceed 12 lbs (5.4 kg.).
  4. Installer shall not grind any portion of door, frame or locking device strikes.
  5. Locking device strikes shall engage strike plate without binding.
- B. Anchorage: The door manufacturer shall provide anchors appropriate for substrate to which door frame is to be fastened. Structural frames shall have pre-drilled bolt hole patterns not to exceed 12 inches (300 mm) on center. The manufacturer shall verify substrates involved, and supply any special fastening tools (e.g., special drill or bit) required by anchoring system. The anchor shall be acceptable for shock/short duration loading and have potential for removal during life of building. The anchor shall also meet the following requirements:
1. Anchor diameter: 3/8-inch (10 mm) minimum.
  2. Embedment and edge distances shall be as indicated on Contract Drawings and as appropriate for anchor and substrate, but not less than the following:
    - a. Embedment in concrete: 3 1/2 inches (90 mm).
    - b. Embedment in solid masonry: 6 inches (150 mm).
    - c. Edge distance: 3 inches (75 mm).
  3. The minimum anchor strengths shall be:
    - a. Yield Strength: 135,000 psi (900 MPa)
    - b. Tensile Strength: 186,000 psi (1240 MPa)
  4. Avoid cutting of rebar during concrete anchor installation. Shims provided for rough opening (RO) frame clearance should not exceed 1/4 inch (6 mm). Cap plugs used in frame shall match frame finish.

### **3.2 ADJUST AND CLEAN**

- A. General: Upon request of COR, remove protective coverings and clean exposed surfaces. Repair damaged elements, restore abraded surfaces, touch-up base-coat paint finish with air-drying primer, and remove imperfections from exposed natural metal finishes.
- B. Check and readjust hardware, devices, and accessories with door-to-frame-and-sill/threshold clearances set for proper operation of locks, door seals, and other operational units. Do not remove permanently applied performance labels.
- C. Comply with "Door Hardware" section requirements for protection and handling of keys and locking devices, and associated information.

D. Exercise extreme care in the cleaning of exposed surfaces of polycarbonate; comply with manufacturer's directions.

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**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Aluminum-framed entrances and storefronts.

**1.2 RELATED REQUIREMENTS**

- A. Door Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Glass and Glazing: Section 08 80 00, GLAZING.
- C. Hardware: Section 08 71 00, DOOR HARDWARE.
- D. Aluminum Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. American Architectural Manufacturers Associations (AAMA):
  - 2603-15.....Performance Requirements and Test Procedures  
for Pigmented Organic Coatings on Aluminum  
Extrusions and Panels
  - 2604-13.....Performance Requirements and Test Procedures or  
High-Performance Organic Coatings on  
Architectural Extrusions and Panels
  - 2605-13.....Performance Requirements and Test Procedures  
for Superior Performing Organic Coatings on  
Aluminum Extrusions and Panels
- C. American Welding Society (AWS):
  - D1.2/D1.2M-14.....Structural Welding Code - Aluminum
- D. ASTM International (ASTM):
  - A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel  
Plate, Sheet, and Strip for Pressure Vessels  
and for General Applications
  - B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate.
  - B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate  
(Metric)
  - B221-14.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles, and Tubes
  - B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles, and Tubes (Metric)



- D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- E283/E283M-19.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- E330/E330M-14.....Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- E331-00(2016).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- E1886-19.....Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials
- E1996-17.....Performance of Exterior Windows, Curtain Walls, Doors, and impact Protective Systems Impacted by Windborne Debris in Hurricanes
- F468-16.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-17.....Stainless Steel Bolts, Hex Cap Screws, and Studs
- E. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual
- F. National Fenestration Rating Council (NFRC):  
500-14(E1A0).....Determining Fenestration Product Condensation Resistance Values
- G. Department of Veterans Affairs(VA):  
1. VA Physical Security and Resiliency Design Manual October 1, 2020

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings: Minimum 1 to 2 (half size) scale.
1. Show size, configuration, and fabrication and installation details.
  2. Show anchorage and reinforcement.
  3. Show interface and relationship to adjacent work, including thermal, air, and water barrier continuity.
- C. Manufacturer's Literature and Data:

1. Description of each product.
2. Doors, each type.
3. Entrance and Storefront construction.
4. Installation instructions.
5. Warranty.

D. Samples:

1. Door Corner Section: Minimum 450 mm x 450 mm (18 x 18 inches) for each specified door type, showing head rail and hinge stile, door closer reinforcement, internal reinforcement.
2. Aluminum Anodized Finish: sample extrusions minimum 150 mm (6 inches) long for each specified color in sets of three showing maximum color range.

E. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

F. Test reports: Certify products comply with specifications.

G. Certificates: Certify products comply with specifications.

1. Certify anodized finish thickness.

H. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list .
2. Installer with project experience list.
3. Welders and welding procedures.

I. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1. Show location and magnitude of loads applied to building structural frame.
2. Identify deviations from details shown on drawings.
3. Blast Design Calculations
  - a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying storefront assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the

structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant entrances and storefronts to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

J. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

### **1.5 QUALITY ASSURANCE**

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
  - a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications: Manufacturer authorized representative.

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.
  - a. Project Experience List: Provide contact names and addresses for completed projects.

C. Welders and Welding Procedures Qualifications: AWS D1.2/D1.2M.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight and conditioned facility.
- E. Protect products from damage during handling and construction operations.

### **1.7 WARRANTY**

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
  1. Warranty Period: 20 years.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM PERFORMANCE**

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.
  - 1. Minor deviations to details shown on drawings to accommodate manufacturer's standard products may be accepted by Contracting Officer's Representative when deviations do not affect design concept and specified performance.
- B. Design aluminum framed entrances and storefronts complying with specified performance:
  - 1. Wind and Seismic Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings when tested according to ASTM E330/E330M.
    - a. Wind Load: 1.4 kPa ( 30 psf) positive and negative, minimum.
    - b. Maximum Deflection: 1/175 of span, maximum with minimum 1.65 safety factor.
  - 2. Thermal Movement: Accommodate ambient temperature range of 67 degrees C (120 degrees Fahrenheit).
  - 3. Blast Resistance:
    - a. Mission Critical Protected Facilities: W1 design threat level located at standoff distance not to exceed pressures and impulses associated with GP2.
      - 1) Standoff Distance: 25 feet
      - 2) Mullion deformation not to exceed deformation limits shown in Table 6-4 of the referenced Physical Security and Resiliency Design Manual.
      - 3) Glass shall be restrained within the mullions with ½" bite and 3/8" wide continuous bead of structural silicone adhesive attaching the inner lite of the glass to the frame
  - 4. Windborne-Debris Impact Resistance: Pass ASTM E1886.
    - a. Openings within 9144 mm (30 feet) of Grade: ASTM E1996 large missile test.
  - 5. Condensation Resistance: NFRC 500.
    - a. Fixed Framing: 45 CRF, minimum.
  - 6. Water Resistance: ASTM E331; No uncontrolled penetration at 380 Pa (8 pounds/square foot), minimum, pressure differential.
  - 7. Fixed Framing Air Infiltration Resistance: ASTM E283; 0.30 liter/second/square meter (0.06 cubic foot/minute/square foot),

- maximum at 300 Pa (6.24 pounds/square foot), minimum, pressure differential.
8. Entrance Doors Air Infiltration Resistance: ASTM E283; maximum allowable at 75 Pa (1.57 pounds/square foot), minimum, pressure differential.
    - a. Single Doors: 2.5 liter/second/square meter (0.5 cubic foot/minute/square foot).
  9. Uniform Load Deflection: A static air design load of 60.15 psf (2880 Pa) for single doors shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 for typical application or L/180 for Small-Missile and Large-Missile impact, of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
  10. Energy Efficiency:
    - a. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: Insulated Glass - 0.52 (low-e) per AAMA 507 per NFRC 100.
    - b. Solar Heat-Gain Coefficient (SHGC): Glazed thermally broken aluminum door and frame shall have a Solar Heat Gain Coefficient (SHGC) of no greater than 0.55 as determined according to NFRC 200.
    - c. Visible Transmittance (VT): Glazed thermally broken aluminum door and frame shall have a Visible Transmittance (VT) of no greater than 1.10 as determined according to NFRC 200.

## 2.2 MATERIALS

### A. Aluminum:

1. Sheet Metal: ASTM B209M (ASTM B209), minimum 1.6 mm (0.063 inch) thick.
2. Extrusions: ASTM B221M (ASTM B221).
  - a. Framing: Minimum 3 mm (0.125 inch) wall thickness.
  - b. Glazing Beads, Moldings, and Trim: Minimum 1.25 mm (0.050 inch) thick.
3. Alloy 6063 temper T5 for doors and door frames. storefronts
4. Alloy 6061 temper T6 for guide tracks for other extruded structural members.

- a. Color Anodized Aluminum: Provide aluminum alloy required to produce specified color.
- B. Stainless Steel: ASTM A240/A240M; Type 302 or Type 304.
- C. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.

### **2.3 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide aluminum framed entrances and storefronts from one manufacturer.
- C. Provide aluminum entrances, storefront, windows, curtain wall systems from same manufacturer.
- D. Sustainable Construction Requirements:
  - 1. Aluminum Recycled Content: 50 percent total recycled content, minimum.

### **2.4 FRAMES**

- A. Framing Members: Extruded aluminum, thermally broken.
- B. Stops: Provide integral fixed stops and glass rebates and snap on removable stops.
- C. Provide concealed screws, bolts and other fasteners.
- D. Secure cover boxes to frames in back of lock strike cutouts.

### **2.5 STILE AND RAIL DOORS**

- A. Stiles and Rails: Extruded aluminum, thermally broken.
  - 1. Thickness: 45 mm (1-3/4 inch).
  - 2. Stiles and Head Rails: 90 mm (3-1/2 inches) wide.
  - 3. Bottom Rails: 250 mm (10 inches) wide.
- B. Single-Acting Doors:
  - 1. Bevel: 3 mm (1/8 inch) at lock, hinge, and meeting stile edges.
  - 2. Clearances: 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds.
- C. Glass Rebates: Integral with stiles and rails.
- D. Glazing Beads: Extruded aluminum, 1.3 mm (0.050 inch) thick. Integral with stiles and rails or applied type, snap-fit secured.
- E. Stile and Rail Joints: Welded or interlocking dovetail joints between stiles and rails.
  - 1. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel tie rod extending into stiles and having self-locking nut and washer at both ends.

2. Reinforce stiles and rails to prevent door distortion when tie rods are tightened.
  3. Provide compensating spring-type washer under each nut for stress relief.
  4. Construct joints to remain rigid and tight when door is operated.
- F. Weather-stripping: Removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder.
1. Make slots for applying weather-stripping integral with doors and door frame stops.
  2. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames so doors swing freely and close positively.

## **2.6 FABRICATION**

- A. Form metal parts and fit and assemble joints, except joints designed to accommodate movement. Seal joints to resist air infiltration and water penetration.
- B. Welding:
1. Make welds without distorting and discoloring exposed surfaces.
  2. Clean and dress welds. Remove welding flux and weld spatter.
- C. Prepare and reinforce doors and frames for hardware and accessories.
1. Coordinate preparation with specified hardware. See Section 08 71 00, DOOR HARDWARE.
  2. Fabricate reinforcement from stainless steel plates.
    - a. Hinge and pivot reinforcing: Minimum 4.5 mm (0.179 inch) thick.
    - b. Lock Face, Flush Bolts, Concealed Holders, Concealed and Surface Mounted Closers Reinforcing: Minimum 2.6 mm (0.104 inch) thick.
    - c. Other Surface Mounted Hardware Reinforcing: Minimum 1.5 mm (0.059 inch) thick.
  3. Where concealed hardware is specified, provide space, cutouts, and reinforcement for installation and secure fastening.
- D. Factory assembled doors.

## **2.7 FINISHES**

- A. Aluminum Anodized Finish: NAAMM AMP 500.
1. Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

## **2.8 ACCESSORIES**

- A. Dielectric Tape: Plastic, non-absorptive, with pressure sensitive adhesive; 0.18 to 0.25 mm (7 to 10 mils) thick.

- B. Barrier Coating: ASTM D1187/D1187M.
- C. Welding Materials: AWS D1.2/D1.2M, type to suit application.
- D. Fasteners:
  - 1. Aluminum: ASTM F468, Alloy 2024.
  - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.
- E. Anchors: Aluminum or stainless steel; type to suit application.
- F. Galvanizing Repair Paint: MPI No. 18.
- G. Touch-Up Paint: Match shop finish.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
  - 1. Coordinate floor closer installation recessed into concrete slabs.
  - 2. Coordinate anchor installation built into masonry and concrete.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
- D. Apply dielectric tape or barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

#### **3.2 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings.
  - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install aluminum framed entrances and storefronts plumb and true, in alignment and to lines shown on drawings.
- C. Anchor frames to adjoining construction at heads, jambs and sills.
- D. Provide concealed aluminum clips to connect adjoining frame sections.
- E. Install door hardware and hang doors. See Section 08 71 00, DOOR HARDWARE.
- F. Adjust doors and hardware uniform clearances and proper operation.
- G. Touch up damaged factory finishes.
  - 1. Repair galvanized surfaces with galvanized repair paint.
  - 2. Repair painted surfaces with touch up primer.
- H. Tolerances:



1. Variation from Plumb, Level, Warp, and Bow: Maximum 3 mm in 3 meters (1/8 inch in 10 feet).
2. Variation from Plane: Maximum 3 mm in 3.65 meters (1/8 inch in 12 feet); 6 mm (1/4 inch) over total length.
3. Variation from Alignment: Maximum 1.5 mm (1/16 inch) in-line offset and maximum 3 mm (1/8 inch) corner offset.
4. Variation from Square: Maximum 3 mm (1/8 inch) diagonal measurement differential.

### **3.3 PROTECTION, CLEANING AND REPAIRING**

- A. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.
- B. Protect aluminum-framed entrances and storefronts from construction operations.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

- - - E N D - - -

**SECTION 08 44 13**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies glazed aluminum curtain wall system.
  - 1. Thermally isolated, pressure equalized on interior.
  - 2. Type: Stick system to include following:
    - a. Glass, Insulated Metal Panels, Glass Spandrel Panels.
    - b. Integral reinforcing.
    - c. Closures, trim, subsills and flashings.
    - d. Fasteners, anchors, and related reinforcement.

**1.2 RELATED WORK:**

- A. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Miscellaneous Metal Members: Section 05 50 00, METAL FABRICATIONS.
- C. Firestopping between Curtain Wall and Structure: Section 07 84 00, FIRESTOPPING.
  - 1. Sheet Metal Flashing and Trim: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- E. Aluminum and Glass Hinged Entry Doors and Storefront Construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES
- F. Aluminum Windows: Section 08 56 53, BLAST RESISTANT WINDOWS.
- G. Glazing: Section 08 80 00, GLAZING.
- H. Finish Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- I. Louvers and Wall Vents: Section 08 90 00, LOUVERS AND VENTS.

**1.3 QUALITY ASSURANCE:**

- A. Qualifications:
  - 1. Approval by Contracting Officer Representative (COR) 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 similar type and for projects of equivalent size.

- b. Installer: Manufacturer approved in writing who has continuously installed glazed aluminum curtain walls systems of similar type and for projects of equivalent size for previous five (5) years.
- c. Manufacturer is to 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. Manufacturers Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain walls that are similar to those indicated for this Project in material, design, and extent.
- e. Testing Laboratory: Contractor is to retain 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.
- f. Product Options: Information on construction documents 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 (1) or more methods including preconstruction testing, field testing, or in-service performance.
  - 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- g. Qualification of Welders:
  - 1) Welding is to be performed by certified welders qualified in accordance with AWS D1.2/D1.2M, using procedures, materials, and equipment of the type required for this work.

**1.4 SUBMITTALS:**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
  - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. 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, performance test data and instructions for installation, and adjustments.
  - 4. Recommendations for maintenance and cleaning of exterior surfaces.
- D. Shop Drawings:
  - 1. Show elevations of glazed curtain wall system at 1:48 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, flashing and coping details, glazing details, firestopping assemblies at edge of slabs and details of installation. Show interfaces and relationships to work of other trades and continuity with adjacent thermal, weather, air and vapor barriers.
  - 2. Submit for curtain wall system, accessories. Tentative approval of drawings is to be received before fabrication.
    - a. Specified in Section 08 51 13, ALUMINUM WINDOWS.
  - 3. Operation and Maintenance Manuals
    - a. Submit cleaning and maintenance instructions.
- E. Samples:
  - 1. Submit pairs of samples of each specified color and finish on 305 mm (12-inch) long section by width of each tubular, or extruded shape section or 305 mm by 305 mm (12-inch by 12-inch) wide sections of sheet shapes.
  - 2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one (1) sample minimum 305 mm by 305 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one (1) composite sample incorporating all components and features listed may be submitted.
- F. Calculations: Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in

design of blast resistant window systems, verifying window and glazing assembly including anchors comply with specified blast resistance performance given in Section 2.1.a of this specification. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant windows to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

G. Glass:

1. Specified in Section 08 80 00, GLAZING.

H. Quality Assurance Submittals:

1. Design Data:

- a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings signed and sealed by a Professional Engineer (PE).

2. Factory Test Reports:

- a. Test Reports: Submit 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. 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. Submit appropriate testing reports for specific tests indicated below:

- 1) Deflection and structural tests.
    - 2) Water penetration tests.
    - 3) Air infiltration tests.

- 4) Delamination tests.
- 5) Thermal conductance tests.
- 6) Sound transmission loss test.

I. Manufacturer's Certificates:

- 1. Submit Certificates of Compliance, with specification requirements, for the following:
  - a. Metal extrusions.
  - b. Metal accessories.
  - c. Statement(s) that aluminum has been given specified thickness of anodizing or organic coating finish.
  - d. Statement(s) indicating manufacturers and installers conform with qualifications as specified.
- 1. Submit list (minimum of five (5) of equivalent project size installations for both manufacturer and installer.
- 2. Manufacturer with project experience list demonstrating a minimum of 5 years of experience manufacturing blast resistant assemblies.

J. 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.

K. Welders: Submit welders qualifications as specified.

L. Testing Laboratory: Submit Testing Laboratory qualifications.

**1.5 DELIVERY, STORAGE AND HANDLING:**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection sequence.
- C. Prior to shipment from factory, place knocked-down lineal curtain wall 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 to permit easy access for inspection and

handling. Sealing and caulking compounds, including handling, is to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.

#### 1.6 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.

#### 1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
  - 501.8-14.....Test Method for Determination of Resistance of Human Impact of Window Systems Intended for Use in Psychiatric Applications
  - MCWM-1-89.....Metal Curtain Wall Manual
  - CW 10-12.....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)
  - TIR A11-04.....Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads
  - 501-05.....Methods of Test for Exterior Walls
  - 503-08.....Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems
  - 2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels
- C. American Society of Civil Engineers (ASCE):
  - ASCE 7-10.....Minimum Design Loads for Buildings and Other Structures
- D. ASTM International (ASTM):
  - A36/A36M-12.....Structural Steel
  - A123/A123M-13.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A193/A193M-14a	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
A307-14	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
B209-14	Aluminum and Aluminum Alloy Sheet and Plate
B209M-14	Aluminum and Aluminum Alloy Sheet and Plate (Metric)
B211-12	Aluminum and Aluminum Alloy Bar, Rod, Wire
B211M-12	Aluminum and Aluminum Alloy Bar, Rod, Wire (Metric)
B221-14	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
B221M-13	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes (Metric)
B316/B316M-10	Aluminum and Aluminum Alloy Rivet and Cold- Heading, Wire, and Rods
C578-14a	Rigid Cellular Polystyrene Thermal Insulation
C612-14	Mineral Fiber Block and Board Thermal Insulation
C920-14a	Elastomeric Joint Sealants
C794-10	Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
C1193-13	Guide for Use of Joint Sealants
C1363-11	Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
C1521-13	Practice for Evaluating Adhesion of Installed Weatherproofing
D1037-12	Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials
E84-14	Surface Burning Characteristics of Building Materials
E330/E330M-14	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
E331-00 (R2009)	Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference



- E413-10.....Classification for Rating Sound Insulation
- E783-02 (R2010) .....Test Method for Field Measurement of Air  
Leakage Through Installed Exterior Windows and  
Doors
- E1105-00 (R2008) .....Field Determination of Water Penetration of  
Installed Exterior Windows, Curtain Walls, and  
Doors By Uniform or Cyclic Static Air Pressure  
Differences
- E. American Welding Society, Inc. (AWS):  
D1.2/D.1.2M-06 (R2014) ..Structural Welding Code-Aluminum
- F. Military Specifications (MIL):  
MIL-C-18480.....(Rev. B) Coating Compound, Bituminous Solvent,  
Coal Tar Base
- G. National Association of Architectural Metal Manufacturers (NAAMM):  
500 Series (2006) .....Metal Finishes Manual
- H. Society for Protective Coatings (SSPC)  
Paint 25-97 (2004) .....Zinc Oxide, Alkyd, Linseed Oil Primer for Use  
Over Hand Cleaned Steel Type 1 and Type II  
Paint 20-82 (2019) .....Zinc-Rich Coating, Type I-Inorganic, and Type  
II-Organic.
- I. U.S. Veterans Administration:  
Physical Security Design Manual for VA Facilities (VAPSDG); Life Safety  
Protected
- J. Environmental Protection Agency (EPA):  
40 CFR 59(2014) .....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

## **1.8 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their glazed aluminum curtain wall system for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION:**

- A. Design Requirements:
1. Curtain Wall System: Tubular aluminum sections with thermal break condition, self-supporting framing, factory prefinished, vision

glass, glass, insulated metal panel, spandrel infill; related flashings, anchorage and attachment devices.

2. System Assembly: Site assembled.
  3. Maximum wall framing member deflection, in a direction normal to plane of wall:  $1/175$  of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of AAMA TIR A11 and tested in accordance with ASTM E330/E330M.
  4. Maximum wall framing member deflection when a gypsum wallboard surface is affected:  $1/360$  of span.
  5. Maximum Framing Member Permanent Deformation: 0.2 percent of its clear span when tested in accordance with ASTM E330/E330M for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements.
- B. No glass breakage, or damage to fasteners, hardware or accessories is permitted due to deformation design requirements indicated.
- 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 AAMA MCWM-1.
  - b. Obtain all components of curtain wall system, including framing from single manufacturer.
  - c. Fully coordinate system accessories directly incorporated and adjacent to contiguous related work and ensure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified. Coordinate continuity with adjacent thermal, weather, air and vapor barriers.
  - 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. Calculations: Submit professionally prepared calculations to indicate how design requirements for structural loading, thermal, and other performance criteria have been satisfied.

## 2.2 PERFORMANCE REQUIREMENTS:

- A. Delegated Design: Engage a qualified Professional Engineer, to design glazed aluminum curtain walls.
- B. Conform with system performance requirements specified.
- C. Provide curtain wall components tested in accordance with requirements below and meeting performance requirements specified:
  - 1. 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 calculated in accordance with code as calculated in accordance with ASCE 7.
  - 2. Water Penetration:
    - a. No water penetration is to 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.
  - 3. Air Infiltration:
    - a. Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.
    - b. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
    - c. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
  - 4. Deflections Test: ASTM E330/E330M, Procedure B:
    - a. No member is to 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, is to 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 is to be minimum 1.5 mm (1/16 inch).
  - 5. Delamination Test:

- a. Adhesively bonded metal-faced panels are to show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D1037.
- 6. Thermal Conductance Tests: ASTM C1363.
  - a. The thermal transmittance of opaque panels are not to exceed a U-value, Btu/hr./sq. ft./ degree F, as required and indicated on construction documents for exterior wall system, when tested in accordance with ASTM C1363. Average calculated thermal transmittance of complete wall assembly including panels, windows, and all other components are not to exceed a U-value of 0.22 Btu/(hr·ft<sup>2</sup>·°F).
  - b. For 1-3/4" (44.4 mm) glass with Center of Glass (COG) U-factor of 0.12 Btu/(hr·ft<sup>2</sup>·°F) and warm edge spacer, when simulated using NFRC 100 or AAMA 507, the thermal transmittance (U-factor) shall not be more than 0.22 Btu/(hr·ft<sup>2</sup>·°F) per NFRC 100.
- 7. Solar Heat Gain Coefficient:
  - a. Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.55 as determined according to NFRC 200.
- 8. Sound Transmission Loss:
  - a. When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:
    - 1) STC 33 or OITC 27 based upon 1-3/4" (44.4 mm) triple insulating glass (1/4", 1/2" AS, 1/4", 1/2" AS, 1/4")

## 2.3 MATERIALS:

- A. Extruded Aluminum Framing Members: ASTM B221M (B221); 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 (B209); 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 A36/A36M.
- D. Primer: TS TT-P-645; red, for shop application and field touch-up.

## E. Fasteners:

1. For Exterior Cap Retainers: ASTM A193/A193M B8 300 series, stainless steel screws.
2. For Framework Connections: ASTM B211M (B211) 2024-T4 aluminum, ASTM A193/A193M 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.

## 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. Sealants used inside the weatherproofing system are to have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).
5. Structural silicone sealant performance requirements: ASTM C920.
  - a. Hardness: Type A, 30 durometer.
  - b. Ultimate Tensile Strength: 1172 kPa (170 psi).
  - c. Tensile at 150% Elongation (of original bench mark distance): 55 kPa (80 psi).
  - d. Joint Movement Capability after 14 Day Cure: +/- 50%.
  - e. Peel Strength Aluminum, After 21 Day Cure: 599 g/mm (34 pounds per inch).
6. Structural silicone is not be used to support dead weight of vertical glass or panels.
7. Comply with recommendations of sealant manufacturer for specific sealant selections.
8. 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.
9. Exposed Metal to Metal Joints: Silicone sealant selected from manufacturer's standard colors.

## H. Glazing Materials:

1. As specified under Section 08 80 00, GLAZING.
2. Glazing Gaskets:
  - a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
  - b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
3. Glass Sizes and Clearances:
  - a. Accommodate up to 1-3/4 inch (44.4 mm) 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 is to 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. Firestopping: Refer to Section 07 84 00, FIRESTOPPING for requirements.

#### **2.4 FABRICATION:**

- A. Curtain wall components are to be of materials and thickness indicated in construction documents. Details indicated are representative of required design and profiles. Maintain sightlines. Unless specifically indicated or specified otherwise, methods of fabrication and assembly are to be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices are to permit adjustment in three directions. No exposed fasteners are permitted.
- B. Joints: Joints exceeding +1.5 mm (+1/16") are to 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 are to be nonstaining, noncorrosive, and nonbleeding.
- D. Protection and Treatment of Metals:
  1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
  2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent

contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

- E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.
- F. Concealed Interior Mullion Reinforcing: ASTM A36/A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123/A123M.
- G. Metal Spandrel Panels: Manufacturer's standard laminated aluminum-faced panels of thickness indicated, flat with no deviations in plane exceeding 1.5 mm in 610 mm (1/16 inch in 24 inches) or 3 mm (1/8 inch) over entire panel. Provide with edge flanges:
  - 1. Face Sheets: 0.6 mm (0.024-inch) minimum thickness finished to match system framing.
    - a. Texture: Smooth.
  - 2. Concealed Back Sheets: Aluminum or galvanized steel in manufacturer's standard thickness.
- H. Stabilizer Sheets:
  - 1. 3 mm (1/8 inch) thick tempered hardboard.
- I. 13 mm (1/2 inch) thick gypsum board.
  - 1. Gypsum board at inner face and hardboard at outer face as required to provide surface burning characteristics when tested according to ASTM E84.
- J. Panel Core Material:
  - 1. Extruded-polystyrene thermal insulation complying with ASTM C578, Type IV requirements: R-Value: R11.
  - 2. Edge Configuration: Sealed.

## **2.5 METAL FINISHES:**

- A. In accordance with NAAMM AMP500 series.
- B. Anodized Aluminum:
  - 1. AA-C22A41 Chemically etched medium matte, with anodic coating, Class 1 Architectural, 0.7-mil thick (min.).
- C. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to 610 gm/sq. m (2.0 oz./sq. ft.) Primed with iron oxide paint.

- D. Apply one (1) coat of bituminous paint to concealed aluminum and steel surfaces one (1) coat in contact with cementitious or dissimilar materials.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION:**

- A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.
- B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

#### **3.2 PREPARATION:**

- A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Contact between aluminum and dissimilar metals are to receive a protective coating of bituminous paint for prevention of electrolytic action and corrosion.

#### **3.3 INSTALLATION:**

- A. Install and erect glazed curtain wall system and all components 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 3657 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 (2) identical members abutting end to end in line: 0.8 mm (1/32 inch).
  - 3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).
- I. Joint Sealants:
  - 1. Joint Sealants: Are to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
  - 2. Surfaces to be primed and sealed are to be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions are to conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings are to be of type that leave no residue on metals.
  - 3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound is to be uniformly smooth and free of wrinkles and, unless indicated otherwise, is to be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four (4) hours, but at no time is this amount exceed 19 liters (5 gallons).
  - 4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after sealant work is completed.

5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated in construction documents. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with solvent approved by sealant and curtain wall manufacturers. Upon completion of sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

J. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawings 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.
4. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer and by curtain wall manufacturer.
5. Provide sashes designed for outside glazing.
6. Provide continuous snap in glazing beads to suit glass as specified.
7. Insulating and tempered glass, and glass of other types that exceed 2540 mm (100 united inches) in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Provide perimeter frames and ventilator sections with glazing rebates for unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.

8. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Provide weeping of lock-strip gaskets in accordance with recommendation of glass manufacturer.

K. Metal Copings:

1. Refer to Section 07 60 00, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
2. Coordinate curtain wall installation with metal coping detail on construction documents. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

**3.4 ADJUSTING:**

- A. Adjust doors to provide a tight fit at contact points and operate easily.
- B. Adjust weather-stripping to make even contact with surfaces.
- C. Adjust operating hardware and moving parts.

**3.5 CLEANING:**

- A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

**3.6 FIELD QUALITY CONTROL:**

- A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COR for approval.

- B. Conduct field check test for water leakage on designated wall areas after erection to comply with AAMA MCWM-1. Conduct test on two (2) wall areas, two (2) bays wide by two (2) stories high where directed. Conduct test and take necessary remedial action as directed by COR.
- C. Test Specimen:
1. Test specimen is to include curtain wall assembly and construction. Test chamber is to be affixed to exterior side of test specimen and test is to be conducted using positive static air pressure.
  2. Test specimens are to be selected by COR after curtain wall system has been installed in accordance with construction documents.
- D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer's field representative, in a minimum of two (2) areas and as follows:
1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13.
  2. Test weatherseal sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
- E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783 and to values indicated below, whichever is more stringent.
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 is to 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 are to be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, COR 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 is cause for rejection of wall system and adjacent construction on project.

**3.7 DEMONSTRATION, TESTING, AND ACCEPTANCE:**

- A. Acceptance: At completion of project, and as a condition of acceptance, entrance door equipment and systems are to be operated for a period of fifteen (15) consecutive calendar days without breakdown.

**3.8 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 are to be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -

**SECTION 08 56 53  
BLAST RESISTANT WINDOWS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Prefabricated fixed aluminum, blast resistant exterior window units.

**1.2 RELATED REQUIREMENTS**

A. Window Color: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Forced entry and ballistic rated glazing: Section 08 80 00, GLAZING.

**1.3 APPLICABLE PUBLICATIONS**

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

B. American Architectural Manufacturers Association (AAMA):

AAMA/WDMA/CSA 101/I.S.2/A440-11 Windows, Doors, and Skylights

C. American Welding Society (AWS):

D1.1/D1.1M-15.....Structural Welding Code - Steel

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

D1.6/D1.6M-07.....Structural Welding Code - Stainless Steel

D. ASTM International (ASTM):

A36/A36M-19.....Carbon Structural Steel

A123/A123M-17.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

A320/A320M-18.....Alloy-Steel and Stainless Steel Bolting  
Materials for Low-Temperature Service

A666-15.....Annealed or Cold-Worked Austenitic Stainless  
Steel Sheet, Strip, Plate and Flat Bar

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles, and Tubes

E283/A283M-18.....Standard Test Method for Determining Rate of  
Air Leakage Through Exterior Windows, Curtain  
Walls, and Doors Under Specified Pressure  
Differences Across the Specimen

E331-00(2016).....Standard Test Method for Water Penetration of  
Exterior Windows, Skylights, Doors, and Curtain  
Walls by Uniform Static Air Pressure Difference

F1233-08(2019).....Standard Test Method for Security Glazing  
Materials and Systems

F1642/F1642M-17.....Standard Test Method for Glazing and Glazing  
Systems Subject to Air blast Loadings

E. National Association of Architectural Metal Manufactures (NAAMM):  
AMP 500-06.....Metal Finishes Manual

F. UL LLC (UL):  
752-10(R2013).....Bullet Resisting Equipment

G. Department of Veterans Affairs:  
VA Physical Security and Resiliency Design Manual October 1, 2020

#### **1.4 SUBMITTALS**

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

B. Submittal Drawings:

1. Show dimensioned details of window units, including intended metal and glazing materials. 1: 20 (Three quarter inch equals 1 foot) scaled elevations showing interior and exterior. Indicated how window units can be replaced or removed, including replacement of glazing. Shop drawings shall be submitted for review and approval prior to fabrication. The contractor is responsible for all field verification of existing conditions and dimensions for new construction that is being conducted adjacent to or integral with existing construction. The field verification shall be conducted and incorporated in the submitted shop drawings and calculations prior to submission. Blast calculations and or testing data shall be submitted with the shop drawings.
2. Show detailed sections at 1: 5 (3 inch equal 1 foot) scale for members; indicating construction, size, and thickness of components, together with connections, fasteners, and means of separating dissimilar metals.
3. Provide final submittal drawings as DWG AutoCAD files.

C. Manufacturer's Literature and Data:

1. Description of each product, metal, and alloy when applicable.
2. Indicate manufacturer's recommendations for fasteners, welding, applied finishes, hardware and accessories.
3. Installation instructions.
4. Standard color chart.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- E. Certificates: Indicate each product complies with specifications.
  1. Window forced entry resistance.
  2. Window blast resistance.
- F. Calculations: Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying window and glazing assembly including anchors comply with specified blast resistance performance given in Section 2.1.a of this specification. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant windows to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.
- G. Qualifications: Substantiate qualifications comply with specifications.
  1. Manufacturer with project experience list demonstrating a minimum of 5 years of experience manufacturing blast resistant windows.
  2. Installer with project experience list demonstrating a minimum of 5 years of experience installing blast resistant windows.
  3. Welders and welding procedures.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer and Installer Qualifications:
  1. Regularly manufactures and installs specified products.
  2. Manufactured and installed specified products with satisfactory service on five similar installations for minimum five years.
    - a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.
- B. Welders and Welding Procedures Qualifications:
  1. Steel: AWS D1.1/D1.1M.



2. Sheet Steel: AWS D1.3/D1.3M.

#### **1.6 DELIVERY**

- A. Deliver prefabricated unit in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, unit type, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, wet, or opened packaging.

#### **1.7 STORAGE AND HANDLING**

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

#### **1.8 FIELD CONDITIONS**

- A. Field Measurements: Verify field conditions affecting window fabrication and installation. The field verification shall be conducted and incorporated in the submitted shop drawings and calculations prior to submission. Show field measurements on Submittal Drawings.
  - 1. Coordinate field measurement and fabrication schedule to avoid delay.

#### **1.9 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM PERFORMANCE**

- A. Design windows complying with specified performance:
  - 1. Comply with VA Physical Security and Resiliency Design Manual
    - a. Standoff Distance: 25 feet (Life Safety Protected)
    - b. Design Threat W1 at the standoff not to exceed pressure and impulse associated with GP2 threat for Life Safety Protected Buildings.
    - c. Mullion deformation not to exceed deformation limits shown in Table 6-4 of the referenced Physical Security and Resiliency Design Manual.
    - d. Glazing performance condition shall not exceed those shown in Table 6-3 of the referenced Physical Security and Resiliency Design Manual.
    - e. Glass shall be restrained within the mullions with ½" bite and 3/8" wide continuous bead of structural silicone adhesive attaching the inner lite of the glass to the frame.

- f. ASTM F1642 and AAMA/WDMA/CSA 101/I.S.2/A440.
- 2. Provide indicated levels of resistance for blast resistant window assemblies. Resistance level applies to anchorages, interfaces with adjoining substrates, glass retention, and hardware.
- 3. Would be attackers cannot penetrate through secure closed window assembly.
- 4. Provide combined performances within rating limitations knowing certain attacks can result in severe damage to unit and require replacement.
- B. Blast Resistant (BR) Assemblies: Manufacturer's window unit assembled with panels, inserts, glazing and framing.
  - 1. Provide BR rated units where shown or scheduled:
    - a. As required to meet the blast performance requirements listed in this specification.
- C. Thermal Movement: Assembly capable of withstanding thermal movements resulting from ambient range of 67 degrees C (150 degrees F) to 82 degrees C (180 degrees F).
- D. Design Performance: Comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA/WDMA/CSA 101/I.S.2/A440 for AW Class; Performance Class and Grade: AW-PG80-FW.
  - 1. Wind Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.
  - 2. Air Infiltration: after the AAMA 910 life cycle test, meet AAMA 101 standard of maximum 0.10 cfm/ft<sup>2</sup> when tested per ASTM E 283 at a static air pressure differential of 6.24 psf (300 PA).
  - 3. Water Infiltration: ASTM E331; no uncontrolled penetration at 300 Pa (6.2 psf), minimum, pressure differential.
  - 4. Solar Heat Gain Coefficient:
    - a. Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.55 as determined according to NFRC 200.
  - 5. Energy Efficiency:
    - a. Thermal Transmittance Test (U-Factor): When tested to AAMA specification 1503, AAMA specification 507 or NFRC100 the thermal transmittance (U-Factor) shall not be more than:
      - 1) 1-3/4" triple insulating glass:

- a) U-Factor not more than .19 BTU/hr/sf/°F per AAMA 1503 with exterior 3/16" soft coat low E glass, thermo-plastic butyl spacer, argon gas, center 3/16" soft coat low E glass, thermo-plastic butyl spacer, argon gas, and interior 3/16" clear glass.
- 6. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E1886, information in ASTM E1996, and TAS 201/203.
  - a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1m) of grade.
- 7. Uniform Deflection: no more than L/175 when tested per ASTM E 330 at a static air pressure differential of 80 psf (3840 PA).
- 8. Condensation Resistance (I): When tested to CSA A-440, the condensation index shall not be less than:
  - a. 1-3/4" triple insulating glass made with exterior 1/8" soft coat low E glass, thermoplastic butyl spacer, argon gas, center 1/8" soft coat low E glass thermoplastic butyl spacer, argon gas, and interior 1/8" clear glass:
    - 1) Temperature Index (If) frame not less than 67.
    - 2) Temperature Index (Ig) glass not less than 79.
- 9. Air Infiltration: ASTM E283; Maximum 6 liter/second/square meter (0.1 cubic feet/minute/square foot.) at static pressure difference of 300 Pa (6.2 pound square foot).
- 10. Thermal Barrier Tests: Testing shall be in general accordance with AAMA 505 Dry Shrinkage and Composite Thermal Cycling test procedure, AAMA TIR-A8, Structural Performance of Composite Thermal Barrier systems.

## 2.2 MATERIALS

- A. Stainless Steel: ASTM A666, Type 304; formed stainless steel members.
- B. Aluminum Extrusions: ASTM B221.
  - 1. Framing Members: Alloy 6063-T5, -T6, or -T52, or alloy 6061-T6; 5 mm (3/16 inch) minimum thickness.
  - 2. Trim and Stops not exposed to forced entry attack: Alloy 6063-T5, -T6, or -T52; 1.5 mm (1/16 inch) minimum thickness.
- C. Steel Shapes/Plates/Bars: ASTM A36/A36M, except where another designation is indicated.

- D. Bolts and Fasteners: ASTM A320/A320M; Type 300-series stainless steel screws, bolts, nuts, and washers. Non-removable type where accessible from attack side.
- E. Window Cleaner's Bolts: Nonmagnetic stainless steel, complying with safety regulations for window cleaning equipment.
- F. Glazing Materials: Rated laminated assembly as specified in Section 08 80 00, GLAZING.

### **2.3 PRODUCTS - GENERAL**

- A. Provide blast resistant windows from one manufacturer.
- B. Sustainable Construction Requirements:
  - 1. Steel Recycled Content: 30 percent total recycled content, minimum.
  - 2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.
  - 3. Aluminum Recycled Content: 80 total recycled content, minimum.

### **2.4 FABRICATION**

- A. Assemblies: Shop fabricate matching profiles indicated on Drawings. Make welds that comply with AWS standards; exposed welds ground smooth. Provide welded-in-place reinforcements and anchorage devices.
  - 1. Removable Glazing Stops: Applied to room side of window.
    - a. Miter and weld removable stops at corners.
    - b. Secure removable stops to frames with countersunk screws, spaced as required for specified performance requirements.
  - 2. New Building: Frame system with inner frame, outer frame, and fasteners to connect frames together.
    - a. Fabricate continuous outer frame for masonry embedment as exterior wall is constructed.
    - b. Preassemble inner frame with glazing for bolting to outer frame.
    - c. Provide both frames shall be supplied by one manufacturer.
    - d. Anchorage: Provide anchors as required to meet the project loading requirements.
- B. Unit Anchorages: Fabricate metal anchorage system complying with performance requirements.
- C. Unit Glazing: Laminated glass assembly meeting VA Physical Security and Resiliency Design Manual. Testing shall be in accordance with ASTM F1642, as specified in Section 08 80 00, GLAZING. Where tested glazed systems do not match the project dimensional requirements, submit calculations prepared by a qualified blast consultant using

accepted dynamic methods that demonstrate the submitted system meets the project requirements.

## **2.5 FINISHES**

- A. General: Finish fabricated units including framing, sub-framing, hardware, and accessories.
  - 1. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Steel Surfaces: ASTM A123/A123M galvanized.
- C. Stainless Steel: NAAMM AMP 500; No. 4 polished finish, except retain manufacturer's standard mill finish on exposed fasteners and similar devices.
- D. Blend welds to match adjacent finish.
- E. Aluminum Anodized Finish: NAAMM AMP 500.
  - 1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

## **2.6 ACCESSORIES**

- A. Bituminous Paint: SSPC Paint 12 (cold-applied asphalt mastic).
- B. Welding Materials: Type to suit application for color match, strength and compatibility in fabricated item.
  - 1. Stainless Steel: AWS D1.6/D1.6M, TIG using rods made from alloyed Type 308 stainless steel.
  - 2. Steel: D1.1/D1.1M.
  - 3. Steel Sheet: D1.3/D1.3M-08.
- C. Galvanizing Repair Paint: MPI No. 18.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
  - 1. Verify opening is correctly sized and located.
  - 2. Verify substrate is prepared to receive frame anchors.
- B. Protect existing construction and completed work from damage.
- C. Apply bituminous coating approximately 30 mils dry film thickness, or other suitable permanent separator, on surfaces of dissimilar metals, and metal surfaces in contact with concrete.
  - 1. Where the metals are exposed to view, provide a neoprene separator between dissimilar metals.

### **3.2 INSTALLATION**

- A. Install products according to manufacturer's instructions and approved submittal drawings.

- B. Install window units according to manufacturer's installation instructions.
- C. Set units accurately, plumb, and level.
- D. Securely anchor to partition framing as shown on approved submittal drawings to withstand specified performance.
- E. Touch up damaged factory finishes.
  - 1. Repair galvanized surfaces with galvanized repair paint.

### **3.3 CLEANING**

- A. Clean exposed window surfaces. Remove temporary labels, contaminants, and stains.
- B. Clean glazing according to Section 08 80 00, GLAZING.

### **3.4 PROTECTION**

- A. Protect window units from construction operations.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.

- - E N D - -

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

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes furnishing, installation and commissioning of mechanical and electro-mechanical door hardware for doors specified in "Hardware Sets" and required by actual conditions: including screws, bolts, expansion shields, electrified door hardware, and other devices including access and security requirements for proper application of hardware.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Divisions:
  - 1. Division 03 Concrete
  - 2. Division 06 Rough Carpentry
  - 3. Division 07 Joint Sealants
  - 4. Division 08 Openings
  - 5. Division 09 Finishes
  - 6. Division 26 Electrical
  - 7. Division 28 Electronic Safety and Security

**1.02 REFERENCES**

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
  - 1. ANSI/BHMA A156.1 Butts & Hinges (2016)
  - 2. ANSI/BHMA A156.2 Bored & Preassembled Locks & Latches (2011)
  - 3. ANSI/BHMA A156.3 Exit Devices (2014)
  - 4. ANSI/BHMA A156.4 Door Controls - Closers (2013)
  - 5. ANSI/BHMA A156.5 Cylinders and Input Devices for Locks (2014)
  - 6. ANSI/BHMA A156.6 Architectural Door Trim (2015)
  - 7. ANSI/BHMA A156.7 Template Hinge Dimensions (2016)
  - 8. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders (2015)
  - 9. ANSI/BHMA A156.13 Mortise Locks & Latches (2012)
  - 10. ANSI/BHMA A156.15 Closer Holder Release Devices (2015)
  - 11. ANSI/BHMA A156.16 Auxiliary Hardware (2013)
  - 12. ANSI/BHMA A156.17 Self-Closing Hinges & Pivots (2014)

13. ANSI/BHMA A156.18 Materials & Finishes (2016)
  14. ANSI/BHMA A156.21 Thresholds (2014)
  15. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
  16. ANSI/BHMA A156.26 Continuous Hinges (2012)
  17. ANSI/BHMA A156.28 Keying Systems (2013)
  18. ANSI/BHMA A156.36 Auxiliary Locks (2016)
  19. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
- B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2017.
- C. Underwriters Laboratories, Inc. (UL):
1. UL 10C Positive Pressure Fire Test of Door Assemblies.
  2. UL 1784 Air Leakage Test of Door Assemblies.
  3. UL 294 Access Control System Units
- D. Door and Hardware Institute (DHI):
1. DHI Publications - Keying Systems and Nomenclature (1989).
  2. DHI Publication - Abbreviations and Symbols.
  3. DHI Publication - Installation Guide for Doors and Hardware.
  4. DHI Publication - Sequence and Format of Hardware Schedule (1996).
- E. National Fire Protection Agency (NFPA):
1. NFPA 70 National Electrical Code 2017.
  2. NFPA 80 Standard for Fire Doors and Other Opening Protectives 2016.
  3. NFPA 101 Life Safety Code 2018.
  4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2016.

### **1.03 SUBMITTALS**

- A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements and Submittal Procedures Section.
- B. Shop Drawings:
1. Organize hardware schedule in vertical format as illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
  2. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.



3. Architectural Hardware Consultant (AHC), as certified by DHI, who will affix seal attesting to completeness and correctness, including the review of the hardware schedule prior to submittal.
- C. Submit manufacturer's catalog sheet on design, grade, and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide an index, and cover sheet.
- D. Templates:
  1. Upon final approval of the architectural hardware schedules, submit one set of complete templates for each hardware item to the door manufacturers, frame manufacturers, and the installers. Date and index these 8-1/2 inch x 11 inch papers in a three ring binder, including detailed lists of the hardware location requirements for mortised and surface applied hardware within fourteen days of receiving approved door hardware submittals.
- E. Electrified Hardware: Provide electrical information to include voltage and amperage requirements for electrified door hardware and description of operation.
  1. Description of operation for each electrified opening to include description of component functions including location, sequence of operation and interface with other building control systems.
  2. Wiring Diagrams: Detail wiring for power, signal, and control system and differentiate between manufacturers installed and field-installed wiring. Include the following:
    - a. System schematic.
    - b. Point to point wiring diagram.
    - c. Riser diagram.
    - d. Elevation of each door.
  3. Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
  4. Provide junction boxes, relays and terminal blocks as needed for proper door operations and connections.
- F. Upon door hardware submittal approval, furnish for each electrified opening, three copies of point to point diagrams.
- G. Closeout Submittals: Submit to Owner in a three-ring binder or CD if requested.
  1. Warranties.
  2. Maintenance and operating manual.
  3. Maintenance service agreement.
  4. Record documents.
  5. Copy of approved hardware schedule.

6. Copy of approved keying schedule with bitting list.
7. Door hardware supplier name, phone number, and fax number.

#### **1.04 QUALITY ASSURANCE**

- A. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.
- B. Hardware supplier will employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who will be available at reasonable times during course of work for Project hardware consultation.
  1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Door hardware conforming to ICC/ANSI A117.1: Handles pulls, latches locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
- D. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and/or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.
- E. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent Certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report be submitted to Owner and Contractor. Doors failing inspection must be adjusted, replaced or modified to be within appropriate code requirements.
- F. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.
- G. Substitution request: create a comparison chart that includes the testing information as well as the warranty for both the specified product and the proposed substitution. Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design, function, and quality. Approval of request is at the discretion of the owner, architect, and their designated consultants and will be addressed via addendum prior to bid date.
- H. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware installer who has installed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

I. Hardware listed in 3.07 - Hardware Schedule is intended to establish minimum level of design, type, function and grade of hardware to be used.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed. Shelve hardware off of the floor and with larger items of hardware being stored on wooden pallets. Arrange locksets and keyed cylinders by opening number. Organize the balance of hardware by brand, model of hardware, and hardware set number. Leave the door markings of the hardware visible for installers.
- B. Furnish hardware that is not bulk packed with each unit marked and numbered in accordance with approved finish hardware schedule. Include architect's opening number, hardware set number, and item number for each type of hardware. Include keyset symbols and corresponding hardware component for keyed products.
- C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.
- D. Deliver architectural hardware to the job site according to the phasing agreed upon in the pre-installation meeting. Inventory the delivery with the supplier's assistance. Immediately note shortages and damages on the shipping receipts and bill of lading. Coordinate replacement or repair with the supplier.
- E. Deliver permanent keys, cores, and related accessories directly to Owner via registered mail or overnight package service. Contractor / manufacturer shall send cores, pins, (all required materials for setting up cores) etc. to the Fargo VA Locksmith who will set up a core for each door.
- F. Waste Management and Disposal: Separate waste materials for use or recycling in accordance with Division 1.

#### **1.06 WARRANTY**

- A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrently with other warranties made by Contractor under requirements of the Contract documents.
- B. Special Warranty: Warranties specified in this article will not deprive Owner of other rights.
  - 1. Ten years for manual door closers.
  - 2. Five years for mortise, auxiliary and bored locks.
  - 3. Five years for exit devices.

4. One year for electromechanical door hardware.
5. All electrified security equipment and systems will be warranted for a period of one (1) years commencing with the filing date of the Notice of Completion, provided the system has been inspected and signed off by a factory authorized installer and the factory authorized commissioning agent.
- C. Replace or repair defective products during warranty period in accordance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse, and failure to exercise normal maintenance.
- D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, removal and replacement of door hardware.

#### **1.07 MAINTENANCE**

- A. Furnish a contract for service that will cover the period starting with the first expected activation of each system for installation and test that will continue for an initial period of one (1) years.

### **PART 2 - PRODUCTS**

#### **2.01 HINGES**

- A. Hinges of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Products to be certified and listed by the following:
  1. Butts and Hinges: ANSI/BHMA A156.1.
  2. Template Hinge Dimensions: ANSI/BHMA A156.7.
- C. Butt Hinges:
  1. Hinge weight and size unless otherwise indicated in hardware sets:
    - a. Doors up to 36" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .134" and a minimum of 4-1/2" in height.
    - b. Doors from 36" wide up to 42" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .145" and a minimum of 4-1/2" in height.
    - c. For doors from 42" wide up to 48" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
    - d. Width of hinge is to be minimum required to clear surrounding trim.
  2. Base material unless otherwise indicated in hardware sets:
    - a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
    - b. Interior Doors: Steel material.
    - c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
    - d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.

3. Quantity of hinges per door unless otherwise stated in hardware sets:
  - a. Doors up to 60" in height provide 2 hinges.
  - b. Doors 60" up to 90" in height provide 3 hinges.
4. Hinge design and options unless otherwise indicated in hardware sets:
  - a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
  - b. Out-swinging exterior and out-swinging access-controlled doors are required to have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
  - c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
  - d. When shims are necessary to correct frame or door irregularities, provide metal shims only.
5. Acceptable Manufacturers:

	Standard Weight	Heavy Weight
Hager	BB1279/BB1191	BB1168
Bommer		
McKinney		

Note: Equal Substitutions are allowed.

## 2.01 CONTINUOUS HINGES

- A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Products to be certified and listed by ANSI/BHMA A156.26 Grade 1.
- C. Continuous Geared Hinges:
  1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer's recommendations.
    - a. Size length of hinge to equal the actual door height unless otherwise stated in hardware sets.
- D. Material and Design:
  1. Base material: Anodized aluminum manufactured from 6063-T6 material; unexposed working metal surfaces be coated with TFE dry lubricant.
  2. Bearings:
    - a. Vertical loads be carried on Lubriloy RL bearings for non-fire rated doors.
    - b. Continuous hinges are to have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.

3. Options:

- a. Provide factory-cut preparations for concealed electric power transfers.
- b. Hinges to have Rounded Back Cover Channel (RBCC).
- c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
- d. At fire rated openings provide hinges that carry a UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

E. Acceptable Manufacturers:

	Heavy Duty
Hager	780-111HD
Bommer	
Zero	

Note: Equal Substitutions are allowed.

**2.02 RESCUE HARDWARE**

- A. Rescue hardware sets of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Products to be certified and listed by the following: Butts and Hinges: ANSI/BHMA A156.1.
- C. Material and Design: Provide head and floor pivots that work with square edge doors and consist of stainless steel and polycarbonate top and bottom units. Provide walking type cam operated pivots for top and bottom. Use with wood or hollow metal doors not exceeding 3670 and 135 lbs.
- D. Acceptable Manufacturer:

Hager	611
Approved equal	

Note: Equal Substitutions are allowed.

E. Combination Rescue Door Stop and Double Lipped Strike:

- 1. Door release allows doors to be opened in both directions without damage to frame.
- 2. Provide a strike that is full lip and be the full width dimension of jamb.

F. Acceptable Manufacturer:

Hager	452 for 7 ¼" jamb depth
Approved equal	

Note: Equal Substitutions are allowed.

**2.03 FLUSH BOLTS AND COORDINATORS**

- A. Flush bolts of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMI A156.16.
- C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.
- D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Provide extension rods so that the center line of the top flush bolt is not more than 78" above the finish floor. Provide dust proof strike from bottom bolt.
- E. Acceptable Manufacturers:

	Manual Flush Bolt	Auto Flush Bolt	Dust Proof Strike
Hager	282D	292D	280X
Rockwood			
Trimco			

Note: Equal Substitutions are allowed.

- F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.
- G. Acceptable Manufacturers:

	Coordinator	Mounting Bracket
Hager	297	297B
Rockwood		
Trimco		

Note: Equal Substitutions are allowed.

## 2.04 LOCKS AND LATCHES

- A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Product to be certified and listed by following:
1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
  2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48" in width and up to 96" in height.
  3. UL10C/UBC 7-2 Positive Pressure Rated.
  4. ICC/ANSI A117.1.

C. Lock and latch function numbers and descriptions of manufacturer's series as listed in hardware sets.

D. Material and Design:

1. Lock cases from fully wrapped, 12-gauge steel, zinc dichromate for corrosion resistance.
2. Non-handed, field reversible without opening lock case.
3. Break-away spindles to prevent unlocking during forced entry or vandalism.
4. Levers, zinc cast, forged brass or stainless steel and plated to match finish designation in hardware sets.
5. Sectional Roses, solid brass or stainless-steel material and have a minimum diameter of 2-7/16".
6. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8" beveled edge door.

E. Latch and Strike:

1. Stainless steel latch bolt with minimum of 3/4" throw and deadlocking for keyed and exterior functions.
2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4" x 4-7/8" with proper lip length to protect surrounding trim.
3. Deadbolts to be 1-3/4" total length with a minimum of a 1" throw and 3/4" internal engagement when fully extended and made of stainless-steel material.

F. Options:

1. Provide knurled levers on entry side of doors that are potentially dangerous to visually impaired persons.

G. Electrified Locks

1. Request to Exit: Monitors inside lever rotation (RX).

H. Acceptable Manufacturers:

Hager	3800 Series
Best	
Sargent	

Note: Equal Substitutions are allowed.

## 2.05 EXIT DEVICES

A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touchpad type, finish to match balance of door hardware.

B. Standards: Manufacturer to be certified and/or listed by the following:

1. BHMA Certified ANSI A156.3 Grade 1.



2. UL/cUL Listed for up to 3 hours for "A" labeled doors.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. UL10B Neutral Pressure Rated.
5. UL 305 Listed for Panic Hardware.

C. Material and Design:

1. Provide exit devices with actuators that extend a minimum of one-half of door width.
2. Where trim is indicated in hardware sets provide the lever design to match design of lock levers.
3. Exit device to mount flush with door.
4. Latchbolts:
  - a. Rim device - 3/4" throw, Pullman type with automatic dead-latching, stainless steel
  - b. Concealed vertical rod device - Top 1/2" throw, Pullman type with automatic dead-latching, stainless steel. Bottom 1/2" throw, Pullman type, held retracted during door swing, stainless steel.
5. Fasteners: Wood screws, machine screws, and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets

E. Acceptable Manufactures:

Hager	4500 Series
Von Duprin	
Sargent	

Note: Equal Substitutions are allowed.

F. Electric Modifications:

1. Provide Request to Exit (REX) switches as scheduled.
2. Electrified Trim: Authorized Ingress (AI) switches as scheduled

## 2.06 CYLINDERS AND KEYING

- A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Products to be certified and listed by the following:
  1. Auxiliary Locks: ANSI/BHMA A156.5
- C. Cylinders:
  1. Provide cylinders matched to the types required for hardware that has a locking function and for keyed electronic functions. Furnish with appropriate collars,

cams, and tailpieces to fit and operate associated hardware. Stacking collars is not acceptable, a single collar of proper size is required.

2. Best seven-pin small format interchangeable core (SFIC).
3. Provide concealed key control (CKC) at cylinder by stamping or permanently marking the keyset symbol in a location on the cylinder that is concealed when installed.

D. Keying:

1. Key into Owner's existing key system.
2. Provide a bitting list to Owner of combinations as established, and expand to twenty-five percent for future use or as directed by Owner.
  - a. Include all of the keysets and bittings of the original key system creating one clean version of the entire key system.
  - a. Keys to be shipped directly to the COR. Package the keys in individual envelopes, grouped by keyset symbol, and label envelopes with project name, factory registry number, and keyset symbol.
3. Stamp large bow key blanks with visual key control (keyset symbol) and "Do Not Duplicate".
4. Provide interchangeable cores with construction cores.

E. Acceptable Manufacturers:

Best Locking Systems or equal. Equals must be compatible with existing system.
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**2.07 PUSH/PULL PLATES AND BARS**

- A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Standards: Manufacturer to be certified by the following:
  1. Architectural Door Trim: ANSI/BHMA A156.6.
  2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- C. Push plates: .050" thick, square corner and beveled edges with countersunk screw holes. Width and height as stated in hardware sets.
- D. Acceptable Manufacturers:

Hager	30S
Rockwood	
Trimco	

Note: Equal Substitutions are allowed.

- E. Pull Plates: .050" thick, square corner and beveled edges. Width and height as stated in hardware sets, 1" diameter pull, with clearance of 3" from face of door.
- F. Acceptable Manufacturers:

Hager	H34J
Rockwood	
Trimco	

Note: Equal Substitutions are allowed.

## 2.08 CLOSERS

- A. Closers of one manufacturer as listed for continuity of design and consideration of warranty, unless otherwise indicated on hardware schedule, comply with manufacturer's recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirement, and fire rating.
- B. Standards: Manufacturer to be certified and or listed by the following:
  1. BHMA Certified ANSI A156.4 Grade 1.
  2. ADA Complaint ANSI A117.1.
  3. UL/cUL Listed up to 3 hours.
  4. UL10C Positive Pressure Rated.
  5. UL10B Neutral Pressure Rated.
- C. Material and Design:
  1. Provide cast iron non-handed bodies with full plastic covers.
  2. Closers will have separated staked adjustable valve screws for latch speed, sweep speed, and backcheck.
  3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
  4. One-piece seamless steel spring tube sealed in hydraulic fluid.
  5. Double heat-treated steel tempered springs.
  6. Precision-machined heat-treated steel piston.
  7. Triple heat-treated steel spindle.
  8. Full rack and pinion operation.
- D. Mounting:
  1. Out-swing doors use surface parallel arm mount closers except where noted on hardware schedule.
  2. In-swing doors use surface regular arm mount closers except where noted on hardware schedule.
  3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
  4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.
- E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.

1. Interior hinged openings: 5.0 lbs.

2. Fire-rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

Hager	5100 Series
LCN	
Sargent	

Note: Equal Substitutions are allowed.

## 2.09 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: single doors, size two inches less door width (LDW) on push side of door, and one inch less door width on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door. Adjust sizes to accommodate accompanying hardware, such as, edge guards, astragals and others.

1. Kick Plates 10" high or sized to door bottom rail height.

2. Mop Plates 4" high.

3. Armor Plates 36" high.

C. Products to be certified and listed by the following:

1. Architectural Door Trim: ANSI/BHMA A156.6.

2. UL.

D. Material and Design:

1. 0.050" gage stainless steel.

2. Corners square, polishing lines or dominant direction of surface pattern so they run across door width of plate.

3. Bevel top, bottom, and sides uniformly leaving no sharp edges.

4. Countersink holes for screws. Space screw holes so they are no more than eight inches CTC, along a centerline not over 1/2" in from edge around plate. End screws maximum of 0.53" from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufacturer's UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

Hager	190S
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Trimco	
Burns	

Note: Equal Substitutions are allowed.

## 2.10 STOPS AND HOLDERS

- A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible.
- C. Products to be certified and listed by the following:
  - 1. Auxiliary Hardware: ANSI/BHMA A156.16.
- D. Acceptable Manufacturers:

	Convex	Concave
Hager	232W	236W
Rockwood		
Burns		

Note: Equal Substitutions are allowed.

- E. Overhead Stops and Holders: Provide overhead stops and holders for doors that open against equipment, casework sidelights and other objects. Provide sex bolt attachments for mineral core wood door applications.
- F. Products to be certified and listed by the following:
  - 1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.
- G. Acceptable Manufacturers:

	Heavy Duty Surface	Heavy Duty Concealed
Hager	7000 SRF Series	7000 CON Series
Glynn Johnson		
Sargent		

Note: Equal Substitutions are allowed.

## 2.11 THRESHOLDS

- A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.
- B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless-steel machine screws complying with requirements specified in Division 7 Section "Joint Sealants: Notched in field to fit frame by hardware installer. Refer to Drawings for special details.
- C. Standards: Manufacturer to be certified by the following:
  - 1. Thresholds: ANSI/BHMA A156.21.

2. American with Disabilities Act Accessibility Guidelines (ADAAG).

D. Acceptable Manufacturers:

Hager	520S
K.N. Crowder	
Reese	

Note: Equal Substitutions are allowed.

**2.12 DOOR GASKETING AND WEATHERSTRIP**

A. Door gasketing and weatherstrip of one manufacturer as listed for continuity of design and consideration of warranty.

B. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide noncorrosive fasteners for exterior applications.

1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
4. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4" beyond width of door.

C. Products to be certified and listed by the following:

1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing.

D. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

E. Acceptable Manufacturers:

1. Perimeter Gasketing:

	Stop Applied	Adhesive Applied
Hager	881S	726
K.N. Crowder		
Reese		

Note: Equal Substitutions are allowed.

2. Meeting Stile Weatherstrip:

Hager	802S B
K.N. Crowder	
NGP	136 P

Note: Equal Substitutions are allowed.

3. Overlapping Astragal:

Hager	874SN
K.N. Crowder	
Reese	

Note: Equal Substitutions are allowed.

4. Door Bottom Sweeps:

Hager	770SV
K.N. Crowder	
Reese	

Note: Equal Substitutions are allowed.

5. Overhead Drip Guard

Hager	810S
K.N. Crowder	
Reese	

Note: Equal Substitutions are allowed.

## 2.13 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Products to be certified and listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

	Hollow Metal Frame
Hager	307D
Rockwood	
Trimco	

Note: Equal Substitutions are allowed.

## FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine doors and frames, with Installers present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- C. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- D. Notify Architect via a prepared written report and endorsed by Installer of any discrepancies between the door schedule, door types, drawings and scheduled hardware. Report will have a list of conditions detrimental to application, to the proper and timely completion of the work and performance of the hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### **3.02 INSTALLATION**

- A. Install hardware using manufactures recommended fasteners and installation instructions, at height locations and clearance tolerances that comply with:
  - 1. NFPA 80
  - 2. NFPA 105
  - 3. ICC/ANSI A117.1
  - 4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
  - 5. DHI Publication - Installation Guide for Doors and Hardware
  - 6. Approved shop drawings
  - 7. Approved finish hardware schedule
- B. Install soffit mounted gaskets prior other soffit mounted hardware to provide a continuous seal around the perimeter of the opening without cutting or notching.
- C. Install door closers so they are on the interior of the room side of the door. Stairwell doors will have closers mounted on the stair side and exterior doors will be mounted on the interior side of the building.
- D. In drywall applications provide blocking material of sufficient type and size for hardware items that mount directly to the wall.
- E. Locate wall mounted bumper to contact the trim of the operating trim.
- F. Mount mop and kick plates flush with the bottom of the door and centered horizontally on the door.



- G. Set thresholds for exterior, and acoustical doors at sound control openings in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants" forming a tight seal between threshold and surface to which set.
- H. Anchor all components firmly into position and use anchoring devices furnished with the hardware item, unless otherwise specified.
- I. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- J. Power Supplies: locate power supplies as indicated and verified in the low-voltage coordination meeting.

### **3.03 FIELD QUALITY CONTROL**

- A. Material supplier to schedule final walk through to inspect hardware installation ten (10) business days before final acceptance of Owner. Material supplier will provide a written report detailing discrepancies of each opening to General Contractor within seven (7) calendar days of walk through.

### **3.04 ADJUSTMENT, CLEANING, AND DEMONSTRATING**

- A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.
- B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finish hardware per manufacturer's instructions after final adjustments have been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.
- C. Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finish hardware to be turned over and explained usage at the meeting. Record all training and provide to the Owner for future reference.

### **3.05 PROTECTION**

- A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts project as complete.

### **3.06 HARDWARE SET SCHEDULE**

- A. Intent of Hardware Groups
  - 1. Should items of hardware not specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
  - 2. Where items of hardware aren't correctly specified and are required for

completion of the Work, a written statement of such omission, error, or other discrepancy is required to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or furnish such items in the type and quality established by this specification, and appropriate to the service intended.

- B. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.
- C. Hardware schedule does not reflect handing, backset, method of fastening, and like characteristics of door hardware and door operation.
- D. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

### 3.07 HARDWARE SCHEDULE

#### Hardware Sets

##### SET #1

Doors: CO01

2 Continuous Hinge	780-111HD x LAR x EPT PREP x RBCC	CLR	HA
2 Power Transfer	2-679-0623	ALM	HA
2 Exit Device	4501 CVR RX	US32D	HA
2 Exit Trim	45CE ARC AI	US26D	HA
2 Mortise Cylinder	3902 SFIC x LAR	US26D	HA
2 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
2 Closer	5100 x HD	ALM	HA
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Threshold	413S x LAR	MIL	HA
1 Weatherstrip	881S N x LAR	MIL	HA
2 Astragal	802S B x LAR	MIL	HA
1 Rain Drip Cap	810S x LAR	MIL	HA
2 Door Sweep(s)	770S V x LAR	MIL	HA
2 Magnetic Switch	2-679-0626		HA
1 Power Supply	Power Supply		BYOT
1 Wiring Diagram(s)	RISER/POINT TO POINT		BYOT

\*Doors Monitored.

**SET #2**

Doors: STAIR 24 BASEMENT DOOR B

1 Continuous Hinge	780-111HD x LAR x EPT PREP x RBCC	CLR	HA
1 Power Transfer	2-679-0623	ALM	HA
1 Exit Device	4501 RIM RX	US32D	HA
1 Exit Trim	45NL ARC AI	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100 x HD	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Threshold	413S x LAR	MIL	HA
1 Weatherstrip	881S N x LAR	MIL	HA
1 Rain Drip Cap	810S x LAR	MIL	HA
1 Magnetic Switch	2-679-0626		HA
1 Power Supply	Power Supply		BYOT
1 Wiring Diagram(s)	RISER/POINT TO POINT		BYOT

\*Door Monitored

**SET #3**

Doors: BD-130A

3 Hinge(s)	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
1 Exit Device	4501 RIM	US32D	HA
1 Exit Device Trim	45NL ARC	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Rim Cylinder	3901 SFIC	US26D	HA
1 Closer	5100 HDCS	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #4**

Doors: STAIR 24 BASEMENT DOOR A

3 Hinge(s)	BB1168 4 1/2 X 4 1/2	US26D	HA
1 Exit Device	4501 RIM F	US32D	HA

1 Exit Device Trim	45BE ARC	US26D	HA
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #5

Doors: STAIR 24 FIRST FLOOR DOOR

3 Hinge(s)	BB1168 5 X 4 1/2	US26D	HA
1 Exit Device	4501 RIM F	US32D	HA
1 Exit Device Trim	45BE ARC	US26D	HA
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #6

Doors: BD-117B

2 Continuous Hinge	780-111HD x LAR x EPT PREP x RBCC	CLR	HA
1 Set Manual Flush Bolt	282D	US26D	HA
1 Dust Proof Strike	280X	US26D	HA
1 Lockset	3880 SECT ARC RX SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100 x HD	ALM	HA
	*Active leaf with hold open.		
2 Kick Plate	190S 10" x 1" LDW	US32D	HA
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Threshold	413S x LAR	MIL	HA
1 Weatherstrip	881S N x LAR	MIL	HA
1 Astragal	874S N x LAR	MIL	HA
1 Rain Drip Cap	810S x LAR	MIL	HA
2 Door Sweep(s)	770S V x LAR	MIL	HA
2 Magnetic Switch	2-679-0626		HA
1 Power Supply	Power Supply		BYOT
1 Wiring Diagram(s)	RISER/POINT TO POINT		BYOT

\*Doors Monitored

**SET #7**

Doors: BD-115, BD-116, BD121

6 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Set Manual Flush Bolt	282D	US26D	HA
1 Dust Proof Strike	280X	US26D	HA
1 Lockset	3880 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 OH Door Hold Open	7017 SRF	US32D	HA
	*Inactive leaf		
1 Closer	5100 x HO	ALM	HA
	*Active leaf		
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Astragal	874S N x LAR	MIL	HA
2 Silencer(s)	307D	GREY	HA

**SET #8**

Doors: 1D-194, BD-117

3 Hinge	BB1279 5 X 4 1/2	US26D	HA
1 Lockset	3880 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #9**

Doors: 1D-195, BD-120

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	3880 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA

1 Wall Stop(s)	232W/236W (as required)	US32D	HA
3 Silencer(s)	307D	GREY	HA

#### SET #10

Doors: 1D-191A

3 Hinge(s)	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
1 Lockset	3880 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100 x HD	ALM	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #11

Doors: 1D-180, 1D-183

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	Cipher Lock with Key Override	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #12

Doors: NOT USED

#### SET #13

Doors: 1D-191B

3 Hinge	BB1279 5 X 4 1/2 NRP	US26D	HA
1 Lockset	3880 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100 HDCS	ALM	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #14

Doors: C002

6 Hinge(s)	BB1168 5 X 4 1/2	US26D	HA
1 Set Auto Flush Bolts	292D	US32D	HA
1 Dust Proof Strike	280X	US26D	HA

1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Coordinator	297D x LAR	BLACK	HA
2 Closer	5100	ALM	HA
2 Armor Plate	190S 36" x 1" LDW	US32D	HA
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA
2 Astragal	802S B x LAR	MIL	HA
2 Mag Holder	380F	LS	HA

\*Description of operation:

Doors held open by magnetic holders.

Activation of fire/smoke alarm or loss of power releases the magnets doors close and latch.

Doors may be released from magnets manually.

**SET #15**

Doors: 1D-121

6 Hinge(s)	BB1168 5 X 4 1/2 NRP	US26D	HA
1 Set Auto Flush Bolts	292D	US32D	HA
1 Dust Proof Strike	280X	US26D	HA
1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Coordinator	297D x LAR	BLACK	HA
2 Closer	5100 TRK NHOTA	ALM	HA
2 Armor Plate	190S 36" x 1" LDW	US32D	HA
2 Mag Holder	380F	LS	HA
1 Set Smoke Seal	726 x LAR	S	HA
2 Astragal	802S B x LAR	MIL	HA

\*Description of operation:

Doors held open by magnetic holders.

Activation of fire/smoke alarm or loss of power releases the magnets doors close and latch.

Doors may be released from magnets manually.

**SET #16**

Doors: 1D-191

6 Hinge(s)	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
1 Set Auto Flush Bolts	292D	US32D	HA
1 Dust Proof Strike	280X	US26D	HA
1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Coordinator	297D x LAR	BLACK	HA
2 Mounting Bracket(s)	297B	BLACK	HA
2 Kick Plate	190S 10" x 1" LDW	US32D	HA
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA
2 Astragal	802S B x LAR	MIL	HA

**SET #17**

Doors: BD-110

6 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Set Manual Flush Bolt	282D	US26D	HA
1 Dust Proof Strike	280X	US26D	HA
1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
*Active leaf			
2 Kick Plate	190S 10" x 1" LDW	US32D	HA
2 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA
1 Astragal	874S N x LAR	MIL	HA

**SET #18**

Doors: 1D-173A, 1D-173B, 1D-178, 1D-188, BD-111, BD-112, BD-122, BD-126,

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA



**SET #19**

Doors: BD-130

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	3870 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #20**

Doors: 1D-193

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	3850 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
3 Silencer(s)	307D	GREY	HA

**SET #21**

Doors: 1D-192

3 Hinge	BB1279 5 X 4 1/2	US26D	HA
1 Lockset	3850 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Overhead Stop	7016 SRF	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #22**

Doors: 1D-196, 1D-197, 1D-198, 1D-199, BD-113, BD-114, BD-124, BD-125, BD-127, BD-128, BD-129, BD-131

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Lockset	3850 SECT ARC SFIC7	US26D	HA
1 IC Core	BEST IC CORE MATCH EXISTING	US26D	BE
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #23**

Doors: 1D-182

1 Pivot	611	US26D	HA
1 Privacy w/Indicator	3896 SECT ARC	US26D	HA
1 Strike	452	US26D	HA
1 Overhead Stop	7016 CONC	US32D	HA
2 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Astragal	136 P x LAR		NA

\* Door lockset shall have emergency key override for ingress from out of room

#### SET #24

Doors: 1D-188A, BD-118B, BD-119B, BD-132

3 Hinge(s)	BB1279 4 1/2 X 4 1/2	US26D	HA
1 Privacy w/Indicator	3896 SECT ARC	US26D	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Mop Plate	190S 4" x 1" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

\* Door lockset shall have emergency key override for ingress from out of room

#### SET #25

Doors: BD-118A, BD-119A

3 Hinge(s)	BB1191 4 1/2 X 4 1/2	US32D	HA
1 Privacy w/Indicator	3896 SECT ARC	US32D	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Mop Plate	190S 4" x 1" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

#### SET #26

Doors: BD-118, BD-119

3 Hinge(s)	BB1168 4 1/2 X 4 1/2	US26D	HA
1 Push Plate	30S 6 X 16	US32D	HA
1 Pull Plate	34J 4 X 16	US32D	HA
1 Closer	5100	ALM	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Mop Plate	190S 4" x 1" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
3 Silencer(s)	307D	GREY	HA

**SET #27**

Doors: BD-123

3 Hinge(s)	BB1168 4 1/2 X 4 1/2	US26D	HA
1 Passage	3810 SECT ARC	US26D	HA
1 Kick Plate	190S 10" x 2" LDW	US32D	HA
1 Mop Plate	190S 4" x 1" LDW	US32D	HA
1 Wall Stop(s)	232W/236W (as required)	US32D	HA
1 Set Smoke Seal	726 x LAR	S	HA

**SET #28**

Doors: 1D-171, 1D-172, 1D-174, 1D-175, 1D-176, 1D-177, 1D-179, 1D-181, 1D-184,  
1D-185, 1D-186, 1D-187, 1D-189, 1D-190

1 All Hardware: All hardware by door MFR. See spec section 084100 Wood Doors  
BYOT

**SECTION 08 80 00  
GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the following:
  - 1. Glass.
  - 2. Glazing materials and accessories for both factory and field glazed assemblies.

**1.2 RELATED WORK**

- A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES,
- B. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Mirrors.
- D. Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS Glazed Curtain Walls:  
Glazed Curtain Walls.
- E. Section 09 06 00, SCHEDULE FOR FINISHES: Color of spandrel glass,  
tinted (heat absorbing or light reducing) glass, and reflective  
(metallic coated) glass.
- F. Section 08 34 53, SECURITY DOORS AND FRAMES: Forced Entry (FE)  
resistant rated doors and frames.
- G. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER AND CONDUCTORS AND  
CABLES: Wiring (120 V AC, 15A or 20A).
- H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction  
and Switch Boxes.
- I. Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS: Access Control  
Systems.

**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 label requirements.
  - 3. Temporary labels are to remain intact until glass is approved by  
Contracting Officer Representative (COR).
- B. Permanent labels:
  - 1. Locate in corner for each pane.
  - 2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
    - a. Tempered glass.
    - b. Laminated glass or have certificate for panes without permanent  
label.

3. Fire rated glazing assemblies: Mark in accordance with IBC.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.
- B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
  - 1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
- C. Blast- resistant glazing assemblies:
  - 1. For blast-resistant units comply with requirements in Physical Security Design Manual for VA Life Safety Protected Facilities, and project-specific criteria provided on the drawings and specifications.
  - 2. Spall Resistance: Laminated glazing is not permitted to produce spall to interior (protected side) when impacted with scheduled ballistics.
  - 3. Tolerances:
    - a. Outside dimensions: Overall outside dimensions (height and width) of laminated security glazing is to maintain tolerance of  $\pm 3$  mm ( $\pm 0.12$  inch).
    - b. Warpage: Out-of-flat (warpage or bowing) condition of laminates is not to exceed 2.5 mm per lineal meter (0.10 inch per 3.3 lineal foot). The condition, if present, is to be localized to extent not greater than 0.75 mm (0.03 inch) for any 0.3 meter (0.98 feet) section.

- D. Windborne-Debris-Impact Resistance: Comply with enhanced-protection testing requirements in ASTM E1996 for project wind zone when tested according to ASTM E1886, based upon testing of specimens not less than the size required for project and utilizing installation method identical to that specified for project.
  - 1. Project Wind Zone: Wind Zone 1
  - 2. Large-Missile Test: For glazing located within 9.1 m (30 feet) of grade.
- E. 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.

### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Sustainable Design Submittals, as described below:
  - 1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
- C. Manufacturer's Certificates:
  - 1. Certificate on solar heat gain coefficient when value is specified.
  - 2. Certificate on "R" value when value is specified.
  - 3. Certificate that blast resistant glass meets the specified requirements.
- D. Manufacturer Warranty.
- E. Manufacturer's Literature and Data:
  - 1. Glass, each kind required.
  - 2. Insulating glass units.
  - 3. Elastic compound for metal sash glazing.
  - 4. Putty, for wood sash glazing.
  - 5. Glazing cushion.
  - 6. Sealing compound.
- F. Samples:
  - 1. Size: 305 mm by 305 mm (12 inches by 12 inches).
  - 2. Tinted glass.
  - 3. Reflective glass.
- G. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were

tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
  - 1. Treat security glazing as fragile merchandise and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
  - 2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
  - 3. Temporary protections: The glass front and polycarbonate back of glazing are to be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces is to be approved and applied by manufacturer.
  - 4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the

- four (4) edges are to be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to be used, with flanges extending into face sides of glazing.
5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

#### **1.7 PROJECT CONDITIONS:**

- A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

#### **1.8 WARRANTY**

- A. Construction Warranty: Comply with the FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.
1. Insulating glass units to remain sealed for ten (10) years.
  2. Laminated glass units to remain laminated for five (5) years.
  3. Polycarbonate to remain clear and ultraviolet light stabilized for five (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 Architectural Manufacturers Association (AAMA):
- 800.....Test Methods for Sealants
  - 810.1-77.....Expanded Cellular Glazing Tape
- C. American National Standards Institute (ANSI):
- Z97.1-14.....Safety Glazing Material Used in  
Building - Safety Performance Specifications  
and Methods of Test
- D. American Society of Civil Engineers (ASCE):
- 7-10.....Wind Load Provisions
- E. ASTM International (ASTM):





- E2190-19.....Insulating Glass Unit
- E2240-06.....Test Method for Assessing the Current-Voltage  
Cycling Stability at 90 Degree C (194 Degree F)  
of Absorptive Electrochromic Coatings on Sealed  
Insulating Glass Units
- E2241-06.....Test Method for Assessing the Current-Voltage  
Cycling Stability at Room Temperature of  
Absorptive Electrochromic Coatings on Sealed  
Insulating Glass Units
- E2354-10.....Assessing the Durability of Absorptive  
Electrochromic Coatings within Sealed  
Insulating Glass Units
- E2355-10.....Test Method for Measuring the Visible Light  
Transmission Uniformity of an Absorptive  
Electrochromic Coating on a Glazing Surface
- F1233-08 (2019).....Standard Test Method for Security Glazing  
Materials and Systems
- F1642/F1642M-17.....Test Method for Glazing and Glazing Systems  
Subject to Airblast Loadings
- F. Code of Federal Regulations (CFR):
- 16 CFR 1201-10.....Safety Standard for Architectural Glazing  
Materials
- G. Glass Association of North America (GANA):
- 2010 Edition.....GANA Glazing Manual
- 2008 Edition.....GANA Sealant Manual
- 2009 Edition.....GANA Laminated Glazing Reference Manual
- 2010 Edition.....GANA Protective Glazing Reference Manual
- H. International Code Council (ICC):
- IBC.....International Building Code
- I. Insulating Glass Certification Council (IGCC)
- J. Insulating Glass Manufacturer Alliance (IGMA):
- TB-3001-13.....Guidelines for Sloped Glazing
- TM-3000.....North American Glazing Guidelines for Sealed  
Insulating Glass Units for Commercial and  
Residential Use
- K. Intertek Testing Services - Warnock Hersey (ITS-WHI)
- L. National Fire Protection Association (NFPA):
- 80-16.....Fire Doors and Windows

252-12.....Fire Tests of Door Assemblies

257-12.....Standard on Fire Test for Window and Glass  
Block Assemblies

M. National Fenestration Rating Council (NFRC)

N. Safety Glazing Certification Council (SGCC) 2012:  
Certified Products Directory (Issued Semi-Annually).

O. Underwriters Laboratories, Inc. (UL):

9-08(R2009).....Fire Tests of Window Assemblies

263-14.....Fire Tests of Building Construction and  
Materials

752-11.....Bullet-Resisting Equipment.

P. Department of Veterans Affairs:

Q. Physical Security Design Manual for VA Mission Critical Protected  
Facilities January 2015

R. Architectural Design Manual for VA Facilities (VASDM)

S. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

## **PART 2 - PRODUCT**

### **2.1 GLASS**

A. Provide minimum thickness stated and as additionally required to meet performance requirements.

1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:

1. ASTM C1036, Type I, Class 1, Quality q4.

D. Tinted Heat reflective and low emissivity coated glass:

1. ASTM C1036, Type I, Class 2, Quality q3.

### **2.2 HEAT-TREATED GLASS**

A. Roller Wave Limits for Heat-Treated Glass: Orient all roller wave distortion parallel to bottom surface of glazing, and provide units complying with the following limitations:

1. Measurement Parallel to Line: Maximum peak to valley 0.203 mm  
(0.008 inch).

2. Measurement Perpendicular to Line: Maximum 0.0254 mm (0.001 inch).

3. Bow/Warp: Maximum 50 percent of bow and warp allowed by ASTM C1048.

B. Clear Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.

C. Tinted Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.

D. Clear Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.

E. Tinted Tempered Glass.

1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.

F. Tempered Patterned Glass:

1. ASTM C1048, Kind FT, Type II, Class 1, Form 3, finish, pattern and quality as indicated in construction documents.

## 2.3 COATED GLASS

A. Reflective-Coated Low-E Coated Tempered Glass:

1. ASTM C1376 and ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with reflective metallic coating.

B. Ceramic Coated Vision Glass:

1. ASTM C1048, Kind HS or FT, Condition C, Type I, Quality q3 with ceramic coating applied by silk-screen process.
2. Coated one face with a hard adherent reflective film of chromium or other coating of proven equivalent durability.
3. Visible light transmittance; eight percent, plus or minus two percent.
4. Visible reflectance; sixty percent, plus or minus five percent.
5. Light ratio; mirror side 10 or more; observer side one or less.
6. Assemble with coating covered and protected with a layer of clear glass not less than 3 mm (1.8 inch) thick.
7. Clean interface glass prior to assembly.
8. Tape edge to seal interface and hold panes together.

## 2.4 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Two or more lites of heat treated glass bonded with polyvinyl butyral, ionomeric polymer, or cast-in-place and cured-transparent-resin interlayer complying with interlayer manufacturer's written instructions. Minimum total laminated thickness of 1/4" for blast resistant glazing.
- B. Interlayer: Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing unless otherwise indicated in construction documents.
- C. Interlayer: Use 1.5 mm (0.060 inch) thick interlayer for:

1. Horizontal or sloped glazing.
2. Acoustical glazing.
3. Assemblies requiring heat strengthened or fully tempered glass.
- D. Interlayer: Use 2.28 mm (0.090 inch) thick interlayer where required to meet performance requirements.
- E. Interlayer Color: Clear, unless otherwise indicated in construction documents.

## **2.5 SECURITY GLAZING ASSEMBLY**

- A. Forced Entry Resistance: In accordance with ASTM F1233.
- B. Blast Resistance: Provide exterior glazing units that meet the specified blast pressures and impulses providing protection based upon hazard rating as scheduled, in accordance with Physical Security and Resilience Design Manual for Life Safety Protected Facilities October 2020 as indicated in Specification Section 08 56 53.

## **2.6 INSULATING GLASS UNITS**

- A. Provide factory fabricated, hermetically sealed glass unit consisting of three panes of glass separated by a dehydrated air space and comply with ASTM E2190. The exterior glass unit shall be fully tempered and the inner glass unit shall be laminated annealed at a minimum for all blast resistant glazing.

## **2.7 FIRE PROTECTION AND FIRE RESISTANCE GLAZING**

- A. Fire-Protection-Rated Glazing: Glazing units tested for use in fire door assemblies or fire windows, UL, ITS-WHI or equivalent listed and labeled by testing agency in accordance with IBC, for fire-protection ratings as indicated on construction documents, based upon positive-pressure testing per NFPA 257 or UL 9, and complying with NFPA 80.
  1. Hose-Stream Test: Units must comply, except units having fire-protection rating of 20 minutes.
  2. Labeling: Permanently label fire-protection-rated glazing units in accordance with IBC.
  3. Safety Glazing: Comply with 16 CFR 1201, Category II.
  4. Fire-Protection-Rated Tempered Glass: For 20-minute fire-protection-rated door assemblies, of thickness scheduled.
  5. Fire-Protection-Rated Laminated Ceramic Glazing: Units made from two lites of clear, ceramic glass, 8 mm (5/16 inch) total thickness, for rating scheduled.
  6. Fire-Protection-Rated Laminated Glass with Intumescent Interlayers: Units made from multiple lites of uncoated, ultra-clear (low-iron)

float glass, in intumescent interlayers, of thickness and rating scheduled.

## **2.8 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 are to have a finish that will not corrode or stain while in service. Fire rated glazing to be installed with glazing accessories in accordance with the manufacturer's installation instructions.
- B. Setting Blocks: ASTM C864:
  - 1. Silicone type.
  - 2. Channel shape; having 6 mm (1/4 inch) internal depth.
  - 3. Shore A hardness of 80 to 90 Durometer.
  - 4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
  - 5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  - 6. 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: 25 to 76 mm (1 to 3 inches).
  - 4. Shore A hardness of 40 to 50 Durometer.
- D. Glazing Tapes:
  - 1. Semi-solid polymeric based closed cell 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.
  - 3. Complying with AAMA 800 for the following types:
    - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
    - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
- E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

- F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.
- G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.
- H. 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.
- I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- J. Glazing Sealants: ASTM C920, silicone neutral cure:
  - 1. Type S.
  - 2. Class 25 or 50 as recommended by manufacturer for application.
  - 3. Grade NS.
  - 4. Shore A hardness of 25 to 30 Durometer.
  - 5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).
- K. Structural Sealant: ASTM C920, silicone acetoxo cure:
  - 1. Type S.
  - 2. Class 25.
  - 3. Grade NS.
  - 4. Shore a hardness of 25 to 30 Durometer.
- L. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
  - 1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
  - 2. Designed for dry glazing.
- M. Color:
  - 1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to 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 are to 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 is approved shop drawings.
- B. Review for 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.

### **3.2 PREPARATION**

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA 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 Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 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. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Laminated Glass:
  1. Tape edges to seal interlayer and protect from glazing sealants.
  2. Do not use putty or glazing compounds.
- H. Insulating Glass Units:
  1. Glaze in compliance with glass manufacturer's written instructions.



2. When glazing gaskets are used, they are to 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.
- I. Fire Protective and Fire Resistance Glass:
1. Wire Glass: Glaze in accordance with NFPA 80.
  2. Other fire protective and fire resistant glass: Glaze in accordance with manufacturer's installation instructions and NFPA 80.

### **3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

### **3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 152 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

- F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant type is to be compatible with glazing tape.
- G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.6 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line. Sealant type is to be compatible with glazing tape.
- F. Trim protruding tape edge.

### **3.7 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, sealant, and other setting material in clean, whole, and acceptable condition.

### **3.8 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### **3.9 INSULATING LAMINATED GLASS SCHEDULE (FORCE PROTECTION AND PHYSICAL SAFETY)**

- A. Glass Type: Clear insulating laminated glass, spandrel at locations noted in drawings.
  - 1. Overall Unit Thickness: 30 mm (1-1/4 inch).

2. Outdoor Lite: Clear annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
  - a. Minimum Thickness of Outdoor Lite: 6 mm (0.23 inch).
3. Interspace Content: Argon.
4. Indoor Lite: Clear laminated glass with three lites of annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
  - a. Minimum Thickness of Each Glass Lite: 3 mm (0.12 inch).
  - b. Interlayer Thickness: 0.76 mm (0.030 inch)
5. Visible Light Transmittance: 100 percent minimum.
6. Solar Heat Gain Coefficient: 0.55 maximum.
7. Safety glazing label required.
8. Blast Resistance: Provide units meeting the following:
  - a. GP Value.

### **3.10 FIRE-PROTECTIVE AND FIRE-RESISTANCE GLAZING SCHEDULE**

- A. Glass Type: Fire-protection-rated tempered glass.
  1. Thickness: 6 mm (0.23 inch).
  2. Rating: 45 minutes.
  3. Application: Fire-protection-rated door assemblies with openings not over 0.65 square meter (100 square inch).

### **3.11 SECURITY GLAZING SCHEDULE**

- A. Glass Type: Clear Heat Strengthened Glass Clad Polycarbonate Security Glazing Unit:
  1. Outer Glass Panes: Heat strengthened, 3 mm (0.12 inch) thick.
  2. Interlayers: Minimum 1.3 mm (0.050 inch) polyurethane sheeting, in thickness required to meet performance requirements.
  3. Core: Clear polycarbonate sheet, minimum 3 mm (0.12 inch) thick, in thickness required to meet performance requirements.

- - - E N D - - -

**SECTION 08 90 00  
LOUVERS AND VENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

**1.2 RELATED WORK**

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Color of finish.
- B. Section 23 37 00 AIR OUTLETS AND INLETS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each type, showing material, finish, size of members, operating devices, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
  - 1. Each type of louver and vent.
- D. Color samples.
- E. Blast Design Calculations: Louver System and Anchorage
  - 1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years' experience in design of blast resistant louver systems, verifying louver assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security Design Standards Data Definitions which is a document separate from the referenced VA Security Design Manual. The Physical Security Design Standards Data Definitions are provided on a need-to-know basis by the blast/structural engineer performing the blast design on VA projects. It is the responsibility of the engineer of blast resistant windows to request and obtain the Physical Security Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

**1.4 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):  
Approved Product List - Updated Monthly
- C. ASTM International (ASTM):
  - A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
  - A1008/A1008M-20.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
  - B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate
  - B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate (Metric)
  - B221-14.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B221M-13.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
  - D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual
- E. National Fire Protection Association (NFPA):  
90A-15.....Installation of Air Conditioning and Ventilating Systems
- F. American Architectural Manufacturers Association (AAMA):  
2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels
- G. Air Movement and Control Association, Inc. (AMCA):  
500-L-07      Testing Louvers
- H. Department of Veterans Affairs:  
VA Physical Security Design Manual for Life Safety Protected Facilities  
January 2015

## I. Protective Design Center

PDC-TR-08 Single Degree of Freedom Structural Response Limits for  
Antiterrorism Design

**PART 2 - PRODUCTS****2.1 MATERIALS:**

- A. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.
- B. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.
  - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
  - 2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel with same finish as louvers.
- C. Inorganic Zinc Primer: MPI No. 19.
- D. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

**2.2 EXTERIOR WALL LOUVERS:**

- A. General:
  - 1. Provide fixed type louvers of size and design shown.
  - 2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
  - 3. Furnish louvers with sill extension or separate sill as shown.
  - 4. Furnish louvers with bird screens.
  - 5. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics: See Section 23 37 00 AIR OUTLETS AND INLETS.
  - 1. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.
  - 2. Blast Resistance:
    - A. Louvers in exterior walls shall be blast resistant and meet the following criteria per the VA Physical Security Design Manual for Life Safety Protected Facilities January 2015:
      - 1. Standoff Distance: 25 feet (Life Safety Protected)

- a. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with GP1 threat for Life Safety Protected Buildings
  - b. Deformation not to exceed those defined by B3 response per the Protective Design Center document PDC-TR-08 while experiencing design level pressures.
- C. Formed Steel Louvers: Form galvanized louvers using 1.5 mm (0.059-inch) thick sheet for frames, blades, sills and mullions.
  - 1. Provide louver with fixed 45 degree drainable blades with water baffle. Make overall frame size 13 mm (1/2-inch) less than opening, unless otherwise indicated in construction documents.
  - 2. Single louver sections are not to exceed 1676 mm (66 inches) in width. For openings larger than 1676 mm (66 inches) wide, provide multiple sections not larger than 1676 mm (66 inches) side separated by mullions.

### **2.3 CLOSURE ANGLES AND CLOSURE PLATES:**

- A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.
- B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
- C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

### **2.4 FINISH:**

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers:
  - 1. Anodized finish
    - a. AA-M10C22A42, chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.
- C. Steel: Surfaces of steel work, for which no other finish is specified, are to be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

### **2.5 PROTECTION:**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces

of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on colored anodized finish is not approved.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

- A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Set wall louvers in masonry walls during progress of the work. If wall louvers are not delivered to job in time for installation in prepared openings, make provision for later installation.

#### **3.2 CLEANING AND ADJUSTING:**

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration



are unsuccessful, as determined by Contracting Officer  
Representative (COR) damaged units and replace with new units.

- - - E N D - - -

**SECTION 09 06 00**  
**SCHEDULE FOR FINISHES**

VAMC: Fargo VA Health Care System

Location: Fargo, North Dakota

Project no. and Name: 437-315; Expand Building 1 for Primary Care

Submission: Construction Documents

Date: November, 2021

**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.

**1.2 MANUFACTURERS**

- A. Manufacturer's 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.

**1.3 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.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)  
6/1/2019.....Architectural Painting Specification Manual

**PART 2 - PRODUCTS****2.1 DIVISION 03 - CONCRETE**

- A. SECTION 03 30 00, CAST IN PLACE CONCRETE SECTION 03 30 53, (SHORT FORM) CAST-IN-PLACE CONCRETE

Surface	Finish Description
Exposed and Finished Surface	Troweled finish per specifications

**2.2 DIVISION 04 - MASONRY**

- A. Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING

Finish Code	Manufacturer	Mfg. Color Name
n/a		Color to match existing.

## B. Section 04 20 00, UNIT MASONRY

1. FACE BRICK (FB)				
Finish Code	Size	Pattern	Manufacturer	Mfg. Color Name/No.
n/a	To match existing	To match existing	Hebron Brick	To match existing

## C. CAST STONE MASONRY

Name of Stone	Color, Texture, Finish	Stone Source
TBD	To Match Exg Cast Stone Masonry	TBD

**2.3 DIVISION 05 - METALS**

## A. SECTION 05 12 00, STRUCTURAL STEEL FRAMING - WHERE EXPOSED TO VIEW

Component	Finish	Color
Structural Steel		Flat Black

## B. SECTION 05 36 00, STEEL DECKING, WHERE EXPOSED TO VIEW

Finish	Color
	Flat Black

## C. SECTION 05 50 00, METAL FABRICATIONS

Item	Finish
Loose Lintels	TBD - Brick Match

Shelf Angles	TBD - Brick Match
Steel Ladders	Flat Black
Steel Pipe Railings	Flat Black
Existing Steel Roof Hatch Guardrail	Flat Black
Steel Pipe Bollards	Traffic Yellow

## D. SECTION 05 51 00, METAL STAIRS

Finish	Color
Paint	Color TBD

## E. SECTION 07 95 13, EXPANSION JOINT COVER ASSEMBLIES

	Material	Finish	Manufacturer	Mfg. Color Name/No.
Floor Component Cover Plate Frame Gasket or Sealant (interior only)	Aluminum	Anodized	CS Group	Flooring Match - Color TBD
Exterior Wall Cover Plate Frame Thermoplastic Joint	Alum/Thermoplastic	Anodized	CS Group	Brick Match - Color TBD

## 2.4 DIVISION 07 - THERMAL AND MOISTURE PROTECTION

## A. SECTION 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER (e) ROOFING

Color	Manufacturer	Mfg. Color Name/No.
Black	Firestone	

## B. SECTION 07 60 00, FLASHING AND SHEET METAL

Item	Material	Finish
Copings		Alum Anodized Dk Bronze to match existing.
	Aluminum	
	Stainless steel	

## C. SECTION 07 92 00, JOINT SEALANTS

Location	Color	Manufacturer	Manufacturer Color
Masonry Expansion Joints	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
Masonry Control Joints	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
Precast Concrete Panels	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
New to Existing Walls	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
Building Expansion Joints	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
Masonry Sealed Joints	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify
Stone Sealed Joints	Match adjacent mortar.	Tremco - Dymonic 100	Limestone - Verify

**2.5 DIVISION 08 - OPENINGS****A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES**

1. Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door	
Component	Color of Paint Type and Gloss
Door	To Match Existing
Frame	To Match Existing

**B. SECTION 08 14 00, INTERIOR WOOD DOORS (Including Sliding Doors)**

Component	Finish/Color
Doors (Swing)	Mfr PLAM - to match exg
Doors (Sliding)	(Serenity Doors) to match exg PLam
Frames	Match existing.

**C. SECTION 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

Material	Finish	Manufacturer	Manufacturer Color Name/No.
Aluminum	Anodized	Kawneer	Dk Bronze
Glass			

**D. SECTION 08 51 13, ALUMINUM WINDOWS**

Type	Finish	Glazing	Manufacturer	Mfg. Color Name/No.
Fixed			Kawneer	Dk Bronze

## E. WINDOW SILLS

Room No. and Name	Material	Finish
All windows in new addition	Solid Surface	Formica Blanco Terrazzo 742

## F. SECTION 08 71 00, BUILDERS HARDWARE

Item	Material	Finish
Hinges	Per specification	Match Existing
Door Closers	Per specification	Match Existing
Floor Closers	Per specification	Match Existing
Floor Pivot Sets	Per specification	Match Existing
Closer/ Holder	Per specification	Match Existing
Floor Stops	Per specification	Match Existing
Door Holders	Per specification	Match Existing
Lock/ Latches	Per specification	Match Existing
Armor Plates	Per specification	Match Existing
Kick Mop Plates	Per specification	Match Existing
Door Edging	Per specification	Match Existing
Exit Device	Per specification	Match Existing
Flush Bolts	Per specification	Match Existing
Door Pulls	Per specification	Match Existing
Push Plates	Per specification	Match Existing
Combination Push Pull Plate	Per specification	Match Existing
Coordinators	Per specification	Match Existing
Light Proof Seals	Per specification	Match Existing
Weather Strip	Per specification	Black
Threshold	Aluminum	Clear Anodized



## G. SECTION 08 80 00, GLAZING

Glazing Type	Manufacturer	Mfg. Color Name/No.
G-1		
G-2		
G-3		
G-4		
G-5		
G-6		
G-7		
G-8		
G-9		
G-10		
G-11		
G-120		

## H. SECTION 08 44 13, GLAZED ALUMINUM CURTAIN WALLS

Component	Material	Finish	Manufacturer	Mfg. Color Name/No.
Aluminum	Aluminum	Anodized	Kawneer	Dk Bronze
Glazing	See 08 80 00 Glazing			
Standard Panel	Aluminum	Anodized	Kawneer	Dk Bronze

## I. SECTION 09 30 13, CERAMIC/PORCELAIN TILING

1. MOSAIC TILE (PT-3)					
Color	Size	Shape	Pattern	Manufacturer	Mfg. Color Name/No.
MIXED	MOSAIC	LINEAR HEX	ALAIR	AMERICAN OLEAN	SLATE/AL17

2. SECTION 09 30 13, CERAMIC/PORCELAIN TILING					
Finish Code		Manufacturer		Mfg. Color Name/No	
PT-1		DAL TILE		UNITY/ASHGREY P405	
PT-2		DAL TILE		FABRIQUE/CRÈME LINEN P686	
3. SECTION 09 30 13, [CERAMIC/PORCELAIN TILING] QUARRY TILE (QT)					
Finish Code	Size	Shape	Pattern	Manufacturer	Mfg. Color Name/No.
QT-1	8X8	SQUARE	N/A	DAL TILE	QUARRY TEXTURES/ASHEN GRAY OT03

4. SECTION 09 30 13, [CERAMIC/PORCELAIN TILING] QUARRY TILE GROUT					
Finish Code		Manufacturer		Mfg. Color Name/No.	
		MAPEI		KERAPOXY/PEWTER 02	

5. SECTION 09 30 13, [CERAMIC/PORCELAIN TILING] METAL DIVIDER STRIPS					
Size		Material		Manufacturer	
1/4"		ANODIZED ALUMINUM		SCHLUTER-RONDEC BULLNOSE	

## J. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color Pattern	Manufacturer	Mfg Name/No.
	Exposed Suspension System			
ACT-1	Type III	WHITE 815	ARMSTRONG	FISSURED TEGULAR

## K. SECTION 09 65 19, RESILIENT TILE FLOORING

Finish Code	Size	Material/Component	Manufacturer	Mfg Name/No.
LVT-1	6"X40"	VINYL	MANNINGTON	ACCESS WOOD COLLECTION, DUSKY WALNUT SX5W2542
LVT-2	18"X18"	VINYL	MANNINGTON	ACCESS ABSTRACT COLLECTION, SX5A3800
RF	STAIR TREADS AND LANDING TILES, HAMMERED	RUBBER	ARMSTRONG	PEBBLE

## L. SECTION 09 65 16, [ RESILIENT SHEET FLOORING], HEAT WELDED SEAMS (WSF)

Finish Code	Pattern name	Manufacturer	Mfg. Color Name/No.
LIN	MARMOLEUM	FORBO	VIVACE, GRANADA 3405

## 1. SECTION 09 65 16, [RESILIENT SHEET FLOORING], CAP STRIPS (WSF)

Finish Code	Manufacturer	Mfg. Color Name/No.
	FORBO	SLIM CAP - MATCH EXISTING

## M. SECTION 09 65 13, RESILIENT BASE AND ACCESSORIES

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
RB1	Rubber Base (RB)	4"	JOHNSONITE	FAWN 80

## N. SECTION 09 68 00, CARPETING (CP)

Finish Code	Pattern	Manufacture	Mfg. Color Name/No.
CPT-1	DATUM, 24"X24"	MOHAWK COMMERCIAL	GRANITE, MONOLITHIC INSTALLATION

## 1. SECTION 09 68 00, [CARPETING], CARPET EDGE STRIP

Finish Code	Material	Manufacturer	Mfg. Color Name/No.
TRANSITIONS	Vinyl	JOHNSONITE	FAWN 80

## O. SECTION 09 91 00, PAINTING

## 1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4		a "satin-like" finish	20-35 units, and
min. 35 units			
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6a	traditional gloss	70-85 units	
Gloss level 7		a high gloss more than 85 units	

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
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P-1	4	SHERWIN WILLIAMS	BALANCED BEIGE, SW7037
P-2	4	SHERWIN WILLIAMS	EXTRA WHITE, SW7006
P-3	4	SHERWIN WILLIAMS	MEGA GREIGE, SW7031
P-4	4	SHERWIN WILLIAMS	SLATE TILE, SW7624

**2.6 DIVISION 10 - SPECIALTIES**

## A. SECTION 10 21 23, CUBICLE CURTAIN TRACKS

Finish Code	Manufacturer	Mfg. Color Name/No.
n/a	INPRO	WHISPERCARE, WHITE PVC

## B. SECTION 08 90 00, LOUVERS AND VENTS

Item	Material	Finish	Manufacturer	Mfg. Color Name/No.
	Aluminum	Anodized	Architectural Louvers - E4WH	Dk Bronze

## C. SECTION 10 26 00, WALL AND DOOR PROTECTION

Item	Material	Manufacturer	Mfg. Color Name/No.
Corner Guards	ACROVYN	INPRO	MATCH EXISTING
Wall Guards and Handrail	ACROVYN	INPRO	MATCH EXISTING
Wall Guard	ACROVYN	INPRO	MATCH EXISTING

## D. SECTION 10 14 00, SIGNAGE

Room No. and Name	Item	Finish	Manufacturer	Mfg. Color Name/No.
See Signage Schedule	Door Signage		CS-Acrovyn	TBD - Campus Standard

## E. SECTION 10 44 13, FIRE EXTINGUISHER CABINETS

Component	Material	Finish
Cabinet	JL Industries - Steel	White Enamel
Door	JL Industries - Steel	White Enamel

## F. SECTION 10 28 00, TOILET, BATH AND LAUNDRY ACCESSORIES

Item	Material	Manufacturer	Mfg. Color Name/No.
Grab Bars	Aluminum	Bobrick	Clear Anodized
Mirrors	Aluminum	Bobrick	Clear Anodized
Paper Towel Disp	Aluminum	Bobrick	Clear Anodized
Toilet Paper Disp	Aluminum	Bobrick	Clear Anodized

## G. SECTION 10 28 00, [TOILET, BATH AND LAUNDRY ACCESSORIES] CUSTOM TOILET ACCESSORIES

Item	Component	Finish	Manufacturer	Mfg. Color Name/No.
	Vinyl Fabric			

## H. SECTION 12 32 00, MANUFACTURED WOOD CASEWORK

Item Type	Location	Finish/Color
HIGH PRESSURE PLASTIC LAMINATE	Cabinetry	FORMICA WALNUT RIFTWOOD 9283

## I. SECTION 12 36 00, COUNTERTOPS

Type	Finish/Color
HIGH PRESSURE PLASTIC LAMINATE	FORMICA WHITE ICE GRANITE 9476-58 (STAFF ONLY AREAS)
SOLID SURFACE	FORMICA BLANCO TERRAZZO 742 (PATIENT AREAS)

## J. SECTION 12 24 00, WINDOW SHADES

Expand Building 1 For Primary Care  
Fargo VA Health Care System

VA Project No: 437-315  
09 06 00 Schedule for Finishes-114

Component	Material	Manufacturer	Mfg. Color Name/No.
Shade Cloth	25% POLYESTER/75% VINYL	DRAPER	SHEERWEAVE PW4400 LINEN, ALABASTER
Venetian Blinds	LIGHTBLOCKER VINYL	BALI	WHITE/WHITE FASCIA

**2.7 DIVISION 22 - PLUMBING**

## A. SECTION 22 40 00, PLUMBING FIXTURES

Item	Color
Water Closet	American Standard - Afwall - White
Lavatories	Kohler - Brookline - White Kohler - Soho - White
Service Sink	Fiat - Terrazzo - Grey
Clinic Service Sink	Kohler - Bryant (oval) - White

**2.8 DIVISION 26 - ELECTRICAL**

## A. SECTION 26 51 00, INTERIOR LIGHTING

Fixture Type	Exterior Finish	Color
SEE LIGHTING SCHEDULE	SEE LIGHTING SCHEDULE	WHITE

## B. SECTION 26 56 00, EXTERIOR LIGHTING

Type and Component	Exterior Finish	Manufacturer	Mfg. Name/No.
SEE LIGHTING SCHEDULE		SEE LIGHTING SCHEDULE	SEE LIGHTING SCHEDULE

**PART 3 - EXECUTION****3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS**

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	ACT
Carpet Module Tile	CPT
Ceramic Mosaic Tile	FTCT
Concrete	C
Concrete Masonry Unit	CMU
Existing	E
Exposed Divider Strips	EXP
Exterior	EXT
Floor Tile, Mosaic	FT
Fluorocarbon	FC
Folding Panel Partition	FP
Foot Grille	FG
Glass Masonry Unit	GUMU
Glazed Face CMU	GCMU
Granite	GT
Gypsum Wallboard	GWB
Marble	MB

Material	MAT
Mortar	M
Multi-Color Coating	MC
Natural Finish	NF
Paint	P
Plastic Laminate	HPDL
Quarry Tile	QT
Resilient Stair Tread	RST
Rubber Base	RB
Rubber Tile Flooring	RT
Vinyl Base	VB
Vinyl Coated Fabric Wallcovering	W
Vinyl Composition Tile	VCT
Vinyl Sheet Flooring	VSF
Vinyl Sheet Flooring (Welded Seams)	WSF
Wall Border	WB
Wood	WD

--- E N D---



**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, or other building boards.

**1.2 RELATED WORK**

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Pull down tabs in steel decking: Section 05 36 00, COMPOSITE METAL DECKING.
- D. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS; Section 09 29 00, GYPSUM BOARD.

**1.3 TERMINOLOGY**

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Studs, runners and accessories.
  2. Hanger inserts.
  3. Channels (Rolled steel).
  4. Furring channels.
  5. Screws, clips and other fasteners.
- C. Shop Drawings:
1. Typical ceiling suspension system.
  2. Typical metal stud and furring construction system including details around openings and corner details.
  3. Typical shaft wall assembly
  4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

- D. Test Results: Fire rating test designation, each fire rating required for each assembly.

## **1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- 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)
- A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
- A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems
- C635-07.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
- C636-08.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
- C645-09.....Non-Structural Steel Framing Members
- C754-11.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
- C841-03 (R2008).....Installation of Interior Lathing and Furring
- C954-10.....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
- E580-11.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

## **PART 2 - PRODUCTS**

### **2.1 PROTECTIVE COATING**

- A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

### **2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified and sizes as shown.

1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).
2. Runners same thickness as studs.
3. Exception: Members that can show certified third-party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).
- 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 (16-inch) centers.
- C. Doubled studs for openings
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
  1. Conform to rated wall construction.
  2. C-H Studs Studs.
  3. E Studs.
  4. J Runners.
  5. Steel Jamb-Strt.

## **2.3 FURRING CHANNELS**

- A. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

## **2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
  1. ASTM A641, soft temper, Class 1 coating.

2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

## **2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD**

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION CRITERIA**

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

### **3.2 INSTALLING STUDS**

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (16 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.
- E. Extend studs to underside of structure overhead for fire rated partitions
- G. Openings:
  - 1. Frame jambs of openings in stud partitions and furring with two studs placed back-to-back or as shown.
  - 2. Fasten back-to-back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (16 inches) on center between runner tracks.

H. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

I. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

**3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
- B. Wall furring-Stud System:
  1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (16 inches) on center, installed vertically.
  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.

**3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

**3.5 INSTALLING SHAFT WALL SYSTEM**

- A. Conform to UL Design No. U438 for two-hour fire rating where shown on the drawings.

- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (16 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
  - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
  - 2. Frame openings cut within a liner panel with E studs around perimeter.
  - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

### **3.6 INSTALLING SUSPENDED CEILINGS OR SOFFITS**

- A. Install 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 6-inch centers for gypsum board anchorage.
- B. New exposed concrete slabs:
  - 1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
  - 2. Furnish for installation under Division 3, CONCRETE.
  - 3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.
- C. Concrete slabs on steel decking composite construction:
  - 1. Use pull down tabs when available.
  - 2. Use power activated fasteners when direct attachment to structural framing cannot be accomplished.
- D. Where beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed

1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

G. Installing suspended ceiling system for gypsum board (ASTM C635 Option):

1. Install only for ceilings to receive screw attached gypsum board.
2. Install in accordance with ASTM C636.
  - a. Install main runners spaced 1200 mm (48 inches) on center.
  - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
  - c. Install wall track channel at perimeter.

H. Installing Ceiling Bracing System:

1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and overhead construction. Lap channels not less than 600 mm (2 feet) at midpoint back-to-back. Screw or bolt lap together with two fasteners.
2. Install bracing at an approximate 45-degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.

### 3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

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**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

C. Section 09 51 00, ACOUSTICAL CEILING.

**1.3 TERMINOLOGY**

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

**1.4 SUBMITTALS**

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

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.
2. Edge trim.
3. Control joints.

E. Test Results:



1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

#### **1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- A. In accordance with the requirements of ASTM C840.

#### **1.6 ENVIRONMENTAL CONDITIONS**

- A. In accordance with the requirements of ASTM C840.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
  - C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-15.....Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-13.....Application and Finishing of Gypsum Board
  - C919-12.....Sealants in Acoustical Applications
  - C954-15.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
  - C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1047-14.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - C1177-13.....Glass Mat Gypsum Substrate for Use as Sheathing
  - C1178/C1178M-18.....Specification for Coated Glass Mat Water Resistant Backing Panel
  - C1658-13.....Glass Mat Gypsum Panels
  - C1396-14.....Gypsum Board
- C. Underwriters Laboratories Inc. (UL):
  - Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
  - Latest Editions.....Certification Listings

**PART 2 - PRODUCTS****2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.
- B. Coreboard or Shaft Wall Liner Panels.
  - 1. ASTM C1396, Type X.
  - 2. Coreboard for shaft walls 400mm (16inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C1178, Type X, 16 mm (5/8 inch) thick.
- D. Paper facings shall contain 100 percent post-consumer recycled paper content.

**2.2 GYPSUM SHEATHING BOARD**

- A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.
- B. ASTM C1177, Type X.

**2.3 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

**2.4 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

**2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE**

- 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 all partitions.
  - 1. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

### 3.2 INSTALLING GYPSUM BOARD

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
  - 1. For single-ply construction, use perpendicular application.
  - 2. For two-ply assemblies:
    - a. Use perpendicular application.
    - b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
- G. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.
  - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints.
  - 5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of

- wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
  7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
  9. Control Joints ASTM C840 and as follows:
    - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
    - b. Not required for wall lengths less than 9000 mm (30 feet).
    - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
  2. Install in one piece, without the limits of the longest commercially available lengths.
  3. Corner Beads:
    - a. Install at all vertical and horizontal external corners and where shown.
    - b. Use screws only. Do not use crimping tool.
  4. Edge Trim (casings Beads):
    - a. At both sides of expansion and control joints unless shown otherwise.
    - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
    - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.

d. Where otherwise shown.

### **3.3 INSTALLING GYPSUM SHEATHING**

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.
- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
- D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
- E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

### **3.4 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Reference 09 06 00 Schedule for Finishes or Level finishes throughout.
- B. Before proceeding with installation of finishing materials, assure the following:
  - 1. Gypsum board is fastened and held close to framing or furring.
  - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated fire rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the fire rated. Sanding is not required of non-decorated surfaces.

### **3.5 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non-decorated surface to provide smoke tight construction fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

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**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies tile, waterproofing membranes for thin-set applications, coupling membranes, and tile backer board.

**1.2 RELATED WORK**

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Color, Texture, Pattern, and Size of Field Tile and Trim Shapes, and Color of Grout Specified.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Tile, each type, each color, each size.
  2. Quarry tile, each type, color, and size.
  3. Porcelain tile, each type, color, patterns and size.
  4. Wall (or wainscot) tile, each color, size and pattern.
- C. Product Data:
1. Tile, marked to show each type, size, and shape required.
  2. Chemical resistant mortar and grout (epoxy and furan).
  3. Cementitious backer unit.
- D. Installer Qualifications:
1. Submit letter stating installer's experience.

**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 QUALITY ASSURANCE**

- A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.
- B. Each type and color of tile to be provided from a single source.
- C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

**1.6 WARRANTY**

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

## 1.7 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):

A10.20-06(R2016).....Safe Operating Practices for Tile, Terrazzo and  
Marble Work

A108/A118/A136.1:2019...Installation of Ceramic Tile

A108.01-18.....Subsurfaces and Preparations by Other Trades

A108.02-19.....Materials, Environmental, and Workmanship

A108.1A-17.....Installation of Ceramic Tile in the Wet-Set  
Method with Portland Cement Mortar

A108.1B-17.....Installation of Ceramic Tile on a Cured  
Portland Cement Mortar Setting Bed with Dry-Set  
or Latex-Portland Cement Mortar

A108.1C-17.....Contractors Option; Installation of Ceramic  
Tile in the Wet-Set method with Portland Cement  
Mortar or Installation of Ceramic Tile on a  
Cured Portland Cement Mortar Setting Bed with  
Dry-Set or Latex-Portland Cement Mortar

A108.4-09.....Ceramic Tile with Organic Adhesives or Water  
Cleanable Tile-Setting Epoxy Adhesive

A108.5-10 .....Ceramic Tile with Dry-Set Portland Cement  
Mortar or Latex-Portland Cement Mortar

A108.6-10.....Ceramic Tile with Chemical Resistant, Water  
Cleanable Tile-Setting and -Grouting Epoxy

A108.8-10.....Ceramic Tile with Chemical Resistant Furan  
Resin Mortar and Grout

A108.9-10.....Ceramic Tile with Modified Epoxy Emulsion  
Mortar/Grout

A108.10-17.....Grout in Tilework

A108.11-18.....Interior Installation of Cementitious Backer  
Units

A108.12-10.....Installation of Ceramic Tile with EGP (Exterior  
Glue Plywood) Latex-Portland Cement Mortar

A108.13-16.....Load Bearing, Bonded, Waterproof Membranes for  
Thin-Set Ceramic Tile and Dimension Stone



A666-15.....Annealed or Cold-Worked Austenitic Stainless  
Steel Sheet, Strip, Plate and Flat Bar

A1064/A1064M-18a.....Carbon-Steel Wire and Welded Wire  
Reinforcement, Plain and Deformed, for Concrete

C109/C109M-20b.....Standard Test Method for Compressive Strength  
of Hydraulic Cement Mortars (Using 2 inch. or  
[50-mm] Cube Specimens)

C241/C241M-15e1.....Abrasion Resistance of Stone Subjected to Foot Traffic

C348-20.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C627-18.....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

C954-18.....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/C979M-16.....Pigments for Integrally Colored Concrete

C1002-18.....Steel Self-Piercing Tapping Screws for the Application of Panel Products

C1027-19.....Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

C1127/C1127M-15.....Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface

C1178/C1178M-18.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

C1325-19.....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

C1353/C1353M-20e1.....Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser

D1204-14 (2020).....Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D2240-15e1.....Test Method for Rubber Property - Durometer Hardness

D2497-07 (2018).....Tolerances for Manufactured Organic-Base Filament Single Yarns

D3045-2018.....Heat Aging of Plastics Without Load

D4397-16.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D5109-12 (Withdrawn 2020). Standard Test Methods for Copper-Clad  
Thermosetting Laminates for Printed Wiring  
Boards (recommend deletion)

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water  
Content, Density Volume Solids, and Weight  
Solids of Surface Coating

E. Marble Institute of America (MIA)/ Building Stone Institute (BSI):  
Dimension Stone Design Manual VIII-2016

F. Tile Council of North America, Inc. (TCNA):

Handbook for Ceramic Tile Installation (2020) G. TCNA DCOF AcuTest-  
2012, Dynamic Coefficient of Friction Test

## **PART 2 - PRODUCTS**

### **2.1 TILE**

A. Comply with ANSI A137.1, Standard Grade, except as modified:

1. Inspection procedures listed under the Appendix of ANSI A137.1.
2. Abrasion Resistance Classification:
  - a. Tested in accordance with values listed in Table 1, ASTM C1027.
  - b. Class IV, 6000 revolutions for remaining areas.
3. Slip Resistant Tile for Floors:
  - a. Coefficient of friction, when tested in accordance with  
ANSI A137.1 and measured per the TCNA DCOF AcuTest.
    - 1) Equal to or greater than .42 for level interior tile floors  
that will be walked on when wet.
  - b. Tile Having Abrasive Grains:
    - 1) Quarry Tile: Abrasive grains uniformly embedded in face at  
rate of approximately 7.5 percent of surface area.
4. Mosaic tile may be mounted or joined by a resinous bonding material  
along tile edges.
5. Back mounted tiles in showers.

### **2.2 TECHNICAL DATA FOR PT-1 PORCELAIN FLOOR TILE:**

- A. Size: 12" x 24"
- B. Finish: Textured
- C. Color: Specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Breaking Strength: >275 lbs., ASTM C648
- E. Chemical Resistance: Resistant, ASTM C650.
- F. Water Absorption: <0.5%, ASTM C373

- G. Scratch Hardness: 8.0, MOHS Scale
- H. Wet Dynamic Coefficient of Friction (COF):
  - 1. Textured: >\_0.60 DCOF AcuTest
- I. Shade & Texture: V2 Slight Variation
- J. Manufactured in US: Yes

**2.3 TECHNICAL DATA FOR PT-2 PORCELAIN WALL TILE:**

- A. Size: 6" x 24"
- B. Finish: Honed
- C. Color: Specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Breaking Strength: >275 lbs, ASTM C648
- E. Chemical Resistance: Resistant, ASTM C650.
- F. Water Absorption: <0.5%, ASTM C373
- G. Scratch Hardness: 8, MOHS Scale
- H. Wet Dynamic Coefficient of Friction (COF):
  - 1. Unpolished (UPS): 0.50-0.60 DCOF AcuTest
  - 2. Honed (HON): 0.42-0.52 DCOF AcuTest
- I. Shade & Texture: V2 Slight Variation
- J. Manufactured in US: Yes

**2.4 TECHNICAL DATA FOR PT-3 MOSAIC TILE:**

- A. Size: 12" x 24, Base: cut to 6" x 24"
- B. Finish: Glass & Aluminum
- C. Color: Specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Breaking Strength: >100 lbs, ASTM C648
- E. Chemical Resistance: Resistant, ASTM C650.
- F. Water Absorption: <0.5%, ASTM C373
- G. Scratch Hardness: 4, MOHS Scale
- H. Wet Dynamic Coefficient of Friction (COF):
  - 1. Unpolished (UPS): 0.50-0.60 DCOF AcuTest
  - 2. Honed (HON): 0.42-0.52 DCOF AcuTest
- I. Shade & Texture: Strong Shade Variation
- J. Manufactured in US: Yes

**2.5 BACKER UNITS**

- A. Cementitious Backer Units:
  - 1. Use in showers or wet areas.
  - 2. Conform to ASTM C1325; Type A.
  - 3. Use in maximum lengths available to minimize end to end butt joints.

**2.6 UNCOUPLING MEMBRANE:**

- A. Description: 1/8 inch (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2 inch by 1/2 inch (12 mm by 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation and is listed by cUPC to meet or exceed the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
- B. Waterproofing seaming membrane.
- C. Provide seams and corners material 0.004 inch (0.1 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

**2.7 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.
- C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

**2.8 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.

**2.9 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCNA Handbook for Ceramic Tile Installation.
- B. Provide mix per manufacturer's recommendations:
  - 1. Epoxy Resin Type: ANSI A118.3.
- C. Waterproofing Membrane:

1. Description: 0.008 inch (0.2 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which is listed by cUPC to meet or exceed requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
2. Corners and seals:
3. Provide matching preformed inside corners.
4. Provide matching preformed outside corners.
5. Provide matching preformed pipe seals.

## **2.10 GROUTING MATERIALS**

- A. Water-Cleanable Epoxy Grout: ANSI A118.3.
  1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 60 and 100 degrees C (140 and 212 degrees F), respectively, and certified by manufacturer for intended use.

## **2.11 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. Provide a patching and leveling compound with the following minimum 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 - 4.1 MPa (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 101 mm (4 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.

## **2.12 WATER**

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

## **2.13 PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) 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 third day of completion of tile work.

### **3.2 ALLOWABLE TOLERANCE**

- F. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
  - 1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
  - 2. Not more than 3 mm in 3048 mm (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.
- G. Variation in Plane of Wall Surfaces:
  - 1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
  - 2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

### **3.3 SURFACE PREPARATION**

- A. 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 elevation shown on construction documents.

- 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.
- B. Mortar Bed for Slopes to Drains:
- 1. Slope compound to drain where drains are shown on construction documents.
  - 2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
  - 3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
  - 4. Screed for slope to drain and float finish.
  - 5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
  - 6. Perform flood test to verify mortar bed slopes to drain before installing tile. Contracting Officer Representative (COR) to be present during flood test.
- C. Additional preparation of concrete floors for tile set with epoxy, or furan-resin is to be in accordance with the manufacturer's printed instructions.
- D. Cleavage Membrane:
- 1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
  - 2. Turn up at edge of depressed floor slab to top of floor.
- E. Walls:
- 1. In showers or other wet areas cover studs with polyethylene sheet.
  - 7. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
  - 8. 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.
- F. Existing Floors and Walls:



1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.

### **3.4 CEMENTITIOUS BACKER UNITS**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A118.9 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a "V" joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.
- G. Joint Treatment:
  1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
  2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

### **3.5 TILE - GENERAL**

- A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.
- B. 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. .
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
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, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to 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. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
  - b. In areas where floor drains occur, slope tile to drains.
  - c. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
  - a. Cover walls and partitions.
9. Joints:

**A. KEEP ALL JOINTS IN LINE, STRAIGHT, LEVEL, PERPENDICULAR AND OF EVEN WIDTH UNLESS SHOWN OTHERWISE ON CONSTRUCTION DOCUMENTS.**

**A. Grout Type and Location:**

1. Grout for wall and base tile.

**B. Workmanship:**

1. Install and cure grout in accordance with the applicable standard.
2. Water-Cleanable Epoxy Grout: ANSI A118.3.

**3.7 MOVEMENT JOINTS**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant as recommended by manufacturer.

TCNA details EJ 171-14.

- H. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.

### **3.8 CLEANING:**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used are not permitted to 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, 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 fully set and cured.
- B. Where traffic occurs over tile floor is unavoidable, 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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