



## CONSTRUCTION DOCUMENTS

### SPECIFICATIONS

(Vol. I - Divisions 00 - 21 and  
Divisions 31-33)

## CHEYENNE VAMC NEW MENTAL HEALTH FACILITY

**Contract Number: VA259-C-1033**  
**JUNE 2013**

**Presented by: AES Group, Inc.**

**DEPARTMENT OF VETERANS AFFAIRS  
SPECIFICATIONS**

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

**1.1 GENERAL INTENTION**

- A. Contractor shall provide all work to complete the construction of a Mental Health Building addition at the Cheyenne, VAMC campus. Work shall include building construction, exterior improvements, minor renovations to existing Building 45 to provide the connection corridor, and all mechanical, electrical, telephone, security and nurse call systems as shown on the contract documents
- B. Visits to the site by Bidders may be made only when a pre-construction meeting shall take place at the facility.
- C. The VAMC Facilities Management staff will render certain technical services during the construction phases of the project.
- D. Offices of AES Group Inc. as the Architect-Engineer will render certain technical services during construction. Such services shall be considered advisory to the Government without affirmation by Contracting Officer or his duly authorized representative.
- E. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Contracting Officer's Representative (COR) in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- E. All employees of General Contractor and all subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access. All employees of the general contractor and the subcontractors
  - 1) Shall have VA badges at all times while on the jobsite.
  - 2) Coordinate with COR to obtain permanent and temporary badges.
- F. Prior to commencing work, general contractor shall provide proof that an OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team prior to the start of construction.
  - 2. Submit training records of all such employees for approval of COR before the start of work.

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

- A. ITEM I, GENERAL CONSTRUCTION Work includes all contract documents, specifications, and minor renovations to construct a 16 bed Mental Health Facility at the Cheyenne, WY, VAMC.

- B. ALTERNATE NO. 1: Alternate Light Fixtures
- C. ALTERNATE NO. 2: Prefinished metal gutter and downspout instead of copper
- D. ALTERNATE NO. 3: Windows – EFCO 670 instead of Kawneer
- E. Refer to specification section 01 23 00 Alternates for more details

### **1.3 CONSTRUCTION SECURITY REQUIREMENTS**

- A. Security Plan:
  - 1. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
  - 1. General Contractor's employees shall not enter the project site without appropriate VA badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
  - 2. For working outside the "regular hours" as defined in the contract, the General Contractor shall give 7 days request to the Contracting Officer and COR. This request is separate from any notices required for utility shutdowns.
    - a) Approval of the request shall be given by COR.
  - 3. No photography of VA premises is allowed without written permission of the CO.
  - 4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.
- C. Key Control:
  - 1. The General Contractor shall provide duplicate keys and lock combinations to the CO and COR for the purpose of security inspections of every area.
  - 2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation
- D. Document Control:
  - 1. The General Contractor is responsible for safekeeping of all drawings, project manuals and other project information to be shared only with those with a specific need to accomplish the project.
- E. Motor Vehicle Restrictions
  - 1. Separate permits shall be issued for General Contractor and its employees for parking in the Contractors work area only.
  - 2. Parking is not allowed on any areas other than paved areas on the site and as defined by COR.

### **1.4 FIRE SAFETY**

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

1. American Society for Testing and Materials (ASTM):
    - E84-2009..... Surface Burning Characteristics of Building Materials
  2. National Fire Protection Association (NFPA):
    - 10-2010 ..... Standard for Portable Fire Extinguishers
    - 30-2008 ..... Flammable and Combustible Liquids Code
    - 51B-2009..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work
    - 70-2011 ..... National Electrical Code
    - 241-2009 ..... Standard for Safeguarding Construction, Alteration, and Demolition Operations
  3. Occupational Safety and Health Administration (OSHA):
    - 29 CFR 1926 ..... Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR and Facility Safety Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
- C. Safety Briefing: Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the General Contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- D. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- E. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet). Location must be approved by COR.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress around the construction project. Entry for all traffic shall be from Converse Avenue only.
- 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.

- J. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR. .
- K. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from Facility Safety Officer at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- L. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Test Fire alarms and fire protection shutdowns. Coordinate with, and report findings and corrective actions weekly to COR.
- M. Smoking: In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- N. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
  - 1) It is the VA's desire to have a minimum of 50% of the waste recycled.
- O. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- P. Fire extinguishers: Contractor to provide and maintain extinguishers in construction areas and it temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- Q. Means of egress; Do not block exiting from existing buildings.
- R. Temporary partitions: Install and maintain a temporary 1 hour rated partition between the existing Building 45 and the new addition.

## **1.5 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
  - 1. The Contractor shall provide a chain link construction fence, 7 feet minimum height around the construction area as indicated on the drawings. Fencing shall be approved by the Safety Officer Provide gates as necessary for required access including hasps and padlocks for use when contractor is off-site. Fasten fence fabric to terminal posts with tension bands and to line posts at the top and bottom rails with wire ties spaced at maximum 15 inches. The bottom of the fence shall extend one inch above grade. Remove the fence when directed by the COR.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the COR.
- C. The Contractor shall, under regulations prescribed by the COR, use only established roadways. 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 and as determined by the COR.

- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of the Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, 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.
- G. Traffic Control; The Contractor shall provide traffic control when any area of the existing roadways is blocked for project work.
- H. All on-site vehicle parking shall be limited to the contractor's enclosure. Workers can use the parking areas designated by the COR in areas not typically used by patients and staff.
- I. 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 the COR. All such actions shall be coordinated by the Contractor with the Utility Company involved.
  - 1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government.
- J. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of building or portion thereof.
  - 1. Contractor to provide a 2 week look ahead schedule at each weekly project meeting.
  - 2. Contractor is to coordinate with new roadway construction anticipated to start in March 2013 and extend thru approximately June 2013.
- K. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, inside the building except as otherwise specified.
- L. Utilities Services: No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems to all other buildings on the VAMC campus may be interrupted without prior approval of COR. Fourteen (14) days written notice is required for all utility work and shall be accomplished with all affected circuits or equipment de-energized.
  - 1. It is the Contractor's responsibility to locate all utility services and shall hand excavate as appropriate.
  - 2. Contractor shall submit a request to interrupt any such services to COR, in writing, at least 14 calendar 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 (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to the operations of Medical Center.
- M. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
  1. All abandoned lines removed to the intent possible. Lines left in place shall be marked on the construction "as built" drawings to extend known.

## 1.6 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of FMS of the areas where building alterations are to occur and areas which are anticipated routes of access, and furnish a report, signed by all three to the COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be in such condition that their use is impossible or impractical, it shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and 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 workmen in executing work of this contract.
- D. Existing Utility Locations: The Contractor is responsible for locating all buried utilities prior to the start of excavation.
- E. 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. 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.

3. When an area outside of the Contractors enclosure is under construction, provide 5 ft high orange construction fencing, with picket posts surrounding the area.

## 1.7 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team from Section 12, Scope of Work document. ICRA Group will monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Construction staff is not allowed to utilize VAMC toilet facilities or enter the VA facilities at any time without proper Infection Control training.
  1. Contractors are to coordinate with the COR as to the placement of the exterior toilet facilities.
- C. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COR and Facility ICRA team.
  1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- D. Medical Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality.
  1. In case of any problem, the Medical Center, along with assistance from the Contractor, shall conduct an environmental assessment to find and eliminate the source.
- E. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
- F. Final Cleanup:
  1. Upon completion of project, remove all construction debris from the building, and all exterior areas.
  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 and new filters provided.
  4. All areas shall be clean to meet hospital requirements. This could include but is not limited to rug cleaning, window washing, wall washing, and hardware cleaning

## 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. 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.
  2. It is the desire of the VA to recycle a minimum of 50% of the construction waste.

## 1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work sites, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
  1. All trees that are to remain surrounding the project shall receive construction fencing at the drip line until allowed by the COR to remove.
  2. At no time shall any vehicles be parked in areas off of the paved roadways and parking lots.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

### (FAR 52.236-9)

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

## 1.10 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. At the Contractors expense 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 at the Contractors expense. .

#### **1.11 PHYSICAL DATA**

- 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 investigations by:
    - a. Subsurface Exploration and Geotechnical Engineering Report by Inberg-Miller Engineers, dated May 16, 2012.
- B. 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, after investigation, decide for themselves character of materials and make their bids accordingly.

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

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the drawings. The Contractor shall also be responsible for maintaining and preserving all stakes through the construction period. **(FAR 52.236-17)**  
(such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- B. 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 indicated.
- C. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

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

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications. These will be checked at each construction conference by the COR.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in to the COR within 15 calendar days after each completed phase. After the acceptance of the project by the COR, and prior to final payment, contractor shall provide a complete set of redline corrected drawings in AutoCAD format in addition to two electronic PDF sets including all manuals and systems drawings. .
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

### **1.14 CONTRACTORS FIELD OFFICE**

- A. The Contractor shall, within fifteen (15) days after receipt of Notice to Proceed, provide a field office in the location as instructed by the COR.
- B. The field office shall meet all local codes.
- C. The Contractor shall provide the following:
  - 1. Electricity, hot and cold water, and necessary utility services.
  - 2. All necessary piping, power circuits network cabling to match VACM campus standards for phones and computers, electrical fixtures, lighting, and other items necessary for the purpose intended.
  - 3. Thermostatically controlled, centralized heating and air conditioning system.
  - 4. Exterior toilet booths shall be provided for all construction personnel. Construction personnel shall not be allowed in the hospital at any time. Coordinate location with COR.
  - 5. The contractor to install a suitable alarm system for the field office.
- D. Contractor shall, for the duration of their occupancy, shall maintain satisfactory conditions in and around the field office and parking area.
- E. At the completion of all work, including the punch list, the Contractor shall remove same, including utility connections, from the Medical Center. The site shall be restored to original condition including utility connections, for future use by Department of Veterans Affairs.

### **1.15 PROJECT CONDITIONS**

- A. Keep temporary services and facilities clean and neat in appearance.
- B. Operate in a safe and efficient manner
- C. Do not allow hazardous, dangerous or insanitary conditions or public nuisances to

develop or persist on the site.

1. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
2. Provide trash containers with lids. Remove trash weekly from site.

#### **1.16 SAFETY PLAN**

- A. The contractor shall provide the COR a copy of their OSHA approved Safety Plan for review and approval by the Safety officer and COR.

#### **1.17 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor shall carefully conserve any utilities furnished without charge.
  1. It will be the responsibility of the Contractor to connect to these utilities at service points as determined by the COR..
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Electricity: Is available at no cost to Contractor.
- D. Water (for Construction and Testing): Furnish temporary water service.
  1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
  2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from Medical Center's system.
- G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense.

#### **1.18 NEW TELEPHONE EQUIPMENT**

- A. The contractor shall coordinate the work of installation of telephone equipment by VA subcontractors or VACM staff knowledgeable regarding the system. This work shall be completed before the building is turned over to VA. All data installations to be certified by an outside agency paid for by the Contractor.

### 1.19 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested. 1.  
The VA will provide a Commissioning agent during construction and for a 1 year system check.
- B. Contractor shall conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated in coordination with the Commissioning Agent. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

### 1.20 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each and 1 CD disc copy) 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.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and

complete maintenance for each piece of equipment. All such training will be at the job site for a period of one 8 hour day. The VA reserves the right of 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 SAFETY SIGN**

- A. Provide a Safety Sign where directed by COR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two, four by four inch posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COR.
- D. Standard Detail Drawing Number SD10000-02(Found on VA TIL) of safety sign.
- E. Post the number of accident free days on a daily basis.

### **1.22 OTHER SIGNAGE**

- A. There may be one project sign no larger than 4Ft x 8Ft identifying the Project, Owner, General Contractor, Architect, Engineers and major subcontractors. No other signage is allowed.

### **1.23 HISTORIC PRESERVATION**

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

### **1.24 CHEYENNE VAMC REQUIRED CONSTRUCTION SAFETY PROGRAM**

#### **CONSTRUCTION SAFETY PROGRAM, Policy No. 00S-12-06**

1. **PURPOSE:** The Construction Safety Program establishes policy for maintaining a healthy environment of care for patients, and a safe and healthy worksite for employees, visitors, and contractors as related to construction activities. The Multi-Disciplinary Construction Safety Program Committee will meet monthly and will report directly to the Environment of Care (EOC) Committee.

2. **POLICY:** This policy affects all construction activities performed by employees or contractors within structures fully managed by VHA or within the purview of VHA authority. The implementation of construction safety programs reduces the potential for injuries and illnesses to patients, employees, and visitors from unsafe construction activities conducted by contractors and VA employees, including our Maintenance & Operations employees, permanent construction crews, and temporary purchase and hire staff. Construction safety programs reduce the potential for VA liability that could result from construction accidents.



### 3. **DEFINITIONS:** \_

- a. CP – Competent Person – A person 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.
- b. COR – Contracting Officer Representative – A person appointed to oversee all aspects of a project from inception to completion and to coordinate all aspects of a project with Service Chiefs, fiscal, contracting, management, infection preventionist, regulatory officials and customers.
- c. Multi-Disciplinary Construction Safety Team – A team of individual safety, security, construction and infection control professionals to oversee regulatory compliance aspects of a project.
- d. OSHA - Occupational Safety and Health Administration.
- e. AIA - American Institute of Architects.
- f. ICRA - Infection Control Risk Assessment.
- g. ILSM - Interim Life Safety Measures.
- h. NFPA – National Fire Protection Association
- i. ASTM - American Society for Testing and Materials.

### 4. **MEMBERSHIP:** N/A

### 5. **PROCEDURES:**

- a. The Multi-Disciplinary Construction Safety Program Committee will:
  - (1) Determine the scope and depth of safety, infection control, and security interventions appropriate for all in-house and contract construction work. The team may develop threshold criteria for each level of intervention. This should be reviewed with contractors during the pre-construction meeting which is held prior to commencement of construction work and at the monthly meetings held while the construction is in progress. After review, some projects may require only VA CP/COR (Competent Person(s)/Project Manager) surveillance to ensure employee safety and OSHA compliance, while other projects will require all disciplines to be involved.
  - (2) Ensure submittals for contract construction or renovation work include the names, qualifications, and training dates for the contractor's CP designated to administer the site-specific safety program, as well as the CP for other activities as required by OSHA regulation (such as scaffolds, cranes, excavations, etc).

- (3) Conduct Infection Control Risk Assessments (ICRA) in accordance with Construction Infection Control Risk Assessment in EOC, Safety Management, Section 1, Chapter 21. Using the current AIA Guidelines as a guide, staff must conduct and document ICRA for all construction projects during the design or planning stage of the work. ICRA's must be documented in writing and focus on eliminating, or minimizing, the risk of infection during construction and renovation activities. The complexity of the ICRA report is determined by the complexity of the threats posed by the construction project. Assigned VA staff, including resident engineers (VA CPs) or project managers for major construction, must confirm compliance during the construction phase of the work.
  - (4) Ensure that facility safety, engineering staff, and VA resident engineers (CPs) implement Interim Life Safety Measures on all construction work in accordance with the Joint Commission, Environment of Care standards. ILSMs are required when Life Safety Code deficiencies or construction activities pose significant hazards.
  - (5) Participate in all phases of construction work from planning through completion. This includes review and approval of the construction plans, contract specifications, and contract submittals related to construction safety and health and any other documents that may assist in the implementation of an effective construction safety program.
  - (6) Ensure that the construction safety program includes periodic construction site hazard surveillance activities with appropriate membership, scope, and frequency for each project as determined by the VA CP and the ICRA report. Hazard surveillance activities must be documented as to date, time, membership of the inspection team, deficiencies, type of corrective action, and time and date of correction.
  - (7) At the pre-construction meeting held prior to commencement of construction, the COR and the CP will review and ensure that the general contractors exercise their responsibilities for ensuring subcontractors comply with VHA safety and health policies and procedures, and contract requirements.
  - (8) The PM will also ensure all contractors entering VHA property comply with the security management program. As a minimum, contractors must notify and obtain permission of the VA Police, be identified by project and employer, and be restricted from unauthorized access.
  - (9) The Multi-Disciplinary Construction Safety Team will evaluate the effectiveness of the construction safety program in an annual report to the facility Safety and/or Environment of Care committee, or equivalent committee.
  - (10) The contractor CP will implement and maintain an effective safety program that identifies and controls hazards that may cause injury or illness to VA patients, staff, visitors, and contractor employees.
- b. Facilities Management Service's Staff and the Safety Officer will utilize the attached Interim Life Safety Measures Checklist (Attachment A) for conducting inspections of contractor areas.
  - c. During construction, the COR will conduct a daily walk-through of construction areas for assigned projects. In addition to the identification of construction management deficiencies, Life Safety requirements will be reviewed. Routine deficiencies will be corrected at the site and

serious Life Safety deficiencies will be documented by memorandum to the Contracting Officer. The Contracting Officer will immediately notify the Contractor in writing of any deficiencies noted during the inspections and require that the deficiencies be corrected within a specified time. The Contracting Officer will immediately notify the Contractor in writing of any deficiencies noted during the inspections and require that the deficiencies be corrected. All noted deficiencies will be corrected immediately.

d. Fire protection activities will be discussed at the pre-construction meeting and a copy of the Construction Safety Checklist (Appendix A) given to the contractor.

e. The Supervisor, Facilities Management Service, will make available the Construction Safety Checklist (Appendix A) for employees to consult and will enforce the standards in the checklist for VA personnel under his/her supervision. Appendix A will be made available to all employees upon their request.

f. The Safety Officer will report to the medical center's EOC Committee regarding construction safety.

## 6. **RESPONSIBILITY:**

a. The Medical Center Director is responsible for:

(1) Establishing and monitoring an effective facility construction safety program utilizing a multi-disciplinary team with representatives from the following program areas: Infection Control, Patient Safety, Occupational Safety and Health, VA Police, Facilities Management Service, Local Union Safety Representatives and Contracting.

(2) Ensuring appropriate staff receives training in construction safety.

b. The Multi-Disciplinary Construction Safety Team will be responsible for overseeing the following:

(1) Protection of patients, visitors, and employees from traumatic injury, as well as occupational and facility-associated infections.

(2) Compliance with OSHA and State construction safety regulations.

(3) Compliance with EPA and State environmental regulations.

(4) Ensuring that VA staff receives training as follows:

(a) Appointed CPs, resident and/or project engineers and Members of the Multi-Disciplinary Construction Safety Team will complete OSHA's 30-hour construction safety course per VHA Directive 2011-036. Every two years after taking the 30-hour course members will need to take the 10-hour refresher.

c. The Contracting Officer will ensure that all construction specification packages issued will specify that on-site general and sub-contractor's construction workers will be required to complete the OSHA 10-hour construction worker course, or the 30-hour construction course and other relevant competency training, as determined by the COR. Contractors will be required to

submit proof that their employees and sub-contractor employees have completed this mandatory training prior to commencement.

(1) The COR will have the responsibility of informing contractors of all safety and environmental requirements, conducting daily and monthly fire and safety inspections of contractor construction areas, and coordinating with the Safety Officer for the establishment of required interim life safety measures.

(2) The Contracting Officer and COR will ensure that the contractor's submittals include a written site-specific safety plan. The plan will be approved by the Safety Officer and the COR. The general contractor will identify their Competent Person in the site specific safety plan and will submit evidence that the Competent Person has the proper qualifications and authority to identify hazards, stop work and fix problems. The site specific safety plan will identify when the contractor's Competent Person must be on site and how to contact the Contractor Competent Person if problems arise. The site specific safety plan must be reviewed by the Safety Officer.

d. The Chief Facility Manager Service ensures compliance with construction safety for station level maintenance projects. This person will ensure that construction areas are secured from the general public, and that Interim Life Safety Measures are implemented when fire safety devices, i.e. sprinklers, pull stations, fire and exit doors, and emergency egress, are affected by construction activities. Facilities Management Service will ensure that fire warning and safety systems are tested and inspected as required.

e. The Safety Officer has the responsibility for maintaining and updating the Construction Safety Checklist and for providing recommendations for compliance with referenced standards. The Safety Officer will conduct fire drills in accordance with Center Directive 00S-09-1 Interim Life Safety Measures (ILSM) whenever interim life safety measures are implemented.

## 7. **REFERENCES:**

- a. Center Directive 00S-09-1 Interim Life Safety Measures.
- b. OSHA 29 CFR 1910.
- c. OSHA 29 CFR 1926.32(f).
- d. NFPA 241.
- e. NFPA 51b.

## 8. **RESCISSION:** Center Directive 138-08-06.

## 9. **ATTACHMENTS:**

Appendix A – Construction Safety Checklist

## 10. **EXPIRATION DATE:** May 2015

**//ES//Original Signature on File**

**CYNTHIA MCCORMACK**  
**Medical Center Director**

**APPENDIX A**

**CONSTRUCTION SAFETY CHECKLIST**

(For protection of VA property, patients, visitors, and personnel)

A. Fire extinguishers (OSHA 1926.150(c))

- \_\_\_\_\_ 1. Extinguisher available within 100 feet. Extinguisher rated not less than 2A.
- \_\_\_\_\_ 2. If flammable liquids or gases present, a fire extinguisher rated not less than 10B within 50 feet.

B. Ignition Hazardous (OSHA 1926.151(a))

- \_\_\_\_\_ 1. Internal combustion engines located away from combustibles.
- \_\_\_\_\_ 2. Smoking is prohibited in construction areas. Work staff are knowledgeable of approved areas.

C. Indoor storage (OSHA 1926.151(d))

- \_\_\_\_\_ 1. Site kept free from accumulation of unnecessary combustibles.
- \_\_\_\_\_ 2. Storage will not obstruct means of exits.
- \_\_\_\_\_ 3. Clearance maintained around lights and heating units.

D. Flammable and combustible liquids (OSHA 1926.152)

- \_\_\_\_\_ 1. Approved containers.
- \_\_\_\_\_ 2. No storage in areas of exits, stairways or people traffic areas.
- \_\_\_\_\_ 3. Max. 25 gallon in a room - otherwise approved storage cabinet.

E. Temporary heating devices (OSHA 1926.154)

- \_\_\_\_\_ 1. Adequate ventilation for workmen and heater combustion.
- \_\_\_\_\_ 2. Clearance combustibles from heaters (3 foot minimum).
- \_\_\_\_\_ 3. Stability of heater.
- \_\_\_\_\_ 4. All Space heaters approved for use by Fire Department

F. Signs and barricades (OSHA 1926.200)

- \_\_\_\_\_ 1. Danger signs where immediate hazard exists.
- \_\_\_\_\_ 2. Caution signs where potential hazard exists.

- \_\_\_\_\_ 3. Safety instruction signs where necessary.
- \_\_\_\_\_ 4. Barricades per Site Standards where necessary to protect persons from hazards.

G. Welding and cutting - Hot work permit required (NFPA-51B and OSHA 1910-252)

- \_\_\_\_\_ 1. Inspection of area before permit given.
- \_\_\_\_\_ 2. Distance from combustibles 35 feet.
- \_\_\_\_\_ 3. Fire extinguisher in immediate area.
- \_\_\_\_\_ 4. Wall and floor openings covered.
- \_\_\_\_\_ 5. No flammable liquids present.
- \_\_\_\_\_ 6. Inspection after work is complete.

H. Electrical (OSHA 1924.400-2 and NFPA 241-4)

- \_\_\_\_\_ 1. All temporary wiring grounded and in accordance with National Electric Code.
- \_\_\_\_\_ 2. Precautions taken to make any open wiring inaccessible to other than authorized personnel.
- \_\_\_\_\_ 3. Temporary lighting bulbs equipped with guards, use heavy-duty cords, and not suspended by their cords unless specifically designed for that use.
- \_\_\_\_\_ 4. Runs of open conductors located away from possible damage and fastened at intervals of no greater than 10 feet.
- \_\_\_\_\_ 5. Outlets in construction sites have GFCI or assured equipment grounding.
- \_\_\_\_\_ 6. Extension cords protected from damage.
  - No worn or frayed cables
  - Not hung from nails or suspended by wire
- \_\_\_\_\_ 7. Fuses or circuit breakers provided for each feeder or branch circuit.

I. Guarding of trenches and excavations (OSHA 1926.651)

- \_\_\_\_\_ 1. Shoring system if over 5 feet deep - designed by qualified person.
- \_\_\_\_\_ 2. Excavations inspected after rainfalls.
- \_\_\_\_\_ 3. Protection of adjoining buildings.
- \_\_\_\_\_ 4. Water will not be allowed to accumulate in an excavation.
- \_\_\_\_\_ 5. Adequate barriers or coverings provided.

- \_\_\_\_\_ 6. Dust conditions kept to a minimum by water, oil, etc.
- \_\_\_\_\_ 7. Review of adjacent underground utilities before excavation starts or DIG-SAFE licensed contractors utilized for on-and off site site verification.

J. Demolition (OSHA 1926.850-858 and NFPA 241, Ch 7)

- \_\_\_\_\_ 1. Electric, gas, water, steam, etc. shut off prior to work.
- \_\_\_\_\_ 2. Any utilities that are necessary to be maintained need protection.
- \_\_\_\_\_ 3. Masonry walls will not be permitted to fall on floors such that it would exceed the safe carrying capacity of the floor.
- \_\_\_\_\_ 4. Floor openings within 10 feet of any wall being demolished will be planked solid - except when no one below.
- \_\_\_\_\_ 5. The storage of waste material and debris will not exceed the floor-loading limit.
- \_\_\_\_\_ 6. Construction of dust barriers as needed. (Not OSHA).
- \_\_\_\_\_ 7. Notification to shut off and protect smoke detectors, etc. during daytime only. (Not OSHA Construction Safety Checklist)
- \_\_\_\_\_ 8. Precautions if floors are soaked with oil or flammable liquids, if dust accumulation is present or other combustibles are present and hot work is being performed.
- \_\_\_\_\_ 9. Smoking is prohibited throughout demolition (NFPA 241, 704.2).
- \_\_\_\_\_ 10. Flammable and combustible liquids removed from area.
- \_\_\_\_\_ 11. Water supplies must still be available from fire hydrants in the vicinity of the structure or area.
- \_\_\_\_\_ 12. All ventilation returns shared with adjacent areas are blocked off to prevent contaminating occupied areas during construction. Exception for non-recirculating return air.
- \_\_\_\_\_ 13. Personal Protective Equipment (PPE) being used by staff as required.

K. Temporary buildings, trailers (NFPA 241, Ch 2)

- \_\_\_\_\_ 1. Temporary offices, trailers, sheds, etc. of combustible construction at least 30 feet from permanent buildings.
- \_\_\_\_\_ 2. Only safely installed, UL rated approved heating devices used. Ample clearance -  
around stoves, heaters, and chimneys per NFPA 211.

L. Roofing operations (NFPA 241, Ch 6)

- \_\_\_\_\_ 1. Asphalt and tar kettles located outside the building or on a non-combustible roof away from combustibles. Kettles must have gravity lids, tight fitting.
- \_\_\_\_\_ 2. Torch applied roofing systems will be installed using extreme caution. Follow manufacturers' instructions. Caution around roof openings, penetrations or flashings.
- \_\_\_\_\_ 3. Fire extinguisher, 20-B minimum, within 30 feet of roof kettle. At least one extinguisher 2A:20-B:C on the roof being repaired; also, one within 30 feet of torch applied roofing equipment.
- \_\_\_\_\_ 4. Fuel containers at least 10 feet away from burner flame.
- \_\_\_\_\_ 5. Notify building occupants who might be affected.
- \_\_\_\_\_ 6. Investigate location of supply air intakes. Coordinate shutdowns as necessary.

M. Exit pathways (NFPA 241, Ch 5)

- \_\_\_\_\_ 1. Every building and area will remain accessible to fire department apparatus and personnel. Roadways will be maintained within 20 feet of all buildings.
- \_\_\_\_\_ 2. Adequate egress paths including stairs and corridors will be maintained at all times. Exits may only be blocked temporarily if unavoidable and when adequate alternate measures are provided (signage, temporary fire detection, training, etc.) to warn personnel.

N. Temporary partitions (General Requirements, Sec. 010.10; and JCAHO requirements)

- \_\_\_\_\_ 1. Temporary partitions will be constructed of non-combustible materials (typically sheet rock and steel studs). When required for strength, the inside (side toward construction) of the partitions may be lined with fire retardant materials such as fire treated plywood.
- \_\_\_\_\_ 2. Temporary partitions will be continuous between floor slabs
- \_\_\_\_\_ 3. Ceiling adjacent to the temporary partitions will be in place.
- \_\_\_\_\_ 4. Construction areas are kept secured from access by the general public.

END



**SECTION 01 23 00  
ALTERNATES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Procedures for pricing alternates.
- B. Documentation of changes to Contract Sum and Contract Time.

**1.2 RELATED SECTIONS**

Not used.

**1.3 DEFINITIONS**

- A. Alternate: Amount proposed by bidders and stated on Bid Form for specific work defined in Bidding Documents that shall be added to or deducted from Base Bid amount if Owner elects to accept a corresponding change in scope of work for products, materials, equipment, systems or installation methods as described in Contract Documents.
  - 1. Cost or credit for each Alternate is net addition to or deduction from Contract Sum to incorporate Alternate into Work.

**1.4 ACCEPTANCE OF ALTERNATES**

- A. Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option.
  - 1. Owner reserves right to select any Alternates up to thirty calendar days after award of Contract unless otherwise stated in Bidding Requirements.
- B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.
  - 1. Include miscellaneous devices, appurtenances, incidental items and labor, materials, tools, equipment, rigging, etc. as required for complete installation whether or not described as part of Alternate.
  - 2. When Owner has made a decision on which, if any, of Alternates will be selected, notify in writing each party involved which Alternates have been selected, rejected, or deferred.
- C. Execute Alternates under same conditions as other Work of this Contract.

**1.5 SCHEDULE OF ALTERNATES**

- A. Alternate No. 1 – Alternate Light Fixtures:
  - See drawing EL501 for lighting schedule.
  - 1. Base Bid Item: DDS and DDP – Polaron T5 lamp
  - 2. Alternative Item:
    - a. DDS and DDP – Beta Calco LED lamp
    - b. Type “BM” to be added in all RRTP Restrooms
- B. Alternate No. 2 – Gutter Materials
  - 1. Base Bid Item: Copper gutter and downspout
  - 2. Alternative Item: Prefinished metal gutter and downspout
- C. Alternate No. 3 – Windows
  - 1. Base Bid Item: Kawneer Windows
  - 2. Alternative Item: EFCO670 Windows

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

--- E N D ---

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**ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Preconstruction meeting.
- B. Site mobilization meeting.
- C. Pre-Installation Meeting
- D. Progress meetings.
- E. Request for Information (RFI)
- F. Construction progress schedule.
- G. Progress photographs.
- H. Coordination drawings.
- I. Layout of work
- J. Field engineering

**1.2 DEFINITIONS**

- A. Coordination Drawings:
  - 1. Show relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in space provided or to function as intended.
- B. Product Data:
  - 1. Printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
- C. Samples:
  - 1. Partial sections of manufactured or fabricated components, cuts or containers of material, color range sets, and swatches showing color, texture, and pattern.
- D. Field samples:
  - 1. Full-sized physical examples erected on-site to illustrate finishes, coatings, or finish materials.
  - 2. Samples used to establish standard by which Work will be judged.
- E. Mockups:
  - 1. Full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

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**ADMINISTRATIVE REQUIREMENTS**

2. Approved mockups will be used to establish standard by which Work will be judged and maybe allowed to remain as part of the permanent Work.

**1.4 PRECEDENCE OF THE CONTRACT DOCUMENTS**

- A. In event of conflict or discrepancy among the Contract Documents, interpretations will be based on the following priorities:
  1. Agreement
  2. Addenda, with those of later date having precedence over those of earlier date.
  3. Supplementary Conditions
  4. General Conditions of the Contracts
  5. Schedules
  6. Drawings & Specifications
    - a. In the case of inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
    - b. Large Scale Drawings
    - c. Small Scale Drawings
    - d. Dimension numbers written on Drawings prevail and take precedence over Dimensions scaled from Drawings.

**1.5 PROJECT COORDINATION**

- A. Cooperate with the COR in allocation of mobilization areas of site; for field offices and sheds, for construction access, traffic, and parking facilities.
- B. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of The Work.
  1. Schedule construction operations in sequence required to obtain best results where installation of one part of Work depends on installation of other components.
  2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
  3. Coordinate storage or staging areas for all trades.
- C. During construction, coordinate use of site and facilities through the COR.
- D. Administrative Procedures:
  1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work.
  2. Administrative activities include, but are not limited to:
    - a. Preparation of Schedules.
    - b. Installation of temporary facilities.
    - c. Delivery and processing of submittals.
    - d. Progress meetings.
    - e. Project closeout activities.
- E. Make the following types of submittals to COR.
  1. Requests for interpretation.
  2. Requests for substitution.
  3. Shop drawings, product data, and samples.
  4. Test and inspection reports.

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**ADMINISTRATIVE REQUIREMENTS**

5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Closeout submittals.

F. Staff Names: Within 15 days of commencement of construction operations, submit a list of Contractor's principal staff assignments, including superintendent and other personnel involved in daily Project activities.

1. Identify individuals, their duties and responsibilities.
2. List personnel addresses and telephone numbers.

G. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

H. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.1 SITE MOBILIZATION MEETING**

A. Contracting Officer will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:

1. Contracting Officer
2. Contracting Officers Representative
2. Architect-Engineer.
3. Contractor.
4. Superintendent.
5. Major Subcontractors.
6. Manufacturers deemed necessary by Contractor and Owner.

C. Agenda:

1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy prior to completion.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Contractor to record minutes and distribute copies within two days after meeting to participants, with two copies to COR, participants, and those affected by decisions made.

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**ADMINISTRATIVE REQUIREMENTS**

**3.3 PRE-INSTALLATION MEETING**

- A. Conduct Pre-Installation Meeting before each activity that requires coordination with other construction activities. Specification Sections requiring Pre-Installation Conferences include:
1. 01 40 00 - Quality Requirements.
  2. 01 84 19 - Acoustical Performance Requirements.
  3. 07 32 13 – Clay roof Tiles
  4. 07 53 23 - EPDM
  5. 07 62 00 - Sheet Metal Flashing and Trim.
  6. 07 84 00 - Firestopping.
  7. 07 90 05 - Joint Sealers.
  8. 08 71 00 - Door Hardware.
  9. 31 23 16 - Earthwork
  10. 31 23 23 - Fill.
- B. Attendance Required:
1. Owner's representatives, CO and COR
  2. Architect.
  3. Contractor.
  4. Installer foreman
  6. Manufacturer's technical representative.
- C. Notifications:
1. Notify attendees of scheduled Conference a minimum of 7 calendar days in advance of the conference.
- D. Agenda:
1. Review progress of other construction activities and preparations for particular activity under consideration, including requirements for following:
    - a. Contract Documents and related Change Orders.
    - b. Shop Drawings, Product Data, and Quality Control Samples.
    - c. Details
    - d. Mockups.
    - e. Possible conflicts or compatibility problems.
    - f. Weather limitations.
    - g. Manufacturer's preparation and installation recommendations.
    - h. Warranty requirements.
    - i. Substrate acceptability.
    - j. Governing regulations.
    - k. Inspecting and testing requirements.
    - l. Protection.
  8. Contractor to record significant discussions, agreements, and disagreements of each conference. It is recommended that this meeting be held either preceding or following a Progress Meeting.
    - a. Number and record meetings sequentially.
    - b. Distribute meeting record to concerned parties, including Architect and Owner, and Owner's Representative within 72 hours after meeting.
- E. Do not proceed with installation if meeting cannot be successfully concluded.
1. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

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**ADMINISTRATIVE REQUIREMENTS**

**3.4 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- C. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of off-site fabrication and delivery schedules.
  - 7. Maintenance of progress schedule.
  - 8. Corrective measures to regain projected schedules.
  - 9. Planned progress during succeeding work period.
  - 10. Coordination of projected progress.
  - 11. Maintenance of quality and work standards.
  - 12. Effect of proposed changes on progress schedule and coordination.
  - 13. Other business relating to Work.
  - 14. Review of project record documents.
- D. Contractor to record minutes and distribute copies within four days after meeting to participants, with two copies to CO, COR, all participants, and those affected by decisions made.

**3.5 REQUESTS FOR INFORMATION**

- A. When field conditions or contents of Contract Documents require clarification or verification by COR, following procedure is required:
  - 1. Present item or items requiring clarification /verification at Progress Meeting for discussion. (For critical or emergency items, contact COR at once.)
  - 2. If it is determined by the COR that item or items do not require written RFI submittals, then clarification/verification determination shall be in Progress Meeting Report.
  - 3. If it is determined by the COR that item or items do require written RFI submittal, prepare each RFI on a form approved by Architect. Design Clarification/Variation Request (DCVR) and other forms are unacceptable.
  - 4. Number RFI's sequentially from "001".
  - 5. Record each RFI in a log, identifying each by RFI-#, subject, date submitted, date of response, and disposition. Update and distribute log at project meetings.
  - 6. Provide a proposed solution to the RFI.
  - 7. Architect shall respond to submitted RFI's within seven calendar days in space provided on RFI form.
  - 8. If potential cost impact is indicated on RFI, then include change order request for the proposed work.
- B. Route and copy RFI's in same manner as correspondence.

**3.6 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned

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operations for the first 60 days of Work, with a general outline for remainder of Work.

- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit 2 week "look ahead" updated schedule at every weekly project meeting.

**3.7 PROGRESS PHOTOGRAPHS**

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to COR.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
  - 1. Foundations in progress and upon completion.
  - 2. Structural framing in progress and upon completion.
  - 3. Enclosure of building, upon completion.
  - 4. Final completion, minimum of ten (10) photos.
- E. Views:
  - 1. Provide non-aerial photographs from four cardinal views at each specified time, until Date of Substantial Completion.
  - 2. Provide factual presentation.
  - 3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
  - 1. Delivery Medium: Via email.
  - 2. File Naming: Include project identification, date and time of view, and view identification.
  - 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
  - 4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

**3.8 COORDINATION DRAWINGS**

- A. Provide information required by Project Coordinator for preparation of coordination drawings.



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- B. Prepare coordination drawings where coordination is needed for installation of products and materials fabricated by separate entities.
  - 1. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- C. Review drawings prior to submission to CO/COR.

**3.9 PRODUCT DATA**

- A. Collect Product Data into a single submittal for each element of construction or system.
- B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required or proposed for Work, clearly mark copies to indicate applicable information.
- C. Include following information:
  - 1. Manufacturer's printed recommendations.
  - 2. Compliance with trade association standards.
  - 3. Compliance with recognized testing agency standards.
  - 4. Performance characteristics and capacities.
  - 5. Notation of dimensions verified by field measurement.
  - 6. Required clearances, wiring and piping diagrams, and controls.
  - 7. Manufacturer's standard schematic drawings and diagrams, modified as required to suit Project requirements.
  - 8. Notation of coordination requirements.
- D. Colors and Patterns:
  - 1. Except where specific color and pattern is indicated in Contract Documents, and whenever a choice of color or pattern is available in specified products, submit 2 color and pattern charts to COR for selection.
- E. Submit following for each required submittal:
  - 1. 2 copies for Architect.
  - 2. 1 copy to COR
  - 3. Number of copies as required for Maintenance manuals.
  - 4. Number of copies as required by Contractor for distribution.
- F. COR will retain 1 copies and return remainder, marked with action taken and corrections or modifications required, to Contractor for distribution.
  - 1. Contractor to retain number of copies required for maintenance manuals.
  - 2. Do not permit use of unmarked copies of Product Data in connection with construction.

**3.10 SAMPLES**

- A. Submit Samples for review of size, kind, color, pattern, and texture, and to illustrate functional and aesthetic characteristics of Product.
- B. Where variation in color, pattern, or texture, or other characteristic is inherent in material or product represented, submit at least 3 multiple units that show approximate limits of variations, or number of units indicated in individual specification Sections.

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- C. Field Samples: Full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish Project standard.

**3.11 QUALITY ASSURANCE SUBMITTALS**

- A. Submit quality control submittals, including:
  - 1. Design data
  - 2. Certifications
  - 3. Manufacturer's instructions
  - 4. Manufacturer's field reports
  - 5. Other quality control submittals required under individual Technical Specifications of Project Manual.
- B. Certifications: Where individual Technical Specifications Sections of Project Manual require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from manufacturer certifying compliance with specified requirements.
  - 1. Certification to be signed by an officer of manufacturer or other individual authorized to sign documents on behalf of company.

**3.12 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Coordination Drawings.
  - 8. Other types indicated.
- B. Submit for COR knowledge as contract administrator or for Owner. No action will be taken.

**3.13 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. When the following are specified in individual sections, submit them at project closeout:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

**3.14 LAYOUT OF WORK**

- A. Survey and verify conditions of project site.
- B. Record existing conditions prior to construction for comparison with Contract Documents.
  - 1. Report conflicts to COR prior to start of Work.
  - 2. COR will provide revisions to Contract Documents or issue instructions to deal with

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- conflicts.
- 3. Be responsible for remedying conflicts which could have been prevented by timely reviews of existing conditions.
- 4. Remedies, which vary from Contract Documents shall be approved by Architect's and Owner's Representatives.

**3.15 FIELD ENGINEERING**

- A. Engineering Services:
  - 1. Provide field engineering services as required for construction.
  - 2. Locate and maintain an accurate benchmark on or near site which has been established by a Registered Surveyor.
    - a. Relate subsequent elevations of finish grades and building elements directly to this benchmark.
- B. Existing Control Points:
  - 1. Protect control points prior to starting Work, and preserve permanent reference points during construction.
  - 2. Make no changes or relocations of control points without prior written notice to COR.
  - 3. Report to COR when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- C. Instrument Layout:
  - 1. Using site bench marks and existing elevation control points, establish lines and levels, located and layed out by survey instrumentation.
  - 2. Locate water supply, storm and sanitary sewer lines.
  - 3. Locate edge and level of paving, curbs, walks, and sloping landscape.
  - 4. Locate building foundations, column locations, and floor levels.
  - 5. Locate controlling lines and levels required for plumbing, mechanical and electrical Work within 5 feet of building perimeter.
- D. Corrections:
  - 1. Record changes in elevations or location of Work on project record Documents.
  - 2. Report errors in horizontal and vertical dimensions and grades prior to starting Work.
- E. Verification:
  - 1. Verify dimensions of new and existing Work.
    - a. If field measurements differ slightly from Drawings, modify to accommodate. If field measurements differ significantly, notify Architect prior to commencing Work.
  - 2. Coordinate locations of openings through floors, roofs and walls with Architectural, Mechanical and Electrical Drawings.
- F. Documentation:
  - 1. Submit documentation to verify accuracy of field engineering Work when requested by COR..

END OF SECTION

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- B. For the purposes of this contract, samples including laboratory samples to be tested, reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- C. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. After an item has been approved, no change in brand or make will be permitted unless:
- D. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;

**1.2 SUBMITTALS**

- A. Forward submittals to permit proper consideration and approval action by Government, 10 working days maximum. Delays attributable to untimely and rejected submittals including any laboratory samples to be tested will not serve as a basis for extending contract time for completion.
- B. Submittals will be reviewed for compliance with contract requirements by the COR.
  - 1. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract.
- C. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs. The Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer assumes no responsibility for checking schedules or layout drawings for exact sizes, qualities, exact numbers and detailed positioning of items for checking quantities or exact numbers included in such submittals.
- D. Submit shop drawings, schedules, manufacturers' literature and data, samples (except laboratory samples) and certificates in quadruplicate, except where a greater number is specified.
  - 1. These drawings and schedules shall be stamped and signed by Contractor certifying accuracy, completeness and compliance with contract requirements.
  - 2. Shop drawings submission shall be coordinated with all elements affecting the material or equipment.
- E. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Submittals shall contain the list of items, name of Medical Center/Building #, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers, and manufacturer and brand,

1. A copy of letter must be enclosed with items, and any items received without identification letter will be returned to the Contractor.
  2. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- F. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to previously specified information required on label and in transmittal letter.
- G. Approved samples will be kept on file by the CO at the site until completion of contract.

--- E N D ---

**SECTION 01 42 19  
REFERENCE STANDARDS & DEFINITIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 QUALITY ASSURANCE**

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to CO for a decision before proceeding.

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

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

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

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

DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management

Facilities Quality Service (00CFM1A)  
 425 Eye Street N.W, (sixth floor)  
 Washington, DC 20001  
 Telephone Numbers: (202) 632-5249 or (202) 632-5178  
 Between 9:00 AM - 3:00 PM

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

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

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>

AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>



EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.et1.com">http://www.et1.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GBI	Green Building Initiative (Green Globes)
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org/">http://www.ieee.org/</a>
IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association

NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NPA	National Particleboard Association, 18928 Premiere Court, Gaithersburg, MD 20879
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>
NWWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>
OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>
PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>
SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings, <a href="http://www.sspc.org">http://www.sspc.org</a>
STI	Steel Tank Institute <a href="http://www.steeltank.com">http://www.steeltank.com</a>
TCA	Tile Council of America, Inc <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200, Madison, WI 53719

UL	Underwriters' Laboratories Incorporated, <a href="http://www.ul.com">http://www.ul.com</a>
ULC	Underwriters' Laboratories of Canada <a href="http://www.ulc.ca">http://www.ulc.ca</a>
WCLIB	West Coast Lumber Inspection Bureau, 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223, (503) 639-0651
WWPA	Western Wood Products Association, <a href="http://www.wwpa.org">http://www.wwpa.org</a>

## 1.6 DEFINITIONS

### A. Approved:

1. When used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in Conditions of Contract.

### B. Building Codes: Refer to Code Sheet in Contract Documents

### C. Directed:

1. Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by CO, requested by CO, and similar phrases.

### D. Furnish:

1. Means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

### E. Indicated:

1. Refers to graphic representations, notes, or schedules in Drawings; or to other paragraphs or schedules in Specifications and similar requirements in Contract Documents.
2. Terms such as "shown," "noted," "scheduled," and "specified" are used to help user locate reference. Location is not limited.

### F. Install:

1. Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

### G. Installer:

1. Contractor or another entity engaged by Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations.
2. Installers are required to be experienced in operations they are engaged to perform.
3. Term "experienced" when used with term "installer" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### H. Owner: Means owner of project or Government.

### J. Product: Material, machinery, components, equipment, fixtures, and systems forming the work

result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

- K. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- L. Project site:
  - 1. Space available to Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.
- M. Provide:
  - 1. Means to furnish and install, complete and ready for intended use.
- N. Regulations:
  - 1. Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of Work.
- O. Testing Agencies:
  - 1. Independent entities engaged to perform specific inspections or tests, either at Project site or elsewhere, or to report on and, if required, to interpret results of those inspections or tests.

## **1.7 SPECIFICATION FORMAT AND CONTENT EXPLANATION (MF10)**

- A. Divisions in Project Manual conform CSI MasterFormat 2010 and roughly to customary trade Work Results.
- B. MasterFormat 2010 numbering system use is encouraged for all parties. If using previous version of MasterFormat in submittals or application for payment, then use the following format:
  - 1. 00 11 22(01122), where the MasterFormat 2010 number is used first, followed by the old five-digit MasterFormat-95 number in parentheses.
- E. Project Manual is done for convenience and shall not relieve Contractor of responsibility of furnishing every item indicated or specified whether segregated or not.
- F. No responsibility will be assumed by Owner or Architect for omission or duplications by Contractor in completion of contract due to arrangement of material in Project Manual.
- G. Specification Content:
  - 1. Abbreviated Language:
    - a. Language used in Specifications and other Contract Documents is abbreviated.
    - b. Words and meanings shall be interpreted as appropriate.
    - c. Words implied, but not stated, shall be interpolated as sense requires.
    - d. Singular words shall be interpreted as plural, and plural words as singular, where applicable as context indicates.
  - 2. Imperative mood and streamlined language are generally used in Specifications.
    - a. Requirements expressed in imperative mood are to be performed by Contractor.
    - b. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.
    - c. Words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T27-06..... Sieve Analysis of Fine and Coarse Aggregates
  - T96-02 (R2006)..... Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - T99-01 (R2004)..... The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
  - T104-99 (R2003)..... Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
  - T180-01 (R2004)..... Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
  - T191-02(R2006)..... Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
  - A325-06..... Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A370-07..... Definitions for Mechanical Testing of Steel Products
  - A490-06..... Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
  - C31/C31M-06..... Making and Curing Concrete Test Specimens in the Field
  - C33-03 ..... Concrete Aggregates
  - C39/C39M-05..... Compressive Strength of Cylindrical Concrete Specimens
  - C109/C109M-05..... Compressive Strength of Hydraulic Cement Mortars
  - C138-07 ..... Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
  - C140-07 ..... Sampling and Testing Concrete Masonry Units and Related Units
  - C143/C143M-05..... Slump of Hydraulic Cement Concrete
  - C172-07 ..... Sampling Freshly Mixed Concrete
  - C173-07 ..... Air Content of freshly Mixed Concrete by the Volumetric Method
  - C330-05 ..... Lightweight Aggregates for Structural Concrete

C567-05 .....	Density Structural Lightweight Concrete
C780-07 .....	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08 .....	Sampling and Testing Grout
C1064/C1064M-05.....	Freshly Mixed Portland Cement Concrete
C1077-06 .....	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07 .....	Compressive Strength of Masonry Prisms
D698-07 .....	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07 .....	Piles Under Static Axial Compressive Load
D1188-07 .....	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07 .....	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07 .....	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06 .....	Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001) .....	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05 .....	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05 .....	Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07 .....	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D3666-(2002) .....	Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07 .....	Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04.....	Radiographic Testing
E164-03.....	Ultrasonic Contact Examination of Weldments
E329-07.....	Agencies Engaged in Construction Inspection and/or Testing
E543-06.....	Agencies Performing Non-Destructive Testing
E605-93(R2006) .....	Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001) .....	Guide for Magnetic Particle Examination

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

D. American Welding Society (AWS):

D1.1-07 .....Structural Welding Code-Steel

**1.3 REQUIREMENTS:**

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by 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 part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.



3. Meet requirements in the geotechnical report and on structural drawings to insure acceptance by geotechnical engineer.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 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. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

### 3.2 LANDSCAPING:

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
1. Test for organic material by using ASTM D2974.

2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to 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 ASTM D1557, Method D.
2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

### **3.4 SITE WORK CONCRETE:**

Test site work concrete including materials for concrete as required in Article CONCRETE of this section, or in landscape divisions for exterior landscape requirements.

### **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 COR 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 and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
  - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.

- b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
- 11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
- 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
- 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
- 14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
- 15. Observe preparations for placement of concrete:
  - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
  - b. Inspect preparation of construction, expansion, and isolation joints.
- 16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
- 17. Observe concrete mixing:
  - a. Monitor and record amount of water added at project site.
  - b. Observe minimum and maximum mixing times.
- 18. Measure concrete flatwork for levelness and flatness as follows:
  - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
  - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
  - c. Provide the Contractor and the 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 COR. 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. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- B. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- C. 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.

### **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 Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
    - g. Verify that correction of rejected welds are made in accordance with AWS D1.1.
    - h. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
  2. Bolt Inspection:
    - a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
    - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
    - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
    - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
    - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.

- f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR.

### **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.

### **3.12 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.

### **3.13 TYPE OF TEST:**

#### **APPROXIMATE NUMBER OF TESTS REQUIRED**

- A. Earthwork:
 

Laboratory Compaction Test, Soils: (ASTM D1557)	3
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Field Density, Soils (AASHTO T191, T205, or T238)	90
Penetration Test, Soils	x
 B. Landscaping:	
Topsoil Test	2
 C. Aggregate Base:	
Laboratory Compaction, (ASTM D1557)	3
Field Density, (ASTM D1556)	6
Aggregate, Base Course	
Gradation (AASHTO T27)	1
Wear (AASHTO T96)	1
Soundness (AASHTO T104)	1
 D. Asphalt Concrete:	
Field Density, (AASHTO T230)//ASTM D1188//	4
Aggregate, Asphalt Concrete	
Gradation (AASHTO T27)	1
Wear (AASHTO T96)	1
Soundness (AASHTO T104)	1
 E. Concrete:	
Making and Curing Concrete Test Cylinders (ASTM C31)	126
Compressive Strength, Test Cylinders (ASTM C39)	84
Concrete Slump Test (ASTM C143)	42
Concrete Air Content Test (ASTM C173)	26
Aggregate, Normal Weight:	
Gradation (ASTM C33)	1
Deleterious Substances (ASTM C33)	1
Soundness (ASTM C33)	1
Abrasion (ASTM C33)	1
 F. Reinforcing Steel:	
Tensile Test (ASTM A370)	1
Bend Test (ASTM A370)	1



## G. Masonry:

Making and Curing Test Cubes (ASTM C109)	9
Compressive Strength, Test Cubes (ASTM C109)	9
Sampling and Testing Mortar, Comp. Strength (ASTM C780)	9

## I. Sprayed-On Fireproofing:

Thickness and Density Tests (ASTM E605)	2
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## SECTION 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

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

#### 1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.

- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

### 1.3 REFERENCES

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

### 1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the 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 COR and 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, 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. Environmental Monitoring Plans for the job site including land, water, air, and noise.

- j. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

## **1.5 PROTECTION OF ENVIRONMENTAL RESOURCES**

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
  - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
  - 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
    - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
    - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
    - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
  - 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
  - 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.

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 on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  6. Manage and control spoil areas on // and off // Government property to limit spoil to areas // shown // on the Environmental Protection Plan // and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  7. 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.
  8. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  9. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Monitor water areas affected by construction.
- D. 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 Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment,

- baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by 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 m (50 feet) (dBA):

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

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

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

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## SECTION 01 58 16 TEMPORARY INTERIOR SIGNAGE

### PART 1 GENERAL

#### DESCRIPTION

- A. This section specifies temporary interior signs.
- B. Doors that require signage include:
  - 1. Egress doors that will not be used for egress during construction.
  - 2. Doors to areas of construction.
  - 3. Doors leading from areas of construction.
    - a. Signs should state: Do Not Enter Hospital.

### PART 2 PRODUCTS

#### 2.1 TEMPORARY SIGNS

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

### PART 3 EXECUTION

#### 3.1 INSTALLATION

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

#### 3.2 LOCATION

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

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**SECTION 01 60 00**  
**PRODUCT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. General product requirements.
- B. GREEN GLOBE-related product requirements.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Spare parts and maintenance materials.

**1.2 RELATED SECTIONS**

- A. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

**1.3 REFERENCES**

- A. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2000.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- C. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; [www.aqmd.gov](http://www.aqmd.gov).

**1.4 DEFINITIONS**

- A. Products: Items purchased for incorporation in Work.
  - 1. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.
  - 2. "Named Products" are items identified by manufacturer's product name, including make or model number or other designation, listed in manufacturer's published product literature.
- B. Materials: Products shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of Work.
- C. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

**1.5 SUBMITTALS**

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
  - 1. Submit within 15 days after date of Agreement.
  - 2. For products specified only by reference standards, list applicable reference standards.

- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

## **1.6 QUALITY ASSURANCE**

- A. Source Limitations: Provide products of same kind from a single source to fullest extent possible.
- B. Compatibility of Products: When given option of selecting products, Contractor is responsible for providing products and construction methods that are compatible with previously selected products and construction methods, or products specified to with those selected products to be compatible.

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

- A. Deliver, store, and handle products according to manufacturer's recommendations.
- B. Schedule delivery to minimize long-term storage at site.
- C. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, or other losses.
- D. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
- F. Store products at site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- G. Store products subject to damage by weather above ground, under cover in a weathertight enclosure, and with ventilation adequate to prevent condensation.
  - 1. Maintain temperature and humidity within range required by manufacturer's instructions.

## **PART 2 - PRODUCTS**

### **2.1 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by the Contract Documents.

- B. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation
- C. Visual Matching:
1. Where matching a sample, Architect's decision will be final on whether a proposed product matches satisfactorily.
- D. Visual Selection:
1. Where product requirements include phrase ". . . as selected from manufacturer's standard colors, patterns, textures, .. " or a similar phrase, Architect will select color, pattern, and texture from product line selected that complies with other specified requirements.
- E. Do not use products having any of the following characteristics:
1. Made using or containing CFC's or HCFC's.
  2. Made of wood from newly cut old growth timber.
- F. Where all other criteria are met, Contractor shall give preference to products that:
1. Are extracted, harvested, and/or manufactured closer to the location of the project.
  2. Have longer documented life span under normal use.
  3. Result in less construction waste.
  4. Are made of vegetable materials that are rapidly renewable.
- G. Regionally-Sourced Products:
1. Overall Project Requirement: Provide materials amounting to a minimum of 20 percent of the total value of all materials (excluding plumbing, HVAC, electrical, elevators, and other equipment) that have been extracted, harvested, or recovered, as well as manufactured, within a radius of 500 miles from the project site.
  2. Specific Product Categories: Provide regionally-sourced products as specified elsewhere.
- H. Aerosol Adhesives:
1. Provide only products having lower volatile organic compound (VOC) content than required by GreenSeal GS-36.
    - a. This provision is applicable to LEED Credit EQ 4.1; submit LEED Prohibited Content Installer Certification Forms.
    - b. Require each installer to certify compliance and submit product data showing product content.
  2. Specific Product Categories: Comply with limitations specified elsewhere.
- I. Provide interchangeable components of the same manufacture for components being replaced.
- J. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- K. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

## **2.2 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only:
  - 1. Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers:
  - 1. Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Proprietary Specification Requirements:
  - 1. Single product or manufacturer is named, provide product indicated.
  - 2. No substitutions are permitted.
- D. Semiproprietary Specification Requirements:
  - 1. Where two or more products or manufacturers are named, provide one of products indicated that complies with Specifications.
  - 2. No substitutions are permitted.
- E. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions:
  - 1. Submit a request for substitution for any manufacturer not named.
- F. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation.
- G. Inappropriate Product Selections:
  - 1. If Contractor believes specified product, method, or system is inappropriate for use, Contractor to notify Architect before performing Work in question.
  - 2. If notice of objection is not received prior to delivery to site, it will be assumed by Owner that Contractor agrees specified products, methods, and systems are appropriate for use in Project.

## **2.3 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF PRODUCTS**

- A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
  - 1. Anchor each product securely in place, accurately located and aligned with other Work.
  - 2. Clean exposed surfaces and protect as necessary from damage and deterioration.

- B. Should job conditions or specified requirements conflict with Manufacturers' instructions, consult Architect for further instructions.

### **3.2 SUBSTITUTION PROCEDURES**

#### **A. Definitions**

1. Substitutions: Contractor proposals for changes in products, materials, equipment, and methods of construction required by Contract Documents made during bidding and after award of Contract are considered to be requests for substitution.
2. Following are not considered to be requests for substitution:
  - a. Revisions to Contract Documents requested by Owner or Architect.
  - b. Specified options of products and construction methods included in Contract Documents.
  - c. Contractor's determination of and compliance with regulations and orders issued by governing authorities.

#### **B. Product Substitutions:**

1. Where products or manufacturers are named and accompanied by term equal, approved, or approved equal, comply with Product Substitution Procedures to obtain approval of an unnamed product.
  - a. No products will be allowed to be substituted after the bid date.
  - b. Substitutions will be examined by the COR up to 7 working days prior to the bid.  
Any allowed substitution shall become part of the bid documents.
2. Substitutions received during Bidding period will be processed as Addenda, if accepted, prior to award of Contract, and thereafter included in Contract Documents.
3. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - a. Submit shop drawings, product data, and certified test results attesting to the b.
  - b. The CO/COR will notify Contractor in writing of decision to accept or reject request.
  - c. CO/COR will be sole judge of acceptability of any proposed substitution.

#### **C. Contractor's Responsibilities**

1. Contractor's responsibilities for substitution requests made after award of Contract are as follows:
  - a. Investigate proposed products and determine they are equal or superior in respects to products specified.
  - b. Provide same guarantee for accepted substitutions as for products specified.
  - c. Make changes in, and coordinate, Work as may be required to incorporate and install accepted substitutions.
  - d. Waive claims for additional costs which subsequently become apparent which are related to substitutions.

- D. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. Equality of different materials or products shall be determined by methods set forth in this Section.
  - 1. No product or material shall be arbitrarily presumed to be "equal" without having first been so judged by appropriate procedures.
  - 2. Provide comparison chart itemizing specified parts or components of specified and proposed substitutions.
  - 3. Comparative analysis to be evaluated by Architect or Engineer approving substitution.
    - a. Architect will be sole judge of acceptability of any proposed substitution and decision is final.
  - 4. A request for substitution constitutes a representation that the submitter:
    - a. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
    - b. Will provide the same warranty for the substitution as for the specified product.
    - c. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
    - d. Waives claims for additional costs or time extension that may subsequently become apparent.
    - e. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. Contractor's submittal and Architect's/COR's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

### **3.4 TRANSPORTATION AND HANDLING**

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling,

disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.5 STORAGE AND PROTECTION**

A. Schedule delivery to minimize long-term storage at site.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

1. Maintain temperature and humidity within range required by manufacturer's instructions.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

--- END ---

**SECTION 01 70 00  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, except payment procedures.

**1.2 RELATED SECTIONS**

- A. Section 01 10 00 - Summary: Work Sequencing.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- F. Section 01 57 19 - Temporary Environmental Controls.
- G. Section 01 60 00 – Product Requirements
- H. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- I. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- J. Section 07 84 00 - Firestopping.
- K. Section 01 84 19 - Acoustical Requirements

**1.3 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.



**SECTION 01 70 00**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. GREEN GLOBES requirements and closeout documentation.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

**1.4 QUALIFICATIONS**

- A. For survey work, employ a land surveyor registered in the State of Wyoming and acceptable to CO/COR. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State of Wyoming.

**1.5 PROJECT CONDITIONS**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

**1.6 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

**SECTION 01 70 00**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

1. All defective work must be repaired and completed prior to final payment.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

**PART 2 PRODUCTS**

**2.1 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct

**SECTION 01 70 00  
EXECUTION AND CLOSEOUT REQUIREMENTS**

locations.

- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

**3.2 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

**3.3 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify CO/COR seven days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to CO/COR,, participants, and those affected by decisions made.

**3.4 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

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EXECUTION AND CLOSEOUT REQUIREMENTS**

- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

**3.5 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

**3.6 UTILITY ALTERATIONS**

- A. Limited drawings showing existing construction and utilities are based on existing record documents only. Contractor to verify all utilities.
  - 1. Verify that utility arrangements are as shown.
  - 2. Report discrepancies to CO/COR before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Services (Including but not limited to Fire Protection, Electrical, and Telecommunications): Extend existing systems to accommodate new construction.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
- C. Protect existing work to remain.
  - 1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 2. Repair adjacent construction damaged during removal work.

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EXECUTION AND CLOSEOUT REQUIREMENTS**

- D. Adapt existing work to fit new work:
- E. Comply with all other applicable requirements of this section.

**3.7 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
  - 1. Provide Green Sweep, sweeping compound, for dust mitigation.
  - 2. Control dust to remain in residence during cleaning. The opening of doors and windows is not permitted until sweeping and vacuuming is complete.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- E. See requirements for closing off ducts during construction and post occupancy flush out.

**3.8 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

**3.9 SYSTEMS STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify CO/COR seven days prior to start-up of each item.

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- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

**3.10 DEMONSTRATION AND INSTRUCTION**

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

**3.11 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93.

**3.12 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

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- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

**3.13 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to CO/COR.
- B. Accompany Owner's Representative on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
- C. Notify CO/COR when work is considered ready for Substantial Completion.
- D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for review.
- E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- F. Accompany Project Coordinator on preliminary final inspection.
- G. Notify CO/COR when work is considered finally complete.
- H. Complete items of work determined by CO/COR and Architect's final inspection.

**3.14 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

END OF SECTION

**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.
  - 1. VA Goal is 50% waste recovery.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.
- E. Contractor shall provide VA with documentation of total waste disposal and weight diver in pounds.

**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 reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

### 1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
    - a. Provide separate bins for each waste type to be diverted.
  - 2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.

- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

## **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  - 4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Contractor is responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

## **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. Green Globes

## **1.7 RECORDS**

Maintain records and provide to COR with payment request 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. Provide schedule and quantity to be salvaged, recycled, reused.
- B. Provide schedule and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

- A. Provide all necessary individual 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.
  - 1. Disposal tickets shall be presented to COR with payment request.

### **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 for period covered with each payment request.
- 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 78 00**  
**CLOSEOUT SUBMITTALS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.
- D. Inspection procedures

**1.2 RELATED SECTIONS**

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

**1.3 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Tenant, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Tenant's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

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

## **PART 3 - EXECUTION**

### **3.1 SUBSTANTIAL COMPLETION**

- A. Prior to requesting inspection for certification of Substantial Completion, complete following.
1. In Application for Payment that coincides with, or first follows, date of Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as substantially complete.
    - a. Include supporting documentation for completion as indicated in these Contract Documents.
    - b. If 100 percent cannot be shown, include a list of incomplete items, value of incomplete construction, and reasons Work is not complete.
  2. Advise Owner of pending insurance changeover requirements.
  3. Submit warranties, workmanship bonds, maintenance agreements, final certifications, lien releases and similar documents.
  4. Obtain and submit releases enabling Owner unrestricted use of Work and access to services and utilities.
    - a. Include occupancy permits.
  5. Submit:
    - a. Record Drawings
    - b. Record Specifications
    - c. Maintenance manuals
    - d. Final project photographs
    - e. Damage or settlement surveys
    - f. Property surveys
    - g. Other final record information.
  6. Deliver tools, spare parts, extra stock, and similar items.
  7. Make final changeover of permanent locks and transmit keys to Owner.
    - a. Advise Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems and instruction to Owner's operation and maintenance personnel.
  9. Discontinue and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
  10. Complete final cleanup requirements.
  11. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.
- B. Inspection Procedures:
1. On receipt from contractor a written request for inspection with certification the project is

substantially complete and a punch list, Architect will proceed with an inspection or advise Contractor of unfilled requirements.

2. CO/COR will prepare Certificate of Substantial Completion following inspection or advise Contractor of construction that must be completed or corrected before certificate can be issued.
  - a. CO/COR will reinspect once when requested with assurance that punch list and Work is substantially complete.
  - b. Results of completed inspection will form basis of requirements for Final Acceptance.
3. Owner will allow Contractor no longer than 30 calendar days from Date of Substantial Completion to remedy deficiencies.

### **3.2 FINAL ACCEPTANCE**

- A. Prior to requesting final inspection for certification of final acceptance and final payment, submit following:
  1. Final payment request with releases, including insurance certificates for products and systems where applicable.
  2. Updated final statement accounting for final additional changes to Contract Sum.
    - a. CO will prepare a final Change Order after final acceptance showing adjustments to Contract Sum which were not made previously by Change Orders.
  3. Copy of CO/COR's final inspection list of items to be completed or corrected.,
    - a. Certification to state each item has been completed or corrected or otherwise resolved for acceptance.
  4. Consent of Surety to Final Payment.
  5. Evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure:
  1. CO/COR will reinspect to verify status of completion upon receipt of notice that Work, including list of items from earlier inspection, has been completed.
    - a. Indicate items for which completion is delayed under circumstances acceptable to CO/COR.
  2. If Work is found to be complete following final inspection, CO will issue a certificate of final acceptance.
  3. Should CO/COR determine that Work is incomplete or defective:
    - a. CO/COR will promptly notify Contractor, in writing, listing incomplete or defective Work.
    - b. Contractor to remedy deficiencies promptly, and notify Architect when ready for reinspection. Contractor shall pay costs for reinspection by the Architect.

### **3.3 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work and

identify as RECORD DRAWINGS - PROJECT SET:

1. Drawings.
  2. Specifications.
  3. Addenda.
  4. Change Orders and other modifications to the Contract.
  5. Reviewed shop drawings, product data, and samples.
  6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Mark Drawings to show actual installation and construction where construction varies substantially from Work as shown.
1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note.
  2. Date entries, and note related Change Order numbers where applicable.
  3. Call attention to entries by a "cloud" drawn around areas affected.
  4. Where overlapping changes occur, mark with different colors.
- C. Conversion of schematic layouts:
1. Design of future modifications of facility may require accurate information as to final physical layout of items which are shown schematically on Drawings.
  2. Show on Project set of Record Drawings, by dimension accurate to within one inch, centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as "cast iron drain", "galv. water", and like. Show, by symbol or note, vertical location of item ("under slab", "in ceiling plenum", "exposed", and like). Relate by identification descriptive to Specifications
- D. Ensure entries are complete and accurate.
- E. Store record documents separate from documents used for construction.
- F. Record information concurrent with construction progress.
- G. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
  2. Show changes in actual Work performed in comparison with Specification text.
  3. Product substitutions or alternates utilized.
  4. Changes made by Addenda and modifications, such as Change Orders and modifications issued during construction..
- H. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  2. Field changes of dimension and detail.
  3. Details not on original Contract drawings.



- I. Final Record Documents: Prior to request for Substantial Completion, secure from COR at no charge to Contractor two (2) complete sets of bond copies of Contract Drawings.
  1. Carefully transfer change data shown on Project set of Record Drawings to corresponding bond copy, coordinating changes as required.
  2. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and actual location of items.
  3. Show final location of electrical junction boxes and outlets, telephone and data outlets, supply and return registers, and like.
  4. Call attention to entries by a "cloud" drawn around areas affected.
  5. Make changes neatly, consistently, and with proper media to assure longevity and clear reproduction.

### **3.4 OPERATION AND MAINTENANCE DATA**

- A. For each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.5 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For each Product, Applied Material, and Finish:
  1. Product data, with catalog number, size, composition, and color and texture designations.
  2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

### **3.6 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For each Item of Equipment and each System:
  1. Description of unit or system, and component parts.
  2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.
  4. Complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
  - C. Include color coded wiring diagrams as installed.
  - D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
  - E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
  - F. Provide servicing and lubrication schedule and list of lubricants required.
  - G. Include Manufacturer's printed operation and maintenance instructions.
  - H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  - I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
  - J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  - K. Additional Requirements: As specified in individual product specification sections.

### **3.7 OPERATION AND MAINTENANCE MANUALS**

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
  2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
    - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
  3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
- J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

### **3.8 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Tenant's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

--- END ---

## **SECTION 01 81 11**

### **SUSTAINABLE DESIGN REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

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

##### **1.2 OBJECTIVES**

- A. To obtain acceptable Indoor Air Quality (IAQ) for the completed project and minimize the environmental impacts of the construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:
  1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. It is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
    - a. Include environmental considerations as part of the normal purchasing process.
    - b. Emphasize pollution prevention early in the purchasing process.
    - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    - d. Compare relevant environmental impacts when selecting products and services.
    - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
  2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
  3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.
  4. Use building practices that insure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.

##### **1.3 RELATED DOCUMENTS**

- A. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT
- B. Section 01 81 09 TESTING FOR INDOOR AIR QUALITY
- C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS

##### **1.4 DEFINITIONS**

- A. Agrifiber Products: Composite panel products derived from agricultural fiber

- B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight
- D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
- E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
- F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
- G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.
- H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky
- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock
- J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
- K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims":  
[www.ftc.gov/bcp/grammar/guides980427](http://www.ftc.gov/bcp/grammar/guides980427)
- L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site
- M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured
- N. Sealant: Any material that fills and seals gaps between other materials
- O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.

- P. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas
- Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

## 1.5 SUBMITTALS

### A. Sustainable Design Submittals:

1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
  - a. VA presented has alternate electric vehicle fueling at solar panel carports.
2. Heat Island Effect:
  - a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.
  - b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.
3. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns and purple water.
4. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
5. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
6. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).

7. Appliances and Equipment: VA will provide copies of manufacturer's product data for all Energy Star eligible equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's Energy Star program.
8. On-Site Renewable Energy Systems: VA will provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
9. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
10. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.
11. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
  - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.

SPEC WRITER NOTE: The submittal frequency suggestion of every third month is not based on LEED or any other requirement, and should be revised to reflect the needs of the specific Project.

12. Regional Materials: The objective is to conserve resources and minimize the energy and environmental impact of extracting and processing non-renewable materials.
  - a. Specify used building materials and components.
  - b. Specify materials with recycled content.
  - c. Specify materials from renewable sources that have been selected based on a life-cycle assessment (LCA).
  - d. Specify locally manufactured materials that have been selected based on a LCA.
  - e. Use lumber and timber panel products which originate from certified and sustainable sources (certified by the CSA (Canadian Standards Association), the FSC (Forestry Stewardship Council), or the SFI (Sustainable Forestry Initiative)) and avoid use of tropical hardwoods.

14. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
16. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content
17. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
18. Floorcoverings:
  - a. Carpet Systems: Submittals for all carpet must include the following:
    - 1) Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
  - b. Engineered Wood Flooring: Submittals for all engineered wood flooring must include manufacturer's product data verifying certification under either the Greenguard or FloorScore indoor emissions testing program.
19. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
21. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
22. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
  - a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
  - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction.  
See above for requirements
27. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
28. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.



29. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.
- B. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
  1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Owner and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
    - a. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
    - b. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
    - c. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
    - d. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.
  2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.
- C. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.
- D. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
  1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the COR's approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:
  2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for

- Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
- a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage
  - b. Schedule of submission to COR of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
  - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
  - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit
3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
    - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
    - b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
  4. Not more than 14 days after Substantial Completion provide the following:
    - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
    - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
    - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance with IAQ testing procedures and requirements defined in Section 01 81 09 "Testing for Indoor Air Quality."
- E. Commissioning: See Section 01 91 00 "General Commissioning Requirements" for submittal requirements.
- F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19 "Construction Waste Management."

2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

## **1.6 QUALITY ASSURANCE**

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

## **PART 2 - PRODUCTS**

### **2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS**

- A. Site Clearing: Topsoil shall be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.
- B. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.
- C. Roofing Materials: All roofing systems, other than vegetated roof systems, must comply with the following requirements:
  1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
  2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.
  3. Roofing Materials: Light-colored, reflective, and high-emissivity roofing helps to reduce localized heat build-up from roof surfaces that contribute to the urban heat island effect.
- D. Exterior Lighting Fixtures:
  1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
  2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
  3. No lighting of building facades or landscape features is permitted.
- E. Irrigation Systems: Any permanent landscape irrigation systems must be supplied entirely by collected rainwater or graywater and must be comprised of below-grade drip emitters controlled by moisture sensors. Timer controls shall not be permitted.

- F. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 40% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:
1. Toilets: no more than 1.3 gallons per flush, otherwise be dual flush 1.6/0.8 gallons per flush, and have documented bowl evacuation capability per MaP testing of at least 400 grams
  2. Urinals: Water sense rated with no more than 0.125 gallons per flush or use where considered appropriate.
  3. Lavatory Faucets: 0.5 gpm with automatic faucet controls
  4. Kitchen Sink Lavatories: 2.2 gpm
  5. Showerheads: no more than 1.5gpm
- G. Process Water Use: Employ strategies that in aggregate result in 20% less water use than the process water use baseline for the building after meeting the commercial equipment and HVAC performance requirements as listed in the Table below. For equipment not addressed by EPACT 2005 or the list below, additional equipment performance requirements may be proposed provided documentation supporting the proposed benchmark or industry standard is submitted.
1. Owner Provided, Owner Installed Clothes Washer: 7.5 gallons/cubic foot/cycle
  2. Ice Machine: 20 gallons/100 pounds ice for machines making over 175 pounds of ice per day; 30 gallons/100 pounds ice for machines making less than 175 ice per day. Avoid water-cooled machines.
- H. Elimination of CFCs AND HCFCs:
1. Ozone Protection: Base building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
  2. Fire suppression systems may not contain ozone-depleting substances.
  3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- I. Appliances and Equipment: All Energy Star eligible equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), shall be qualified by EPA's Energy Star program.
- J. HVAC Distribution Efficiency:
1. All duct systems shall be constructed of galvanized sheet metal, aluminum, or stainless steel as deemed appropriate based on the application requirements. No fiberglass duct board shall be permitted.
  2. All medium- and high-pressure ductwork systems shall be pressure-tested in accordance with the current SMACNA standards.
  3. All ductwork shall be externally insulated. No interior duct liner shall be permitted.

4. Where possible, all air terminal connections shall be hard-connected with sheet metal ductwork. If flexible ductwork is used, no flexible duct extension shall be more than six feet in length.
5. All HVAC equipment shall be isolated from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
6. All supply and return air branch ducts shall include the appropriate style of volume damper. Air terminal devices such as grilles, registers, and diffusers shall be balanced at duct branch dampers, not at terminal face.

K. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
  - a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
  - b. Do not include mechanical and electrical components in the calculations.
  - c. Do not include labor and delivery costs in the calculations.
  - d. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
  - e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.
  - g. The materials in the following list must contain the minimum recycled content indicated:

Category	Minimum Recycled Content
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined

Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined

--- E N D ---

**ACOUSTICAL PERFORMANCE REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Performance requirements for party walls, corridors, windows, doors, floor/ceiling assemblies, and equipment noise.

**1.2 RELATED SECTIONS**

- A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 06 10 00 - Rough Carpentry.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- D. Section 07 84 00 - Firestopping: Firestop at system junction with structure.
- E. Section 07 90 05 - Joint Sealers: Acoustic sealant.
- F. Section 08 80 00 - Glazing.
- G. Section 09 21 16 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.
- H. Section 09 51 00 - Acoustical Ceilings: Suspension system for acoustical panels specified in this section.
- I. Division 22 - Plumbing
- J. Division 23 - HVAC
- K. Division 26 - Electrical

**1.3 PERFORMANCE REQUIREMENTS**

- A. Party Walls: STC 45+.
- B. Corridor Walls: STC 45+.
- C. Floor Ceiling Systems:
  - 1. STC 60+.
  - 2. IIC: 60+.
- D. Entry Doors:
  - 1. Full bulb-type seals and automatic door bottom (surface mounted).
  - 2. STC: 40+.
- E. Background Noise Criterion (NC) in units: NC 35
- F. Equipment Noise:
  - 1. Unit Heat Pumps:
    - a. Isolate fan coil units with spring isolation hangers.
    - b. Supply and Return air duct to be lined and include at least one elbow to reduce fan noise.
    - c. Install 2-inch batt insulation below fan coil unit in bathroom spaces.

- d. Select manufacturer's quiet options for fan systems and cabinet.
      - 1) Bathroom fans with less than 2.0 sones required.
  - G. Plumbing:
    - 1. Isolate attachments to structure with neoprene isolators
    - 2. Insulate around pipes
  - H. Overhead Doors: Isolate track and motor from structure using neoprene mounts.
  - I. Electrical: Provide foam all outlets
- 1.4 SUBMITTALS**
- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
  - B. See related sections specified for submittal requirements.
  - C. Product Data Submittals: Submit manufacturer's standard published data for acoustical requirements. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
  - D. Certificates: Certify that products of this section meet or exceed specified requirements.
- 1.5 PRE-INSTALLATION MEETING**
- A. Convene one week before starting work of this section.
- PART 2 - PRODUCTS - NOT USED**
- PART 3 - EXECUTION**
- 3.1 EXAMINATION**
- A. Contractor to verify that acoustical assemblies are compliance with the contract documents.
- 3.2 FIELD QUALITY CONTROL**
- A. Perform field inspection and testing in accordance with Section 01 40 00.
  - B. See individual specification sections for testing required.

-----END----



**SECTION 01 91 00****GENERAL COMMISSIONING REQUIREMENTS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
  - 1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
  - 2. Verify and document proper integrated performance of equipment and systems.
  - 3. Verify that Operations & Maintenance documentation is complete.
  - 4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.

5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
  6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.
  - G. The Commissioning Agent, both the firm and individual designated as the Commissioning Agent, shall be certified by at least one of the following entities: the National Environmental Balancing Bureau (NEBB), the Associated Air Balance Council Commissioning Group (AABC), and the Building Commissioning Association (BCA). Certification(s) shall be valid and active. Proof of certification(s) shall be submitted to the Contracting Officer and the Resident Engineer three (3) calendar days after the Notice to Proceed.

## **1.2 CONTRACTUAL RELATIONSHIPS**

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the Resident Engineer.
- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.
- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the 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 Resident Engineer 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 Resident Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

### **1.3 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
- C. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
- D. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
- E. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
- F. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.
- G. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- H. Section 31 08 00 COMMISSIONING OF 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 Green Buildings Initiative Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

## 1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. COR: Contracting Officers Representative.
- D. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- E. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- F. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- G. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.
- H. System: A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire

system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

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

## **1.6 SYSTEMS TO BE COMMISSIONED**

- A. Commissioning of a system or systems specified for this project is part of the construction process and in the RFP for commissioning services. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:
  - 1. HVAC (Division 23)
    - a. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).
    - b. Dehumidification Systems (Energy recovery devices – such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).
    - c. Heating Hot Water Systems (Boilers, controls, instrumentation and gages, flues, heating water pumps and motors, Variable Speed Drives, mixing valves).

- d. Condensate Return Systems (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, deaerators, boiler feed pumps and motors, safeties).
- e. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).
- f. Condenser Water Systems for Chillers (Condenser water pumps and motors, Variable Speed Drives, cooling tower fans, cooling tower sump level controls, open-circuit water treatment system, water treatment injection pumps and motors, water treatment controls, cooling tower basin heaters and controls, side stream water cleaners/scrubbers/filters, tower bypass valves).
- g. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
- h. Gas Fired Hydronic System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).
- i. Direct Digital Control System (Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
- k. OR Air Handling Systems (Fans, motors, Variable Speed Drives, Energy recovery devices – such as heat pipes, cooling coils and control valves, heating coils and control valves, filters, HEPA filter performance, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).

## **1.7 COMMISSIONING TEAM**

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

### **1.8 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  - 1. Coordination meetings limited to 8 hrs.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Testing meetings.
  - 4. Witness and assist in Systems Functional Performance Testing.
  - 5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

### **1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES**

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

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

#### **1.10 COMMISSIONING AGENT'S RESPONSIBILITIES**

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene 3 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.

#### **1.11 COMMISSIONING DOCUMENTATION**

- A. Commissioning Agent's Certification(s): Commissioning Agent shall submit evidence of valid and current certification(s), as required in Section 1.1(G), to the Contracting Officer.
- B. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  - 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  - 3. Identification of systems and equipment to be commissioned.
  - 4. Schedule of Commissioning Coordination meetings.
  - 5. Identification of items that must be completed before the next operation can proceed.
  - 6. Description of responsibilities of commissioning team members.
  - 7. Description of observations to be made.
  - 8. Description of requirements for operation and maintenance training.
  - 9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  - 10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.

11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- C. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.
- D. Pre-Functional Checklists: The Commissioning Agent will prepare *Pre-Functional Checklists*. *Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- E. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- F. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The

Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

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

1. Creating an Commissioning Issues Log Entry:

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

2. Documenting Issue Resolution:

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

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

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

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

## 1.12 SUBMITTALS

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary

Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
  4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA 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.

### **1.13 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 60 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.
- C. Within 67 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their

respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.14 QUALITY ASSURANCE**

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

#### **1.15 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements. Meetings will include VA FMS representatives.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and

inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

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

## **PART 3 - EXECUTION**

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

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
  - 1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
    - a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
    - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
  - 2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.



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

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

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

### **3.3 TRENDING AND ALARMS**

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

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

- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

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

Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

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

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

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

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

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

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

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

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



Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Domestic HW Setpoint WH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint WH-2	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 °F	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 #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	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-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
				3 days			
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station Bypass Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 2 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Decoupler Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Secondary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Emergency Shut-down	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Enable	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 2 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 °F	10 Min
Cooling Tower 2 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 °F	10 Min
Condenser Water Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Condenser Water Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Outdoor Air Wet Bulb	AI	15 Minutes	12 Hours	3 days	N/A		

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

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

Steam Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Boiler 1 Feed Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		
Boiler 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Combustion Damper Command	DO	COV	12 Hours	3 days	N/A		
Condensate Recovery Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		

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



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

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

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

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

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

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

AIR HANDLING UNIT AHU-1				
Control	Proportional	Integral	Derivative	Interval

Reference	Constant	Constant	Constant	
Heating Valve Output	1000	20	10	2 sec.

### 3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.
- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
1. System and equipment or component name(s)

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

3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
  4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
  5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

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

### **3.5 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.

### **3.6 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.

### **3.7 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS**

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.



- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
1. Review the Contract Documents.
  2. Review installed systems, subsystems, and equipment.
  3. Review instructor qualifications.
  4. Review instructional methods and procedures.
  5. Review training module outlines and contents.
  6. Review course materials (including operation and maintenance manuals).
  7. Review and discuss locations and other facilities required for instruction.
  8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
  2. Qualification Data: Submit qualifications for facilitator and/or instructor.
  3. Attendance Record: For each training module, submit list of participants and length of instruction time.
  4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
  5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
    - a. Identification: On each copy, provide an applied label with the following information:
      - 1) Name of Project.
      - 2) Name and address of photographer
      - 3) Name of Contractor.
      - 4) Date videotape was recorded.
      - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder.

Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

#### D. QUALITY ASSURANCE

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

#### E. COORDINATION

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

#### F. INSTRUCTION PROGRAM

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

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

4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Seasonal and weekend operating instructions.
    - l. Required sequences for electric or electronic systems.
    - m. Special operating instructions and procedures.
  5. Adjustments: Include the following:
    - a. Alignments.
    - b. Checking adjustments.
    - c. Noise and vibration adjustments.
    - d. Economy and efficiency adjustments.
  6. Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
  7. Maintenance: Include the following:
    - a. Inspection procedures.
    - b. Types of cleaning agents to be used and methods of cleaning.
    - c. List of cleaning agents and methods of cleaning detrimental to product.
    - d. Procedures for routine cleaning
    - e. Procedures for preventive maintenance.
    - f. Procedures for routine maintenance.
    - g. Instruction on use of special tools.
  8. Repairs: Include the following:
    - a. Diagnosis instructions.
    - b. Repair instructions.
    - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    - d. Instructions for identifying parts and components.
    - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:

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

----- END -----

**PSECTION 02 41 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Demolition and removal of utilities, roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
- F. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including traffic, control, 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.
- 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. Refer to ICRA for protection of existing facilities.
- 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, obtain a "hot work" permit from FMS; 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's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES:**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove all abandoned outside utility lines.
- C. Relocate any utilities not indicated on plans which are found to be in use. Notify COR immediately on discovery.
- D. Contractor to document locations on utility plans.

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

#### **PART 3 – EXECUTION**

##### **3.1 DEMOLITION:**

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below and on drawings:
  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 placed in containers away from 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, 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 COR shall be notified prior to further work in that area.

### **3.2 CLEAN-UP:**

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:**

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

**1.2 RELATED WORK:**

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

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

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

**1.4 TOLERANCES:**

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
  - 1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
  - 2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
  - 3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

**1.5 REGULATORY REQUIREMENTS:**

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

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
  - 1. Reinforcing Steel.
  - 2. Cement.
- D. Manufacturer's Certificates:
  - 1. Abrasive aggregate.
  - 2. Lightweight aggregate for structural concrete.
  - 3. Air-entraining admixture.
  - 4. Chemical admixtures, including chloride ion content.
  - 5. Waterproof paper for curing concrete.
  - 6. Liquid membrane-forming compounds for curing concrete.
  - 7. Non-shrinking grout.
  - 8. Liquid hardener.
  - 9. Waterstops.
  - 10. Expansion joint filler.
  - 11. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request to COR including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.
- G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by COR (see FORMWORK) or Contractor.

**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 PRE-CONCRETE CONFERENCE:**

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
  - 1. Submittals.
  - 2. Coordination of work.
  - 3. Availability of material.
  - 4. Concrete mix design including admixtures.
  - 5. Methods of placing, finishing, and curing.
  - 6. Finish criteria required to obtain required flatness and levelness.
  - 7. Timing of floor finish measurements.
  - 8. Material inspection and testing.
  - 9. Architectural appearance of exposed concrete.
  - 10. Joints
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; COR; and Consulting Engineer.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

#### **1.9 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117-10 ..... Tolerances for Concrete Construction and Materials
  - 211.1-91(R2009) ..... Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 211.2-98(R2004) ..... Selecting Proportions for Structural Lightweight Concrete
  - 214R-02 ..... Evaluation of Strength Test Results of Concrete
  - 301-10 ..... Structural Concrete
  - 304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305R-10 ..... Hot Weather Concreting

306R-10 .....	Cold Weather Concreting
308R-01(R2008) .....	Standard Practice for Curing Concrete
309R-05 .....	Guide for Consolidation of Concrete
318-08 .....	Building Code Requirements for Reinforced Concrete and Commentary
347-04 .....	Guide to Formwork for Concrete
SP-66-04 .....	ACI Detailing Manual
C. American Society for Testing and Materials (ASTM):	
A82/A82M-07 .....	Steel Wire, Plain, for Concrete Reinforcement
A615/A615M-09 .....	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A653/A653M-09 .....	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A706/A706M-09 .....	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-09 .....	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
C31/C31M-09.....	Making and Curing Concrete Test Specimens in the field
C33-08 .....	Concrete Aggregates
C39/C39M-09.....	Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-09.....	Ready-Mixed Concrete
C143/C143M-10.....	Slump of Hydraulic Cement Concrete
C150-09 .....	Portland Cement
C171-07 .....	Sheet Materials for Curing Concrete
C172-08 .....	Sampling Freshly Mixed Concrete
C173-10... ..	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07 .....	Making and Curing Concrete Test Specimens in the Laboratory
C231-09 .....	Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06 .....	Air-Entraining Admixtures for Concrete
C330-09 .....	Lightweight Aggregates for Structural Concrete
C494/C494M-10.....	Chemical Admixtures for Concrete
C666/C666M-03.....	Resistance of Concrete to Rapid Freezing and Thawing
C1107/1107M-08 .....	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1315-08 .....	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D297-93(R2006) .....	Rubber Products-Chemical Analysis

- D1751-04(R2008) ..... Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- E1155-96(R2008) ..... Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers
- E. American Welding Society (AWS):
- D1.4/D1.4M-11 ..... Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI):
- Handbook 2008
- G. U. S. Department of Commerce Product Standard (PS):
- PS 1..... Construction and Industrial Plywood
- PS 20..... American Softwood Lumber

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

### **2.2 MATERIALS:**

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
  - 1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
  - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
  - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

- D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.
- E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150  $\mu$ m (No. 100) sieve.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures: All admixtures shall be submitted by contractor and approved by COR prior to use.
  - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
  - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
  - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
  - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  - 5. Air Entraining Admixture: ASTM C260.
  - 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.
- H. Vapor Barrier: ASTM E1745, 0.375 mm (15 mil). Manufactured by Stego (or equal).
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- K. Expansion Joint Filler: ASTM D1751.
- L. Sheet Materials for Curing Concrete: ASTM C171.
- M. 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.

N. Adhesive Binder: ASTM C881.

1. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
2. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
3. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.
4. Testing for floor finishes: Refer to manufacturer's instructions for testing floor moisture content prior to installing floor coverings.

## 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 specifications initially with mix design and for each truck load of fly ash delivered from source. Notify Resident Engineer immediately when change in source is anticipated. Prior to beginning trial mixes submit to the Resident Engineer the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.

1. Fly ash - 2.25 kg (five pounds).
2. Portland cement - 3.5 kg (8 pounds):
  - a. Address -Waterways Experiment Station (WES)
  - b. 3909 Halls Ferry Road

- c. Vicksburg, MS 39180-6199
  - d. ATTN: Engineering Materials Group
- 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 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. 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. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons.

**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) <sup>1,3</sup>	375 (630)	0.45	385 (650)	0.40
30 (4000) <sup>1,3</sup>	325 (550)	0.55	340 (570)	0.50
25 (3000) <sup>1,3</sup>	280 (470)	0.65	290 (490)	0.55
25 (3000) <sup>1,2</sup>	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. 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 or ACI 211.2 for lightweight structural 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 Table II.

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

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)



Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)
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- F. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Determine air content by either ASTM C173 or ASTM C231.

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

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

- G. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- H. 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 and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- I. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.
- J.. 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, 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, 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, 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. Mixing process and equipment must be approved by 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°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 COR.

## **PART 3 – EXECUTION**

### **3.1 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
  1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COR approves their reuse after viewing them prior to use
  2. Provide forms for concrete footings unless COR determines forms are not necessary.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.

2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
  3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent
- E. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
  2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- F. 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 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.

G. 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. 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. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
  1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
  2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength ( $f_y$ ) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
    - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
    - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.

- c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by COR.
- 3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength ( $f_y$ ) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
  - a. Initial qualification: In the presence of COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
  - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by 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. Locate per drawings.

### **3.4 EXPANSION JOINTS:**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

### **3.5 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 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 subject to approval of 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 it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
- 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.

### **3.6 CONTROL JOINTS:**

- A. Saw cut control joints shall be installed per the drawings as soon as the concrete has hardened sufficiently to prevent chipping, spalling or tearing & shall be completed before shrinkage stresses have developed sufficiently to induce cracking.

### **3.7 HOT WEATHER:**

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

### **3.8 COLD WEATHER:**

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by 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 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. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

**3.11 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 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. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless 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.
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 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 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. Contractor retained testing laboratory will take measurements as directed by 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 retained testing laboratory.

- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
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 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. Coordinate with carpet manufacturer's recommendations.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

--- E N D ---

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

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

Section specifies mortar materials and mixes.

#### **1.2 RELATED WORK:**

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

#### **1.3 TESTING LABORATORY-CONTRACTOR RETAINED**

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

#### **1.4 TESTS**

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
  - 2. Mortar:
    - a. Test for compressive strength and water retention; ASTM C270.
    - b. Mortar compressive strengths 28 days as follows:  
 Type M: Minimum 17230 kPa (2500 psi) at 28 days.  
 Type S: Minimum 12400 kPa (1800 psi) at 28 days.  
 Type N: Minimum 5170 kPa (750 psi) at 28 days.
  - 3. Cement:
    - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
    - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
  - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.
- G. During progress of work, testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES, takes and tests samples as specified in that section. Testing procedures and test methods in ASTM C780.

## 1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
  - 1. Testing laboratory's facilities and qualifications of its technical personnel.
  - 2. Indicating that following items meet specifications:
    - a. Portland cement.
    - b. Masonry cement.
    - c. Mortar cement.
    - d. Hydrated lime.
    - e. Fine aggregate (sand).
- C. Laboratory Test Reports:
  - 1. Mortar, each type.
  - 2. Admixtures.
- D. Manufacturer's Literature and Data:
  - 1. Cement, each kind.
  - 2. Hydrated lime.
  - 3. Admixtures.
  - 4. Liquid acrylic resin.

## 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

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

## 1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04 .....Organic Impurities in Fine Aggregates for Concrete
  - C91-05 .....Masonry Cement
  - C109-08 .....Compressive Strength of Hydraulic Cement Mortars (Using 2-in.  
or 50-MM Cube Specimens)
  - C144-04 .....Aggregate for Masonry Mortar
  - C150-09 .....Portland Cement
  - C207-06 .....Hydrated Lime for Masonry Purposes
  - C270-10 .....Mortar for Unit Masonry

C307-03(R2008) ..... Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing

C595-10 ..... Blended Hydraulic Cement

C780-10 ..... Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C979-10 ..... Pigments for Integrally Colored Concrete

C1329-05 ..... Mortar Cement

## **PART 2 - PRODUCTS**

### **2.1 HYDRATED LIME**

ASTM C207, Type S.

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

A. ASTM C144 and as follows:

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

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

### **2.3 BLENDED HYDRAULIC CEMENT**

ASTM C595, Type IS, IP.

### **2.4 MASONRY CEMENT**

A. ASTM C91. Type N, S, or M.

### **2.5 MORTAR CEMENT**

ASTM C1329, Type N, S or M.

### **2.6 PORTLAND CEMENT**

A. ASTM C150, Type I.

### **2.7 WATER**

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

### **2.8 MASONRY MORTAR**

A. Conform to ASTM C270.

B. Admixtures:

1. Do not use mortar admixtures, unless approved by VA COR.
2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
3. Do not use antifreeze compounds.

C. Colored Mortar:

1. Maintain uniform mortar color for exposed work throughout.

2. Match mortar color in approved sample or in adjacent building as designated by Resident Engineer.
  3. Color of mortar for exposed work in alteration work to match color of existing mortar unless specified otherwise in section 09 06 00, SCHEDULE FOR FINISHES.
- D. Color Admixtures:
1. Proportion as specified by manufacturer.
  2. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

### **PART 3 - EXECUTION**

#### **3.1 MIXING**

- A. Mix in a mechanically operated mortar mixer.
  1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
  1. Re-tempered by adding water to restore to proper consistency and workability.
  2. Discard mortar that has reached its initial set or has not been used within two hours.

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

- A. Use Type S mortar for setting cast stone and engineered reinforced unit masonry work.
- B. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- C. Use Type N mortar for other masonry work, except as otherwise specified.

--- E N D ---

**SECTION 04 05 16  
MASONRY GROUTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section specifies grout materials and mixes.

**1.2 RELATED WORK:**

- A. Grout used in Section:
  - 1. Section 04 20 00, UNIT MASONRY
  - 2. Section 04 42 00 EXTERIOR STONE CLADING
- B. Grout Color: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 TESTS:**

- A. Test grout and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
  - 2. Grout:
    - a. Test for compressive strength; ASTM C1019.
    - b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
  - 3. Cement:
    - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
    - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
  - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
  - 1. Indicating that following items meet specifications:
    - a. Portland cement.
    - b. Masonry cement.
    - c. Grout.
    - d. Hydrated lime.
    - e. Fine aggregate (sand).



- f. Coarse aggregate for grout.
- C. Laboratory Test Reports:
  - 1. Grout, each type.
  - 2. Admixtures.
- D. Manufacturer's Literature and Data:
  - 1. Cement, each kind.
  - 2. Hydrated lime.
  - 3. Admixtures.
  - 4. Liquid acrylic resin.

### **1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:**

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

### **1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04 .....Organic Impurities in Fine Aggregates for Concrete
  - C91-05 .....Masonry Cement
  - C150-09 .....Portland Cement
  - C207-06 .....Hydrated Lime for Masonry Purposes
  - C404-07 .....Aggregate for Masonry Grout
  - C476-10 .....Grout for Masonry
  - C595-10 .....Blended Hydraulic Cement
  - C979-10 .....Pigments for Integrally Colored Concrete
  - C1019-11 .....Sampling and Testing Grout

## **PART 2 - PRODUCTS**

### **2.1 HYDRATED LIME:**

ASTM C207, Type S.

### **2.2 AGGREGATE FOR MASONRY GROUT:**

ASTM C404, Size 8.

### **2.3 BLENDED HYDRAULIC CEMENT:**

ASTM C595, Type IS, IP.

### **2.4 MASONRY CEMENT:**

- A. ASTM C91. Type N, S, or M.

**2.5 PORTLAND CEMENT:**

- A. ASTM C150, Type I.

**2.6 LIQUID ACRYLIC RESIN:**

A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

**2.7 WATER:**

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

**2.8 GROUT:**

- A. Conform to ASTM C476 except as specified.
- B. Grout type proportioned by volume as follows:
  - 1. Fine Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
  - 2. Coarse Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
    - d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
  - 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

**PART 3 - EXECUTION****3.1 MIXING:**

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

**3.2 GROUT USE LOCATIONS:**

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

--- E N D ---

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

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies requirements for tuck pointing of existing masonry and stone work of building 45 .

#### **1.2 RELATED WORK**

Mortars: Section 04 05 13, MASONRY MORTARING.

#### **1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C67-07 .....Brick and Structural Clay Tile, Sampling and Testing
  - C216-07 .....Facing Brick (Solid Masonry Units Made From Clay or Shale)
  - C270-07 .....Mortar for Unit Masonry
- C. International Masonry Institute: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

### **PART 2 - PRODUCTS**

#### **2.1 TUCK POINTING MORTAR**

As per appendix X3 of ASTM C270.

#### **2.2 REPLACEMENT MASONRY UNITS**

- A. Face Brick:
  - 1. ASTM C216, Grade SW, Type FBS. Brick shall be classified slightly efflorescent or better when tested in accordance with ASTM C67.
  - 2. Face brick shall match facing brick of the existing building(s) that is being tuck pointed.
- B. Other Units to match existing.

### **PART 3 - EXECUTION**

#### **3.1 JOB CONDITIONS**

- A. Protection: Protect newly pointed joints from rain, until pointed joints are sufficiently hard enough to prevent damage.
- B. Cold Weather Protection:
  - 1. Tuck pointing may be performed in freezing weather when methods of protection are utilized.
  - 2. Comply with applicable sections of "Recommended Practices for Cold Weather Construction" as published by International Masonry Industry All Weather Council.
  - 3. Existing surfaces at temperatures to prevent mortar from freezing or causing other damage to mortar.

### 3.2 INSTALLATION OF TUCK POINTING MORTAR

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

### 3.3 TOOLING OF JOINTS

- A. Tool joints with a jointing tool to produce a smooth, compacted, concaved joint.
- B. Tool joints in patch work with a jointing tool to match the existing surrounding joints.
- C. Dampen surfaces of the surrounding units before new units are placed.
  - 1. Allow existing masonry to absorb surface moisture prior to starting installation of the new replacement units.
  - 2. Butter contact surfaces of existing masonry and new replacement masonry units with mortar.
  - 3. Center replacement masonry units in opening and press into position.
  - 4. Remove excess mortar with a trowel.
  - 5. Point around replacement masonry units to ensure full head and bed joints.
  - 6. When mortar becomes "thumbprint hard", tool joints.

### 3.4 CLEANING

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

--- E N D ---

**SECTION 04 20 00  
UNIT MASONRY****PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls.

**1.2 RELATED WORK**

- A. Mortars and grouts : Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.
- B. Tuck pointing 040531
- C. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- D. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- E. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- F. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
- F. Aluminum windows and storefront: sections 084113 and 085113
- G Fire Stops: 07 84 00 FIRESTOPPING
- H. Light Gauge Framing: 05 40 00 COLD FORMED METAL FRAMING

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Mock (5 feet high):
  - 1. Face brick, sample panel, 5 feet high by 5 feet wide, showing full color range and texture of bricks, bond, and proposed mortar joints. Sample shall include window installation and simulated stone sills.
    - a. match existing brick and joints
  - 2. Concrete masonry units, when exposed in finish work.
  - 3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
- C. Shop Drawings:
  - 1. Special masonry shapes.
  - 2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
  - 3. All accessory pieces to installation
- 4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

**D. Certificates:**

1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
2. Indicating that the following items meet specification requirements:
  - a. Face brick.
  - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
  - c. Simulated cast stone units.
3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

**E. Manufacturer's Literature and Data:**

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

**1.4 SAMPLE PANEL**

- A. Before starting masonry, lay up a sample panel (5' high) in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
  1. Use masonry units from random cubes of units delivered on site.
  2. Include window simulated stone sill, lintel, back-up wall framing, flashings, insulation, sealants, joint, ties and anchors.
- B. Use sample panels approved by COR for standard of workmanship of new masonry work and demonstrate window flashing.
- C. Use sample panel to test cleaning methods.
- D. Use sample panel for water testing
  1. Test panel at a minimum pressure differential of 6.42 psf.
  2. Minimum exposure time is 2 hours.

**1.5 WARRANTY**

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

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A951-06..... Steel Wire for Masonry Joint Reinforcement.
  - A615/A615M-09 ..... Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

- A675/A675M-03(R2009) ..... Standard Specification for Steel Bars, Carbon, Hot-Wrought,  
Special Quality, Mechanical PropertiesC34-03    Structural Clay  
Load-Bearing Wall Tile
- C62-0 ..... Building Brick (Solid Masonry Units Made From Clay or Shale)
- C67-09 ..... Sampling and Testing Brick and Structural Clay Tile
- C90-11 ..... Load-Bearing Concrete Masonry Units
- C216-10 ..... Facing Brick (Solid Masonry Units Made From Clay or Shale)
- C476-10 ..... Standard Specification for Grout for Masonry
- D1056-07 ..... Flexible Cellular Materials - Sponge or Expanded Rubber
- D2000-08 ..... Rubber Products in Automotive Applications
- D2240-05(R2010) ..... Rubber Property - Durometer Hardness
- D3574-08 ..... Flexible Cellular Materials-Slab, Bonded, and Molded Urethane  
Foams
- F1667-11 ..... Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:  
Hot and Cold Weather Masonry Construction Manual-98 (R2000).
- D. American Welding Society (AWS):  
D1.4-11 Structural Welding Code – Reinforcing Steel.
- E. Federal Specifications (FS):  
FF-S-107C-00 ..... Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction (BIA):  
11-2001 ..... Guide Specifications for Brick Masonry, Part I  
11A–1988..... Guide Specifications for Brick Masonry, Part II  
11B–1988..... Guide Specifications for Brick Masonry, Part III Execution  
11C-1998 ..... Guide Specification for Brick Masonry Engineered Brick  
Masonry, Part IV  
11D-1988 ..... Guide Specifications for Brick Masonry Engineered Brick  
Masonry, Part IV continued
- G. Masonry Standards Joint Committee; Specifications for Masonry Structures TMS 602-08/ACI  
530.1-08/ASCE 6-08 (2008 MSJC Book Version TMS-0402-08).

## **PART 2 - PRODUCTS**

### **2.1 BRICK**

- A. Face Brick:
1. ASTM C216, Grade SW, Type FBS.
  2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.
  3. Size:
    - a. Modular – verify and match existing.

4. Color: To match existing brick color; "Cheyenne Blend" by Lakewood Brick.
- B. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.

## **2.2 CONCRETE MASONRY UNITS**

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
  1. Unit Weight: Normal weight.
  2. Fire rated units for fire rated partitions.
  3. Sizes: Modular – refer to drawings.
  4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
  5. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (one inch) minimum radius rounded vertical exterior corners (bullnose units).
  6. Customized units:
    - a. Split face CMU.
      - 1) Color match brick
- B. Concrete Brick: ASTM C55.

## **2.3 CONCRETE MASONRY UNITS**

- A. Simulated Cast Stone Units
  1. Arriscraft Renaissance Stone is used as Design Basis.
  2. Units shall match profile and finish face textures of existing building exterior window sills.
  3. Units shall match color of existing building exterior window sills.

## **2.4 SHEAR KEYS**

- A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).
- B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

## **2.5 REINFORCEMENT:**

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.
- C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.
- D. Joint Reinforcement:
  1. Form from wire complying with ASTM A951.
  2. Galvanized after fabrication.
  3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.



4. Cross wires welded to longitudinal wires.
5. Joint reinforcing at least 3000 mm (10 feet) in length.
6. Joint reinforcing in rolls is not acceptable.
7. Joint reinforcing that is crimped to form drip is not acceptable.
8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
9. Ladder Design:
  - a. Longitudinal wires deformed 4 mm (0.16 inch) diameter wire.
  - b. Cross wires 2.6 mm (0.10 inch) diameter.

## **2.6 ANCHORS, TIES, AND REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
  1. Form from wire complying with ASTM A951.
  2. Galvanized after fabrication.
  3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
  4. Cross wires welded to longitudinal wires.
  5. Joint reinforcement at least 3000 mm (10 feet) in length.
  6. Joint reinforcement in rolls is not acceptable.
  7. Joint reinforcement that is crimped to form drip is not acceptable.
  8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
  9. Ladder Design:
    - a. Longitudinal wires deformed 4 mm (0.16 inch) diameter wire.
    - b. Cross wires 2.6 mm (0.10 inch) diameter.
- C. Adjustable Veneer Anchor for Frame Walls:
  1. Two piece, adjustable anchor and tie.
  2. Anchor and tie may be either type; use only one type throughout.
  3. Loop Type:
    - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
    - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.
  4. Angle Type:
    - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.

- b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.
- E. Individual ties:
  - 1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to a rectangular shape not less than 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not permitted.
  - 2. Adjustable Cavity Wall Ties:
    - a. Adjustable wall ties may be used 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 a rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into the bed joint 50 mm (2 inches).
    - e. Form the other piece to a 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having a 75 mm (3 inch) long bent section for engaging the 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 A82, W0.5, 2 mm, (16 gage) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
  - 2. Rectangular wire wall ties formed of W1.4, 3 mm, (9 gage) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.
- H. Adjustable Steel Column Anchor:
  - 1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
  - 2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend at least 75 mm (3 inches) into joints of masonry.
- I. Adjustable Steel Beam Anchor:
  - 1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
  - 2. Flange hook not less than 38 mm (1 1/2 inches) long.
  - 3. Length to embed in masonry not less than 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
  - 4. Bend masonry end not less than 40 mm (1 1/2 inches).

## 2.7 PREFORMED COMPRESSIBLE JOINT FILLER

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

- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

## **2.8 ACCESSORIES**

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

## **PART 3 - EXECUTION**

### **3.1 JOB CONDITIONS**

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

### **3.2 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
  - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
  - 2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
  - 3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
  - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  - 2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

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

### **3.3 INSTALLATION GENERAL**

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Keep brick cavity free of all mortar.
  - 1. Continually remove excess mortar from cavity.
- C. Anchor masonry as specified in Paragraph, ANCHORAGE.
- D. Wall Openings:
  - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- E. Tooling Joints:
  - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
  - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
  - 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- F. Lintels:
  - 1. Lintels are not required for openings less than 1000 mm (3 feet 4 inches) wide that have hollow metal frames.
  - 2. Openings 1025 mm (3 feet 5 inches) wide to 1600 mm (5 feet 4 inches) wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units filled with grout per ASTM C476 and reinforced with 1- #15m (1-#5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
  - 3. Precast lintels of 25 Mpa (3000 psi) concrete, of same thickness as partition, and with one Number 5 deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, may be used in lieu of reinforced CMU masonry lintels.

4. Use steel lintels, for openings over 1600 mm (5 feet 4 inches) wide, brick masonry, and elevator openings unless shown otherwise.
  5. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
  6. Length for minimum bearing of 100 mm (4 inches) at ends.
  7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.
- G. Wall, Furring, and Partition Units:
1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified 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. Use no piece shorter than 100 mm (4 inches) long.
  5. On interior partitions provide a 6 mm (1/4 inch) open joint for caulking between // existing construction, exterior walls, concrete work, and abutting masonry partitions.
  6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
  7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.
- H. Before connecting new masonry with previously laid, 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. Wetting and Wetting Test:
1. Test and wet brick or clay tile in accordance with BIA 11B.
  2. Do not wet concrete masonry units or glazed structural facing tile before laying.
  3. Special testing shall be conducted on complete mock-up assembly to ensure weather tightness.
- K. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- L. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- M. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

- N. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
1. 10 days for girders and beams.
  2. 7 days for slabs.
  3. 7 days for reinforced masonry soffits.

### **3.4 ANCHORAGE**

- A. Veneer to Frame Walls:
1. Use adjustable veneer anchors.
  2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
  3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.
- D. Masonry Furring:
1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with corrugated wall ties or dovetail anchors.
  2. Space not over 600 mm (2 feet) on centers in both directions.
- F. Anchorage to Steel Beams or Columns:
1. Use adjustable beam anchors on each flange.
  2. At columns weld the 6 mm (1/4 inch) steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

### **3.5 REINFORCEMENT**

- A. Joint Reinforcement:
1. Brick veneer over frame backing walls does not require joint reinforcement.
  2. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
  3. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
  4. Joint reinforcement is required in every other course of stack bond CMU masonry.
- B. Steel Reinforcing Bars:
1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
  2. Use grade 60 bars if not specified otherwise.
  3. Bond Beams:

- a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
- b. Brake bond beams only at expansion joints and at control joints.
- 4. Grout openings:
  - a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
  - b. Locate 75 mm x 75 mm (3 in. x 3 in.) min. clean-out holes at location of vertical reinforcement.
  - c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

### **3.6 BRICK EXPANSION AND CMU CONTROL JOINTS.**

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls.
  - 1. Install preformed compressible joint filler in brick wythe.
  - 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
  - 3. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
- E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

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

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

### **3.8 ISOLATION SEAL**

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.

- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

### **3.9 BRICKWORK**

- A. Lay clay brick in accordance with BIA Technical Note 11 series.
- B. Laying:
  - 1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise.
  - 2. Maintain bond pattern throughout.
  - 3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
  - 4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
  - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
  - 6. Do not structural bond multi wythe brick walls unless shown.
  - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
  - 8. 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 (eight 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 the 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.

### **3.10 CONCRETE MASONRY**

- A. Kind and Users:



1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Do not use brick jambs in exposed finish work.
4. Use concrete building brick only as filler in backup material where not exposed.
5. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.

B. Laying:

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

17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.
22. Simulated Cast Stone Units

Arriscraft Renaissance Stone is used as Design Basis.

Units shall match profile and finish face textures of existing building exterior window sills.

Units shall match color of existing building exterior window sills.

### **3.11 POINTING**

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

### **3.12 GROUTING**

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

C. Low Lift Method:

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

### 3.13 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the COR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- G. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- H. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- I. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

### 3.16 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.

C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Split face block-running bond
3. 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.
4. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: low-lift grouting techniques shall be used subject to requirements which follow.

F. Low-Lift Grouting:

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

**3.16 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 a solution of soapless detergent.  
Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
3. Free clean surfaces of 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.

**3.17 WATER PENETRATION TESTING**

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

**3.18 WATER TESTING ON BRICK MOCK-UP**

- A. Brick mock-up window assembly shall be water tested to ensure assembly is water tight prior to start of bonding brick/window installation
- B. If the mock-up assembly is not found to be water-tight, the mock-up shall be reconstructed until system is water-tight.

--- E N D ---

**SECTION 05 12 00  
STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Joist: Section 05 21 00, STEEL JOIST FRAMING.
- D. Steel Decking: Section 05 31 00, STEEL DECKING.
- E. Light Gage Steel Framing: Section 05 40 00 COLD-FORM METAL FRAMING
- F. Miscellaneous Metal: Section 05 50 00 METAL FABRICATIONS
- F. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

**1.3 QUALITY ASSURANCE:**

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

**1.4 TOLERANCES:**

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

- A. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
- B. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
- C. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

**1.5 DESIGN:**

- A. Connections: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with the details shown on the Drawings, supplementing where necessary. The details shown on the Drawings are conceptual and do not indicate the required weld sizes or

number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the COR of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the COR.

Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

#### **1.6 REGULATORY REQUIREMENTS:**

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

#### **1.7 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete
- C. Certificates:
  - 1. Structural steel from mill.
  - 2. Steel for all connections.
  - 3. Welding materials.
  - 4. Shop coat primer paint.
- D. Test Reports:
  - 1. Welders' AWS qualifying tests.
- E. Design Calculations and Drawings:
  - 1. Connection calculations, if required.
- F. Record Surveys.
- G. Erector qualifications and experience, showing at least five years experience.

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

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
  - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Second Edition, 2005)
  - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
  - 3. Code of Standard Practice for Steel Buildings and Bridges (2010).
- C. American National Standards Institute (ANSI):
  - B18.22.1-65(R2008) ..... Plain Washers
  - B18.22M-81(R2000) ..... Metric Plain Washers
- D. American Society for Testing and Materials (ASTM):

- A6/A6M-09 ..... Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- A36/A36M-08 ..... Standard Specification for Carbon Structural Steel
- A53/A53M-10 ..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A123/A123M-09 ..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A242/A242M-04(R2009) ..... Standard Specification for High-Strength Low-Alloy Structural Steel
- A283/A283M-03(R2007) ..... Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A307-10..... Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A325-10..... Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A490-10..... Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength
- A500/A500M-10 ..... Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07..... Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- A572/A572M-07 ..... Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- A992/A992M-06 ..... Standard Specification for Structural Steel Shapes
- E. American Welding Society (AWS):
  - D1.1/D1.1M-10..... Structural Welding Code-Steel
- F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
  - Specification for Structural Joints Using ASTM A325 or A490 Bolts
- G. Military Specifications (Mil. Spec.):
  - MIL-P-21035 ..... Paint, High Zinc Dust Content, Galvanizing, Repair
- H. Occupational Safety and Health Administration (OSHA):
  - 29 CFR Part 1926-2001 ..... Safety Standards for Steel Erection

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

- A. Structural Steel: ASTM A36, A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.



- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
  - 1. High-strength bolts, including nuts and washers: ASTM A325.
  - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
  - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.
- H. Weld Materials: AWS D.1.1.

### **PART 3 - EXECUTION**

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

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

#### **3.2 FABRICATION:**

Fabrication in accordance with Chapter M, Specification for Steel Buildings.

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

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to following:
  - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
  - 2. Surfaces which will be encased in concrete.
  - 3. Surfaces which will receive sprayed on fireproofing.
  - 4. Top flange of members which will have shear connector studs applied.
- D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting. Ensure compatibility of paint and fireproofing.
- E. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication): Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

**3.4 ERECTION:**

- A. General: Erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- C. Owner shall engage qualified third party inspection agency to perform shop inspections, weld inspections and bolt inspections per special inspection list on structural drawings.

**3.5 FIELD PAINTING:**

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

**3.6 SURVEY:**

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

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**SECTION 05 21 00  
STEEL JOIST FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies open web, longspan, and deep longspan steel joists.

**1.2 RELATED WORK:**

- A. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Finish Painting: Section 09 91 00, PAINTING.

**1.3 DESIGN REQUIREMENTS:**

Design all elements with the latest published version of applicable Codes.

**1.3 TOLERANCES:**

Deviation from a straight line between ends of any installed joist shall not exceed 10 mm in 3 m (3/8 inch in 10 feet).

**1.4 REGULATORY REQUIREMENTS:**

STEEL JOIST INSTITUTE: Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, (Latest Edition).

**1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
  - 1. Fabrication drawings including details and schedules for the fabrication and assembly of each joist.
  - 2. Erection drawings showing the size and location of each joist, bridging, cross bracing, bearing details, connections, welds, bolts and bearing plates.
- C. Certificates: STEEL JOIST INSTITUTE compliance.
- D. Design Calculations: Submit complete calculations covering the design of all members and connections. Calculations must be specifically applicable to the joists supplied.

**1.6 QUALITY ASSURANCE:**

Provide documentation that the joist manufacturer is a member of the Steel Joist Institute and has satisfactorily completed work of a similar scope and nature.

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
  - 1. 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).
- C. American Society for Testing and Materials (ASTM):
  - A307-07.....Carbon Steel Bolts and Studs, 400 MPa (60,000 psi) Tensile Strength
  - A325-09.....Structural Bolts, Steel, Heat Treated, 800/700 MPa (120/105 ksi) Minimum Tensile Strength
  - A490-08.....Heat-Treated Steel Structural Bolts, 1000 MPa (150 ksi) Minimum Tensile Strengths
- D. American Welding Society (AWS):
  - D1.1-08 .....Structural Welding Code – Steel
- E. SSPC: The Society for Protective Coatings:
  - Steel Structures Painting Manual, Volumes 1 and 2
- F. Steel Joist Institute (STEEL JOIST INSTITUTE):
  - Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders (Latest Edition).
- G. U.S. Army Corps of Engineers:
  - CRD-C-621 .....Specification for Non-Shrink Grout

## **PART 2 - PRODUCTS**

### **2.1 OPEN WEB STEEL JOISTS:**

- A. K-Series conforming to STEEL JOIST INSTITUTE standard specifications.

### **2.2 ACCESSORIES – FITTINGS:**

- A. Accessories and fittings, including end supports and bridging, in accordance with standard STEEL JOIST INSTITUTE specification under which joists were designed.
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-strength bolts, including nuts and washers: ASTM A325 or A490 heavy hexagon structural bolts.

### **2.3 BEDDING MORTAR:**

- A. For joist ends bearing on concrete or masonry, provide bedding mortar as follows:
  1. Portland cement and sand, mixed at a ratio of 1 part cement to 3 parts sand, by volume, with enough water for placement and hydration.
  2. Non-metallic, shrinkage-resistant mortar; premixed, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C-621.

## **PART 3 - EXECUTION**

### **3.1 FABRICATION:**

- A. Fabrication and assembly in accordance with applicable standard STEEL JOIST INSTITUTE specification:

1. Make chord splices with full penetration welds capable of developing the ultimate strength in tension of the parent material. Make no allowance for the strength of back-up bars or other material incidental to welding.
2. Provide shop-welded connection plates at panel points to receive supplemental framing.
3. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
4. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable STEEL JOIST INSTITUTE specifications.
5. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with STEEL JOIST INSTITUTE specifications. Provide bridging anchors for ends of bridging lines terminating at walls or beams. Provide bridging adequate to resist the loads indicated on the Contract Documents.
6. End Anchorage: Provide end anchorages, including bearing plates, to secure joists to adjacent construction, complying with STEEL JOIST INSTITUTE specifications, unless otherwise indicated. Design all end anchorages to resist a minimum net uplift of 1.6 kPa (35 pounds per square foot) of supported area.
7. Header Units: Provide header units to support all joists at openings in floor or roof system not framed with steel shapes.
8. Provide supplemental steel support framing for metal deck where normal deck bearing is precluded by other framing members and minor openings.

### **3.2 SHOP PAINTING:**

- A. Shop painting in accordance with applicable STEEL JOIST INSTITUTE standard specification.
- B. Shop paint joists and accessories with a rust-inhibiting primer paint.

### **3.3 ERECTION:**

- A. Installation of joists in accordance with applicable STEEL JOIST INSTITUTE standard specification.
- B. Handle joists in a manner to avoid damaging of joists. Remove damaged joists from site, except when field repair is approved and such repairs are satisfactorily made in accordance with manufacturer's recommendations.
- C. Accurately set joists and end anchorage in accordance with the applicable STEEL JOIST INSTITUTE standard specification. Secure joists resting on masonry or concrete bearing surfaces by welding or bolting to the steel bearing plates as indicated on the Contract Documents. Secure bridging and anchoring in place prior to application of any construction loads. Distribute any temporary loads so that carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging where joist lengths are 12 m (40 feet) and longer. Where joist lengths

are 12 m (40 feet) and longer, install a center row of bolted diagonal bridging to provide lateral stability before slackening of hoisting lines.

**3.4 FIELD PAINTING:**

- A. Clean abraded, corroded, and field welded areas and touch up with same type of paint used in shop painting.

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**SECTION 05 31 00  
STEEL DECKING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09 91 00, PAINTING.
- C. Concrete topping: 03 30 00 CAST-IN-PLACE CONCRETE

**1.3 DESIGN REQUIREMENTS:**

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

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".
- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.
- F. UL listing for assembly to be used to meet 1 hour rating.

**1.5 QUALITY ASSURANCE:**

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

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/A36M-08 ..... Standard Specification for Carbon Structural Steel
  - A611-97 ..... Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
  - A653/A653M-08 ..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
  - C423-08 ..... Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
  - 1. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design (ninth Edition, 1989)
  - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)
- D. American Iron and Steel Institute (AISI):
  - 1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members
- E. American Welding Society (AWS):
  - D1.3-08 ..... Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
  - 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement
  - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)
  - MIL-P-21035B ..... Paint, High Zinc Dust Content, Galvanizing Repair

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

- A. Steel Decking: ASTM A653, Structural Quality/.
- B. Galvanizing: ASTM A653,G60.



- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats).
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
  - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
  - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
  - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
  - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).
  - 5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.
  - 6. Seat Angles for Deck: Provide where a beam does not frame into a column.
  - 7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

## **2.2 REQUIREMENTS:**

- A. Provide steel decking of the type, depth, gauge, and section properties as shown on drawings.
- D. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
  - 1. Wide Rib (Type B) deck.

5. Finish: Galvanized G-60.
- F. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- G. Steel decking units used for interstitial levels shall include an integral system.
  1. System to provide a simple point of attachment for light duty hanger devices.
  2. System to allow for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 50 kg/m<sup>2</sup> (10 psf).
  3. System shall provide for a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely.
  4. Maximum load suspended from any hanger is 23 kg (50 pounds).
  5. System consisting of fold-down type hanger tabs or lip hanger is acceptable.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION:**

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

4. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
5. Mechanically fasten side laps of adjacent roof deck units with spans greater than 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (3 feet) o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
6. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
7. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 55 psf at eave overhang and 25 psf for other roof areas.

**G. Cutting and Fitting:**

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

**3.2 WELDING:**

- A. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.
- B. See drawings for special inspections requirements.

**3.3 FIELD REPAIR:**

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

--- E N D ---

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Open web steel joists: Section 05 21 00, STEEL JOIST FRAMING.
- C. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.
- E. Insulation: Section 07 21 13 THERMAL INSULATION
- F. Joint Sealers: Section 07 92 00 JOINT SEALERS
- G. Firestopping: Section 07 84 00 FIRESTOPPING
- H. Masonry 04 20 00 UNIT MASONRY
- I. Windows 08 51 13 ALUMINUM WINDOWS
- J. Louvers 08 90 00 LOUVERS AND VENTS

**1.3 DESIGN REQUIREMENTS:**

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.
  - a. Exterior Load-Bearing Walls: Lateral deflection of 1/180 of the wall height.
- 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or

other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).

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

#### **1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

#### **1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Iron and Steel Institute (AISI):  
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- C. American Society of Testing and Materials (ASTM):  
A36/A36M-08 ..... Standard Specifications for Carbon Structural Steel  
A123/A123M-09 ..... Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings  
on Iron and Steel Products  
A153/A153M-09 ..... Standard Specifications for Zinc Coating (Hot-Dip) on Iron and  
Steel Hardware  
A307-10..... Standard Specifications for Carbon Steel Bolts and Studs

- A653/A653M-10 ..... Standard Specifications for Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the  
Hot-Dip Process
- C1107/C1107M-08 ..... Standard Specifications for Packaged Dry, Hydraulic-Cement  
Grout (Non-shrink)
- C955 ..... Standard Specification for Load Bearing Steel Framing
- E488-96(R2003) ..... Standard Test Methods for Strength of Anchors in Concrete and  
Masonry Elements
- E1190-95(R2007) ..... Standard Test Methods for Strength of Power-Actuated  
Fasteners Installed in Structural Members
- D. American Welding Society (AWS):
- D1.3/D1.3M-08 ..... Structural Welding Code-Sheet Steel
- E. Military Specifications (Mil. Spec.):
- MIL-P-21035B ..... Paint, High Zinc Dust Content, Galvanizing Repair

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

- A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM A653, structural steel, zinc coated G60, with a yield of 340 MPa (50 ksi) minimum.
- B. Sheet Steel for joists, studs and accessories 18 gage and lighter: ASTM A653, structural steel, zinc coated G60, with a yield of 230 MPa (33 ksi) minimum.
- C. Galvanizing Repair Paint: MIL-P-21035B.D.      Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and a 30 minute working time.

### **2.2 WALL FRAMING:**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with structural drawings and the following:
  1. Design Uncoated-Steel Thickness:                      1.52 mm (0.0598 inch)
  2. Flange Width:                      (2 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 structural drawings and 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 JOIST FRAMING:**

A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness  
// 1.52 mm (0.0598 inch). // // 1.90 mm 0.0747 inch).

2. Flange Width: (2 inches).

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: Matching steel joists.
2. Flange Width 51 mm (2 inches).

### **2.4 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. Joist hangers and end closures.
- 8. Reinforcement plates.

## **2.5 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.

## **2.6 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. Handle and lift prefabricated panels in a manner as to not distort any member.
- B. Securely anchor tracks to supports as shown.
- C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- G. Install headers in all openings that are larger than the stud spacing in that wall.
- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.
- I. Studs in one piece for their entire length, splices will not be permitted.
- J. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- K. Provide joist bridging and web stiffeners at reaction points where shown.
- L. Provide end blocking where joist ends are not restrained from rotation.
- M. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
- N. Provide temporary bracing and leave in place until framing is permanently stabilized.
- O. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- P. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

**3.3 TOLERANCES:**

- A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

**3.4 FIELD REPAIR:**

Touch-up damaged galvanizing with galvanizing repair paint.

--- E N D ---

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items: (12, 14A, 14C)
  - 2. Frames: (24E)
  - 3. Attachment for Ships Ladder
  - 4. Exterior Bollards
  - 5. 18 Gage Metal striping for blocking
  - 6. Loose Lintels
  - 7. Railings: (10)
  - 8. Catwalks and Platforms
  - 9. Trap Doors with Ceiling Hatch
  - 10. Screened Access Doors
  - 11. Stainless Steel Counter

**1.2 RELATED WORK**

- A. Manufactures drawings 01 33 23 SHOP DRAWINGS
- B. Testing: Section 01 45 29, TESTING AND LABORATORY SERVICES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.
- D. corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

- C. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.

2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
1. Finishes as specified.
  2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

#### **1.4 QUALITY ASSURANCE**

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

#### **1.5 APPLICABLE PUBLICATIONS**

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

- A312/A312M-09 ..... Seamless, Welded, and Heavily Cold Worked Austenitic  
Stainless Steel Pipes
- A653/A653M-10 ..... Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated  
(Galvannealed) by the Hot-Dip Process
- B221-08..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire,  
Shapes, and Tubes
- B456-03(R2009) ..... Electrodeposited Coatings of Copper Plus Nickel Plus Chromium  
and Nickel Plus Chromium
- B632-08..... Aluminum-Alloy Rolled Tread Plate
- C1107-08 ..... Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-07 ..... Insect Screening and Louver Cloth Woven from Vinyl-Coated  
Glass Yarns
- F436-10..... Hardened Steel Washers
- F468-10..... Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02(R2008)..... Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-11 ..... Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
- D1.1-10 ..... Structural Welding Code Steel
- D1.2-08 ..... Structural Welding Code Aluminum
- D1.3-08 ..... Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP 521-01 ..... Pipe Railing Manual
- AMP 500-06 ..... Metal Finishes Manual
- MBG 531-09..... Metal Bar Grating Manual
- MBG 532-09..... Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
- SP 1-04 ..... No. 1, Solvent Cleaning
- SP 2-04 ..... No. 2, Hand Tool Cleaning
- SP 3-04 ..... No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
- RR-T-650E ..... Treads, Metallic and Nonmetallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Railings and Handrails: 250 pounds in any direction at any point.
- C. Catwalks and Platforms: 100 pounds per square foot. Use 500 pounds for concentrated loads.

D. Manhole Covers: 1200 kg/m<sup>2</sup> (250 pounds per square foot).

## 2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- E. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- J. Modular Channel Units:
  - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
  - 2. Form channel within turned pyramid shaped clamping ridges on each side.
  - 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
  - 4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
  - 5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.
- K. Grout: ASTM C1107, pourable type.
- L. Insect Screening: ASTM D3656.

## 2.3 HARDWARE

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

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

## **2.4 FABRICATION GENERAL**

### **A. Material**

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

### **B. Size:**

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

### **C. Connections**

- 1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
- 2. Field riveting will not be approved.
- 3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
- 4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
- 5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
- 6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
- 7. Use stainless steel connectors for removable members machine screws or bolts.

### **D. Fasteners and Anchors**

- 1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
- 2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.



3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:
  - a. Fabricate items to design shown.
  - b. Furnish members in longest lengths commercially available within the limits shown and specified.
  - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
  - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
  - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
  - f. Prepare members for the installation and fitting of hardware.
  - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
  - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
  - a. Weld in accordance with AWS.
  - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
  - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
  - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
  - a. Miter or butt members at corners.
  - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

## 4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

## 5. Cutting and Fitting:

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

## F. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
- 2. Aluminum: NAAMM AMP 501.
  - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
  - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
  - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
  - d. Painted: AA-C22R10.
- 3. Steel and Iron: NAAMM AMP 504.
  - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
  - b. Surfaces exposed in the finished work:
    - 1) Finish smooth rough surfaces and remove projections.
    - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
  - c. Shop Prime Painting:

- 1) Surfaces of Ferrous metal:
  - a) Items not specified to have other coatings.
  - b) Galvanized surfaces specified to have prime paint.
  - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
  - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
  - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

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

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

G. Protection:

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

## 2.5 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 flatted 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.

I. Supports for Exam Curtains and Items at Various Conditions at Suspended Ceilings:

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

## 2.6 FRAMES

### B. Channel Door Frames:

1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
  - a. Cut a slot in the lock jamb to receive the lock bolt.
  - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

## 2.10 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
  1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
  2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
  - 1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
  - 2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

## **2.12 PLATE DOOR SILL**

- A. Fabricate of checkered plate as detailed.
  - 1. Aluminum Plate: ASTM B632, 3 mm (0.125 inch) thick.
  - 2. Steel Plate: ASTM A786, 3 mm (0.125 inch thick), galvanized G90.
- B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 300 mm (12 inches), o.c.

## **2.13 SAFETY NOSINGS**

- A. Fed. Spec. RR-T-650, Type C.
  - 1. Aluminum: Class 2, Style 2.
  - 2. Cast iron: Class 4.
- B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.
- C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.
- D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.
- E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.
- F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.
- G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

## **2.14 LADDERS**

- A. Steel Ladders:
  - 1. Refer to Specification Section 05 51 50.

## 2.15 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.
  - 5. Exterior Railings and Post Anchors shall be of Aluminum. Prefabricated components are acceptable providing they are constructed as follows:
    - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
    - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
    - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts
- 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.

## 2.16 CATWALKS

- A. Fabricate catwalks including platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.
- B. Catwalk and platforms floor surfaces as shown on drawings.
- C. Prime paint catwalk system.

## 2.17 TRAP DOOR AND FRAMES WITH CEILING HATCH

- A. Design to support a live load as specified.
- B. Frames:
  - 1. Fabricate steel angle frame to set in concrete slabs and design to set flush with finished concrete slab or curb. If not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles.
  - 2. Miter steel angles at corners and weld together.
  - 3. Weld steel bar stops to vertical leg of frame, to support doors flush with the top of the frame.

4. Weld steel strap anchors on each side not over 600 mm (24 inches) on center to the backs of the frames. If not shown use 6 x 50 x 200 mm (1/4 x 2 x 8 inch) long straps with 50 mm (2 inch bent) ends.
5. Form frames from steel angles with welded corners for reinforcing and bracing of well lining and support of ceiling hatch.

C. Covers:

1. Use 6 mm (1/4 inch) thick steel floor plate.
2. Where double leaf covers are shown, reinforce at meeting edges.
3. Use wrought steel hinges with fixed brass pins.
  - a. Weld to cover.
  - b. Secure to frame with machine screws.
4. Where ladders occur, install hinges on the side opposite the ladder.
5. Provide two bar type drop handles, flush with cover when closed for each leaf.

D. Ceiling Hatch:

1. Construct hatch with "T" or angle frame designed to support edge of ceiling and hatch, weld to well lining.
2. Form hatch panels of 3 mm (1/8 inch) steel, 5 mm (3/16 inch) aluminum or 1 mm (0.0359 inch) thick steel of pan type construction with 25 mm (one inch) of mineral fiber insulation between.
3. Use counter balance device, hinges, latch, hangers and other accessories required for installation and operation of hatch with not over 90 N (20 pounds) of force.
4. Fabricate panels flush and reinforced to remain flat.
5. Locate hatch panel flush with frame.

E. Finish with baked on prime coat.

## 2.20 STEEL COUNTER

- A. Fabricate channel or angle frame with mitered and welded corners as shown.
- B. Drill top of frame with 6 mm (1/4inch) holes spaced 200 mm (8 inches) on center for securing countertop.
- C. Fabricate legs of angle or pipe shapes and continuously weld to frame.
- D. Finish frame with backed on enamel prime coat.

## 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.
- I. Coordinate all special inspections during fabrication and erection.

### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  4. Secure steel plate or hat channels to studs as detailed.
- C. Supports for Wall Mounted items:
  1. Locate center of support at anchorage point of supported item.
  2. Locate support at top and bottom of wall hung cabinets.
  3. Locate support at top of floor cabinets and shelving installed against walls.
  4. Locate supports where required for items shown.
- G. Support for cantilever grab bars:
  1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
  2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
  3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
  4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

### **3.3 DOOR FRAMES**

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.



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

### **3.4 OTHER FRAMES**

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

### **3.9 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.

### **3.11 PLATE DOOR SILL**

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.

### **3.14 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 fixed flanged fittings to concrete with expansion bolts.
  5. Secure posts to steel with welds.
- B. 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.

### **3.15 CATWALK AND PLATFORMS**

- B. Bolt or weld structural components together including ladders and stairs to support system.
- C. Weld railings to structural framing.

- D. Weld walk surface to structural framing.
- E. Smooth field welds and spot prime damaged prime paint surface.
- F. Fasten removable members with stainless steel fasteners.

### **3.18 STEEL COMPONENTS FOR MILLWORK ITEMS**

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

### **3.19 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 50**  
**LADDERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes:
  - 1. Aluminum ship's ladders.

**1.2 RELATED SECTIONS**

- A. Section 055000 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

**1.3 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. Aluminum Association (AA).
- C. American Society for Testing And Materials (ASTM)
- D. OSHA 1910.27 – Fixed Ladders.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Manufacturer's data sheets on each product.
- C. Shop Drawings:
  - 1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
  - 2. Provide templates for anchors and bolts specified for installation under other Sections.
  - 3. Provide reaction loads for each hanger and bracket.
- D. Qualification Data:
  - 1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.
- E. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project for a minimum of 10 years.
  - 1. Record of successful in-service performance.
  - 2. Sufficient production capacity to produce required units.
  - 3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

- B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.
- C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.

## **1.7 PROJECT CONDITIONS**

- A. Field Measurements: Verify dimensions by field measurement before fabrication.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

## **1.8 WARRANTY**

- A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
  - 1. Defects in materials and workmanship.
  - 2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
  - 3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.
- B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

## **1.9 EXTRA MATERIALS**

- A. Furnish touchup kit for each type and color of paint finish provided.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis-of-Design Manufacturer: O'Keeffe's, Inc.; 325 Newhall St. San Francisco, CA 94124. ASD.  
Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email:  
info@okeeffes.com. Web: <http://www.okeeffes.com> approved equal.

### **2.2 APPLICATIONS/SCOPE**

- A. Ship Ladder:

1. Ship Ladder with Platform.
  - a. Model 521 as manufactured by O’Keeffe’s Inc.
2. Incline:
  - a. As drawn.

## **2.3 FINISHES**

- A. Mill finish. As extruded.
- B. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.
- C. Paint. Urethane over chemically pretreated substrate. Verify color preference with owner as follows:
  1. Caution Yellow (RAL 1018).

## **2.4 MATERIALS**

- A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
- B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

## **2.5 FABRICATION**

- A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
  1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
- B. Ship Ladder Seismic Bottom Support: Manufacturer’s standard; two isolation bearings per stringer.
- C. Ladder Safety Post: Retractable hand hold and tie off.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
- B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
- C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

### **3.3 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

--- E N D ---

**SECTION 06 06 60**  
**PLASTIC FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the Plastic Fabrication as shown and specified in the described system(s):
  - 1. Interior window panels
- B. Related Sections include the following:
  - 1. Section 08 11 13 Hollow Metal Doors & Frames

**1.2 SUBMITTALS**

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 "Submittal Procedures".
- B. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.
- C. Submit product test reports from a qualified independent 3rd party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
  - 1. Test reports required are:
    - a. Rate of Burning (ASTM D 635)
    - b. Self-Ignition Temperature (ASTM D 1929)
    - c. Density of Smoke (ASTM D 2843)
    - d. Flame spread and Smoke developed testing (ASTM E 84)
    - e. Room Corner Burn Test (NFPA 286)
    - f. Extent of Burning (UL 94)
    - g. Impact strength (ASTM D 3763)
    - h. Safety glazing impact resistance (ANSI Z97.1-2004)
    - i. UPIIT Test for Combustion Product Toxicity
    - j. Dynamic environmental testing (ASTM standards D 5116 and D 6670)
- D. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.
- E. Samples for Initial Selection:
  - 1. Submit minimum 1 foot by 1 foot samples. Indicate full color, texture and pattern variation.
- F. Samples for Verification:
  - 1. Submit minimum 4 - 1 foot by 1 foot samples for each type, texture, pattern and color of solid plastic fabrication.
- G. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

### **1.3 QUALITY ASSURANCE**

#### **A. Manufacturers Qualifications**

1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five (5) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been successful for use five (5) years or longer.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver Plastic Fabrications, systems and specified items in manufacturer's standard protective packaging.
- B. Do not deliver Plastic Fabrications, system, components and accessories to Project site until areas are ready for installation.
- C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.
- D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.
- E. Before installing Plastic Fabrications, permit them to reach room temperature.

### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install Solid Polymer Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

### **1.6 WARRANTY**

- A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.
- B. Warranty Period: 1 year after the date of substantial completion.
- C. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURER**

- A. Manufacturer: 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500

### **2.2 MATERIALS**

- A. Varia™ produced from ecoresin™ Sheet
  1. Style: Thatch.
  2. Engineered polyester resin
  3. Front and Back Finish: Sandstone.
  4. Sheet Size: Maximum 4' x 10', Gauge 3/8 inch.
  5. Thickness: as needed for maximum impact resistance.

6. Basis of Design Product: The design of Plastic Fabrications is based on Varia™ produced with ecoresin™ as provided by 3form, Inc. Products from other manufacturers must be approved by the Architect or Designer prior to bidding in accordance with the Instructions to Bidders and Section 01 60 00 "Product Requirements".
- B. Interlayer Materials: Compatible with polyesters and bonding process to create a monolithic sheet of material when complete.
- C. Sheet minimum performance attributes:
  1. Rate of Burning (ASTM D 635). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
  2. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 650°F.
  3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 75%.
  4. Flame spread and Smoke developed testing (ASTM E 84). Material must be able to meet a level of Class A (Flame spread less than 25 and smoke less than 450) at thickness of 1".
  5. Room Corner Burn Test (NFPA 286). Material must meet Class A criteria at ¼" thickness as described by the 2003 International Building Code.
  6. Extent of Burning (UL 94). Must submit UL card.
  7. Impact strength. Minimum impact strength test as measured by ASTM D 3763 of 20 ft. lbs. (for durability, shipping, installation, and use).
  8. Safety Glazing. Material must attain a Class A impact rating in accordance with ANSI Z97.1-2004 at 1/8" thickness.
  9. UPITT Test for Combustion Product Toxicity: Product must be recorded as "not more toxic than wood".
  10. Dynamic environmental testing (ASTM standards D 5116 and D 6670). Panels must not have detectable VOC off-gassing agents and must be have Greenguard™ Indoor Air Quality certified.
  11. Panels must be produced from a minimum of 40% post-industrial recycle content. This recycle content must be certified by a recognized 3rd party certification group, such as Scientific Certification Systems (SCS).

## **2.3 FABRICATION**

- A. General: Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the drawings.
- B. Comply with manufacturer's written recommendations for fabrication.
- C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
  1. Sawing: Select equipment and blades suitable for type of cut required.



2. Drilling: Drills specifically designed for use with plastic products.
  3. Milling: Climb cut where possible.
  4. Routing
  5. Tapping
- D. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
1. Cold Bending
  2. Hot Bending
  3. Thermoforming: Acceptable only on uncoated material.
  4. Drape Forming
  5. Matched Mold Forming
  6. Mechanical Forming
- E. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

## **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.
- C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.
- D. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

### **3.2 INSTALLATION**

- A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.
- B. Manufacturer's shop to fabricate items to the greatest degree possible.
- C. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
- D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

- E. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

### **3.3 CLEANING AND PROTECTION**

- A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to VA COR & Architect's satisfaction.

--- E N D ---

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

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

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

#### **1.2 RELATED WORK:**

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

#### **1.3 SUBMITTALS:**

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

#### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:**

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

#### **1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):  
National Design Specification for Wood Construction  
NDS-05 ..... Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):  
A190.1-07..... Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):  
B18.2.1-96(R2005) ..... Square and Hex Bolts and Screws  
B18.2.2-87 ..... Square and Hex Nuts  
B18.6.1-97 ..... Wood Screws  
B18.6.4-98(R2005) ..... Thread Forming and Thread Cutting Tapping Screws and  
Metallic Drive Screws
- E. American Plywood Association (APA):  
E30-07 ..... Engineered Wood Construction Guide

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

- A47-99(R2009)..... Ferritic Malleable Iron Castings
- A48-03(R2008)..... Gray Iron Castings
- A653/A653M-10 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated  
(Galvannealed) by the Hot Dip Process
- C954-10 ..... Steel Drill Screws for the Application of Gypsum Board or Metal  
Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to  
0.112-inch (2.84 mm) in thickness
- C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of  
Gypsum Panel Products or Metal Plaster Bases to Wood Studs  
or Metal Studs
- D143-09 ..... Small Clear Specimens of Timber, Method of Testing
- D1760-01 ..... Pressure Treatment of Timber Products
- D2559-10 ..... Adhesives for Structural Laminated Wood Products for Use  
Under Exterior (Wet Use) Exposure Conditions
- D3498-11 ..... Adhesives for Field-Gluing Plywood to Lumber Framing for Floor  
Systems
- F844-07 ..... Washers, Steel, Plain (Flat) Unhardened for General Use
- F1667-08 ..... Nails, Spikes, and Staples

G. Federal Specifications (Fed. Spec.):

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

H. Commercial Item Description (CID):

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

I. Military Specification (Mil. Spec.):

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

J. Truss Plate Institute (TPI):

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

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

- PS 1-95 ..... Construction and Industrial Plywood
- PS 20-05 ..... American Softwood Lumber Standard

## **PART 2 - PRODUCTS**

### **2.1 LUMBER:**

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

1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.
- C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
  2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
  3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
5. All exterior trim & rafter tails to be Douglas fir No. 1.
- D. Sizes:
1. Conforming to Prod. Std., PS20.
  2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- E. Moisture Content:
1. At time of delivery and maintained at the site.
  2. Boards and lumber 50 mm (2 inches) and less in thickness: 15 percent or less.
  3. Lumber over 50 mm (2 inches) thick: 19 percent or less.
- F. Fire Retardant Treatment:
1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
  2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.
- G. Preservative Treatment:
1. Do not treat Heart Redwood and Western Red Cedar.
  2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
    - a. Do not treat finished lumber.
  3. Treat other members specified as preservative treated (PT).

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

## 2.2 PLYWOOD

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
  1. APA rated Exposure 1 or Exterior; panel grade CD or better.
  2. Wall sheathing:
    - a. Minimum ½ inch thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
    - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
  3. Roof sheathing:
    - a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 400 mm (16 inches) on center unless specified otherwise.
    - b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 600 mm (24 inches) on center.

## 2.3 STRUCTURAL-USE PANELS

- A. Comply with APA.
- B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
- C. Wall and Roof Sheathing:
  1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 400 mm (16 inches) on center and 24/0 or greater for supports 600 mm (24 inches) on center.

~~E. Laminated Veneer Lumber (LVL):~~

## 2.4 ROUGH HARDWARE AND ADHESIVES:

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

- B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
  - 1. ASTM F844.
  - 2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
  - 1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
  - 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
  - 1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
  - 2. ASTM F1667:
    - a. Common: Type I, Style 10.
    - b. Concrete: Type I, Style 11.
    - c. Barbed: Type I, Style 26.
    - d. Underlayment: Type I, Style 25.
    - e. Masonry: Type I, Style 27.
    - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.
- F. Framing and Timber Connectors:
  - 1. Fabricate of ASTM A446, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
  - 2. Framing Angles: Angle designed with bendable legs to provide three way anchors.
  - 3. Straps:
    - a. Designed to provide wind and seismic ties with sizes as shown or specified.
    - b. Strap ties not less than 32 mm (1-1/4 inches) wide.
    - c. Punched for fastener.
  - 5. Joist Hangers (Simpson or equivalent):
    - a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.

- b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
- 7. Joist Ties: Mild steel flats, 5 by 32 mm (3/16 by 1-1/4 inch size with ends bent about 30 degrees from horizontal, and extending at least 400 mm (16 inches) onto framing. Punch each end for three spikes.
- 8. Wall Anchors for Joists and Rafters:
  - a. Mild steel strap, 5 by 32 mm (3/16 by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 by 130 mm (3/8 by 5 inch) pin through strap end built into masonry.
  - b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
  - c. Strap not less than 100 mm (4 inches) embedded end.
- 9. Joint Plates:
  - a. Steel plate punched for nails.
  - b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
  - c. Size for axial eccentricity, and fastener loads.
- G. Adhesives:
  - 1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
  - 2. For structural laminated Wood: ASTM D2559.

### **PART 3 - EXECUTION**

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

- A. Conform to applicable requirements of the following:
  - 1. AFPA National Design Specification for Wood Construction for timber connectors.
  - 2. AITC Timber Construction Manual for heavy timber construction.
  - 3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
  - 4. APA for installation of plywood or structural use panels.
- B. Fasteners:
  - 1. Nails.
    - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
    - b. Use special nails with framing connectors.
    - c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.



- d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
  - e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.
  - f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
- 3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
  - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
- 4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
- 5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
- 6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
  - 1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
  - 2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
  - 3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
  - 1. Install furring, blocking, nailers, and grounds where shown.
  - 2. Use longest lengths practicable.
  - 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
  - 4. Layers of Blocking or Plates:

- a. Stagger end joints between upper and lower pieces.
  - b. Nail at ends and not over 600 mm (24 inches) between ends.
  - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
- //6. Unless otherwise shown, use wall furring 25 mm by 75 mm (1 inch by 3 inch) continuous wood strips installed plumb on walls, using wood shims where necessary so face of furring forms a true, even plane. Space furring not over 400 mm (16 inches) on centers, butt joints over bearings and rigidly secure in place. Anchor furring on 400 mm (16 inches) centers. //

~~K. Rough Bucks:~~

- ~~1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.~~
- ~~2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.~~
- ~~3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.~~
- ~~4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.~~

L. Sheathing:

- 1. Use plywood or structural-use panels for sheathing.
- 2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
- 3. Set nails not less than 9 mm (3/8 inch) from edges.
- 4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
- 5. Match and align sheathing which is an extension of work in place to existing.

--- E N D ---

## **SECTION 06 16 00 SHEATHING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies board sheathing applied to frame wall construction, ready to receive subsequent finishes.

#### **1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Glass board panels, 200 mm by 200 mm (8 inches by 8 inches), minimum size.
  - 2. Fasteners, each type used.
  - 3. Reinforcing tape for joints 300 mm (12 inches) long.
- C. Product Data:
  - 1. Glass board sheathing.
  - 2. Reinforcing tape.
  - 3. Fasteners.

#### **1.3 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact.
- B. Store materials so as to prevent damage or contamination.

#### **1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  - A108.11-1999..... Interior Installation of Backer Units
  - A118.9-1999..... Backer Units
- C. American Society for Testing and Materials (ASTM):
  - C954-04 ..... 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.
  - D226-06 ..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - D4586-07 ..... Asphalt Roof Cement, Asbestos-Free
- D. Federal Specifications (FS):
  - UU-B-790 ..... Building Paper, Vegetable Fiber INT AMD 1 (Kraft, Waterproofed, Water Repellant and Fire Resistant)

### **PART 2 - PRODUCTS**

#### **2.1 BOARD SHEATHING**

- A. Conform to ANSI A118.9, except physical property requirements defined in Table 1 changed to not less than the minimum values stated below.

- B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
  - 1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
  - 2. Size: [48 by 96 inches (1219 by 2438 mm)

## **2.2 ACCESSORY MATERIALS**

- A. Steel Drill Screws: ASTM C954. Modified for flat head. Bugle head not acceptable.

## **PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install units when temperature is below 4.5 degrees Celsius (40 degrees F).
- B. Do not install joint reinforcing tape when temperature is below 10 degrees Celsius (50 degrees F).

### **3.2 INSTALLATION**

- B. A. Remove wrapping and separate to allow air circulation for not less than seven days before installation. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- B. Installing Water Barrier over Framing Members:
  - 1. Apply roof cement or tape to framing members sufficient to adhere and support water barrier.
  - 2. Use either organic felt or water barrier.
  - 3. Apply barrier shingle fashion with horizontal joints lapped not less than 50 mm (2 inches). Lap end joints over framing, not less than 100 mm (4 inches) cemented together with roof cement, stagger end joints.
  - 4. Do not leave over 300 mm (12-inch) wide strip exposed when work is stopped.
  - 5. Coordinate with installation of flashing to lap water barrier over flashing. Install weeps every 600 mm (24 inches) or as detailed, directly above flashing. Provide for clear exit of water to exterior.
  - 6. Repair torn or cut barrier with barrier patch spanning framing space cemented to surface along top and side edges.
- C. Installing Board Units:
  - 1. Apply cement board sheathing immediately over water barrier in accordance with ANSI A108.11, with rounded edges and rough side to exterior, except as specified otherwise.
  - 2. Secure units to framing members with screws spaced not more than 200 mm (8 inches) on center and not closer than 13 mm (1/2-inch) from the edge of the unit.
  - 3. Install screws so that the screw heads do not penetrate the surface of unit.
  - 4. Install 13 mm (1/2-inch) wide horizontal control joints at floors and vertical control joints not over 4.87 m (16 feet) on center unless shown otherwise, maintain alignment.
  - 5. Stop units at edges of building expansion joints.
  - 6. Minimum bearing over framing members: 19 mm (3/4-inch.)
- D. Joint and Surface Treatment: Apply joint reinforcing tape over joints, exposed edges, and corners using adhesive recommended by manufacturer.

- E. Leave surface flush and ready to receive subsequent finishes.

### **3.3 PROTECTION AND REPAIR**

- A. Protect board with temporary coverings against moisture until subsequent finish is applied.
- B. Patch and repair damaged surface prior to application of subsequent finish.
  - 1. Fill cracks.
  - 2. Replace loose, spalling or missing joint finish.
  - 3. Replace broken or damaged boards.

--- E N D ---

## **SECTION 06 16 63 CEMENTITIOUS SHEATHING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies cement board sheathing applied to frame wall construction, ready to receive subsequent finishes.

#### **1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: 1. Cement board panels, 200 mm by 200 mm (8 inches by 8 inches), minimum size.  
2. Fasteners, each type used.  
3. Reinforcing tape for joints 300 mm (12 inches) long.  
4. Water barrier backing, 300 mm (12 inches) square.
- C. Product Data:
  - 1. Cement board sheathing.
  - 2. Reinforcing tape.
  - 3. Fasteners.

#### **1.3 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact.
- B. Store materials so as to prevent damage or contamination.

#### **1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  - A108.11-99(R2010)..... Interior Installation of Cementitious Backer Units
  - A118.9-99(R2010)..... Cementitious Backer Units
- C. American Society for Testing and Materials (ASTM):
  - 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.
  - D226-09 ..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - D4586-07 ..... Asphalt Roof Cement, Asbestos-Free
- D. Federal Specifications (FS):
  - UU-B-790 ..... Building Paper, Vegetable Fiber INT AMD 1 (Kraft, Waterproofed, Water Repellant and Fire Resistant)

### **PART 2 - PRODUCTS**

#### **2.1 CEMENT BOARD SHEATHING**

- A. Conform to ANSI A118.9, except physical property requirements defined in Table 1 changed to not less than the minimum values stated below.
- B. Property Minimum Average Value

- a.) Manufacturer: Certainteed or equal.
- |   |                        |
|---|------------------------|
| 1. Water Absorption by Weight, ASTM D1037 | 20 percent maximum     |
| 2. Flame Spread                           | 5                      |
| 3. Smoke Density                          | 0                      |
| 4. Thickness                              | 13 mm (1/2 inch)       |
| 5. Minimum Width                          | 800 mm (32 inches)     |
| //6. Flexural Strength wet and dry        | 6895 kpa (1000 psi)    |
| 7. Fastener Holding wet and dry           | 33 kpa (125 pounds) // |

## **2.2 ACCESSORY MATERIALS**

- A. Steel Drill Screws: ASTM C954. Modified for flat head. Bugle head not acceptable.
- B. Organic Felt: ASTM D226, Type II, 13.6 kg (30 lb).
- C. Roof Cement: ASTM D4586
- D. Joint Reinforcing Tape:
  - 1. Minimum 100 mm (4-inches) wide open mesh alkali resistant.
  - 2. Glass fiber mesh polymer coated as recommended by Cement Board manufacturer.
- E. Water Barrier: FS UU-B-790. Type I (Barrier paper), Grade D (Water-vapor permeable). Other products meeting or exceeding the Federal specification for a water barrier with water vapor permeability are acceptable.

## **PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install units when temperature is below 4.5 degrees Celsius (40 degrees F).
- B. Do not install joint reinforcing tape when temperature is below 10 degrees Celsius (50 degrees F).

### **3.2 INSTALLATION**

- A. Remove wrapping and separate to allow air circulation for not less than seven days before installation.
- B. Installing Water Barrier over Framing Members:
  - 1. Apply roof cement or tape to framing members sufficient to adhere and support water barrier.
  - 2. Use either organic felt or water barrier.
  - 3. Apply barrier shingle fashion with horizontal joints lapped not less than 50 mm (2 inches). Lap end joints over framing, not less than 100 mm (4 inches) cemented together with roof cement, stagger end joints.
  - 4. Do not leave over 300 mm (12-inch) wide strip exposed when work is stopped.
  - 5. Coordinate with installation of flashing to lap water barrier over flashing. Install weeps every 600 mm (24 inches) or as detailed, directly above flashing. Provide for clear exit of water to exterior.
  - 6. Repair torn or cut barrier with barrier patch spanning framing space cemented to surface along top and side edges.
- C. Installing Cement Board Units:
  - 1. Apply cement board sheathing immediately over water barrier in accordance with ANSI A108.11, with rounded edges and rough side to exterior, except as specified otherwise.

2. Secure units to framing members with screws spaced not more than 200 mm (8 inches) on center and not closer than 13 mm (1/2-inch) from the edge of the unit.
  3. Install screws so that the screw heads do not penetrate the surface of unit.
  4. Install 13 mm (1/2-inch) wide horizontal control joints at floors and vertical control joints not over 4.87 m (16 feet) on center unless shown otherwise, maintain alignment.
  5. Stop units at edges of building expansion joints.
  6. Minimum bearing over framing members: 19 mm (3/4-inch.)
- D. Joint and Surface Treatment: Apply joint reinforcing tape over joints, exposed edges, and corners using adhesive recommended by manufacturer.
- E. Leave surface flush and ready to receive subsequent finishes.

### **3.3 PROTECTION AND REPAIR**

- A. Protect board with temporary coverings against moisture until subsequent finish is applied.
- B. Patch and repair damaged surface prior to application of subsequent finish.
1. Fill cracks.
  2. Replace loose, spalling or missing joint finish.
  3. Replace broken or damaged boards.

--- E N D ---



## **SECTION 06 20 00 FINISH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies exterior and interior millwork.

#### **1.2 RELATED WORK**

- A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Wood doors: Section 08 14 00, WOOD DOORS.
- D. Other Countertops: and Division 12, FURNISHINGS.
- E. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

#### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Millwork items – Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
  - 2. Show construction and installation.
- C. Samples:
  - Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
- D. Certificates:
  - 1. Indicating // preservative treatment // fire retardant treatment // of materials meet the requirements specified.
  - 2. Indicating moisture content of materials meet the requirements specified.
- E. List of acceptable sealers for fire retardant and preservative treated materials.
- F. Manufacturer's literature and data:
  - 1. Finish hardware
  - 2. Sinks with fittings
  - 3. Electrical components

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by VA COR. Store at a minimum temperature of 21<sup>0</sup>C (70<sup>0</sup>F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

## 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
  - A36/A36M-08 ..... Structural Steel
  - A53-07 ..... Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
  - A167-99 (R2009) ..... Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - B26/B26M-09 ..... Aluminum-Alloy Sand Castings
  - B221-08 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - E84-09 ..... Surface Burning Characteristics of Building Materials
- C. American Hardboard Association (AHA):
  - A135.4-04 ..... Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):
  - A156.9-03 ..... Cabinet Hardware
  - A156.11-04 ..... Cabinet Locks
  - A156.16-02 ..... Auxiliary Hardware
- E. Hardwood Plywood and Veneer Association (HPVA):
  - HP1-09 ..... Hardwood and Decorative Plywood
- F. National Particleboard Association (NPA):
  - A208.1-99 ..... Wood Particleboard
- G. American Wood-Preservers' Association (AWPA):
  - AWPA C1-03 ..... All Timber Products – Preservative Treatment by Pressure Processes
- H. Architectural Woodwork Institute (AWI):
  - AWI-99 ..... Architectural Woodwork Quality Standards and Quality Certification Program
- I. National Electrical Manufacturers Association (NEMA):
  - LD 3-05 ..... High-Pressure Decorative Laminates
- J. U.S. Department of Commerce, Product Standard (PS):
  - PS20-05 ..... American Softwood Lumber Standard
- K. Military Specification (Mil. Spec):
  - MIL-L-19140E ..... Lumber and Plywood, Fire-Retardant Treated
- L. Federal Specifications (Fed. Spec.):
  - A-A-1922A ..... Shield Expansion

A-A-1936 .....	Contact Adhesive
FF-N-836D .....	Nut, Square, Hexagon Cap, Slotted, Castle
FF-S-111D(1) .....	Screw, Wood
MM-L-736(C) .....	Lumber, Hardwood

## **PART 2 - PRODUCTS**

### **2.1 LUMBER**

- A. Grading and Marking:
  - 1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
  - 2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  - 3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Sizes:
  - 1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
  - 2. Millwork, standing and running trim, and rails: Actual size as shown or specified.
- C. Hardwood: MM-L-736, species as specified for each item.
- D. Softwood: PS-20, exposed to view appearance grades:
  - 1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
  - 2. Use Prime for painted or opaque finish.
- E. Use edge grain Wood members exposed to weather.

### **2.2 PARTICLEBOARD**

- A. NPA A208.1
- B. Plastic Laminate Particleboard Cores:
  - 1. Use Type 1, Grade 1-M-3, or Type 2, Grade 2-M-2, unless otherwise specified.
  - 2. Use Type 2, Grade 2-M-2, exterior bond, for tops with sinks.
- C. General Use: Type 1, Grade 1-M-3 or Type 2, Grade 2-M-2.
- D. Formaldehyde-free particle board.

### **2.3 PLASTIC LAMINATE**

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.

- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
  - 1. Plastic laminate clad plywood or particle board.
  - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

## **2.4 BUILDING BOARD (HARDBOARD)**

- A. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
- B. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.
- C. Wall paneling at gas chain rack: Type 1, tempered, Fire Retardant treated, smooth surface on side.

## **2.5 ADHESIVE**

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

## **2.6 STAINLESS STEEL**

ASTM A167, Type 302 or 304.

## **2.7 ALUMINUM CAST**

ASTM B26

## **2.8 ALUMINUM EXTRUDED**

ASTM B221

## **2.9 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
  - 2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
  - 3. Fasteners:
    - a. Bolts with Nuts: FF-N-836.
    - b. Expansion Bolts: A-A-1922A.
    - c. Screws: Fed. Spec. FF-S-111.
- B. Finish Hardware
  - 1. Cabinet Hardware: ANSI A156.9.
    - a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.

- b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
  - c. Sliding Door Tracks: B07063.
  - d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
  - e. Concealed Hinges: B1601, minimum 110 degree opening.
  - f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
  - g. Cabinet Door Catch: B0371 or B03172.
  - h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
- 2. Cabinet Locks: ANSI A156.11.
  - a. Drawers and Hinged Door: E07262.
  - b. Sliding Door: E07162.
- 3. Auxiliary Hardware: ANSI A156.16.
  - a. Shelf Bracket: B04041, japanned or enameled finish.
  - b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
  - c. Closet Bar: L03131 chrome finish of required length.
  - d. Handrail Brackets: L03081 or L03101.
    - 1) Cast Aluminum, satin polished finish.
    - 2) Cast Malleable Iron, japanned or enamel finish.
- 4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
- 5. Pipe Bench Supports:
  - a. Pipe: ASTM A53.
- 6. Fabricated Wall Bench Supports:
  - a. Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.
  - b. Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, not more than 200 mm (8 inches) on center between ends or corners.
  - c. Stainless steel bars brackets: ASTM A167, fabricated to shapes shown, Number 4 finish. Use 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and not less than two 13 mm (1/4 inch) hole for anchors on vertical member.

7. Thru-Wall Counter Brackets:
  - a. Steel angles drilled for fasteners on 100 mm (4 inches) centers.
  - b. Baked enamel prime coat finish.
8. Folding Shelf Bracket:
  - a. Steel Shelf bracket, approximately 400 mm by 400 mm (16 by 16 inches), folding type with baked gray enamel finish or chrome plated finish.
  - b. Bracket legs shall be approximately 28 mm (1-1/8 inches) wide.
  - c. Distance from center line of hinge pin to back of vertical leg shall be 44 mm (1-3/4 inches) or provide for wood spacer if hinge line is at joint of vertical and horizontal leg.
  - d. Distance from face to face of bracket when closed shall be 50 mm (2 inches).
  - e. Brackets shall automatically lock when counter is raised parallel to floor and shall unlock manually.
  - f. Each bracket shall support not less than 68 Kg (150 pounds) evenly distributed.
9. Edge Strips Moldings:
  - a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
  - b. Stainless steel or extruded aluminum channels.
  - c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.
10. Rubber or Vinyl molding
  - a. Rubber or vinyl standard stock and in longest lengths practicable.
  - b. Design for closures at joints with walls and adhesive anchorage.
  - c. Adhesive as recommended by molding manufacturer.
11. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

## **2.10 MOISTURE CONTENT**

- A. Moisture content of lumber and millwork at time of delivery to site.
  1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
  2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
  3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

## **2.11 PRESERVATIVE TREATMENT**

Wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including wood members used for rough framing of millwork items except heart-wood Redwood and Western Red Cedar shall be preservative treated in accordance with AWPAs Standards.

- B. Use Grade A, exterior plywood for treatment.

## 2.12 FABRICATION

### A. General:

1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
  - a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.
  - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
  - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter // and sills // including back splashes and end splashes of countertops.
  - d. Use backing sheet on concealed large panel surface when decorative face does not occur.

### B. Pegboard:

1. Perforated hardboard sheet size as shown.
2. Spacing strip: 13 mm by 13 mm (1/2 by 1/2 inch); glued to hardboard sheet.
  - a. Locate at perimeter of sheet edge.
  - b. Locate material intermediate spacing strips at 800 mm (32 inches) o.c.
3. Use 19 mm (3/4 inch) one quarter round edge trim to cover exposed edge and finish flush with hardboard surface. Glue to spacing strip and hard board.

### C. Pass Thru Counter.

1. Fabricate counter as shown. Return hardwood edge to metal frame at ends. Fabricate to join other counters where shown.
2. Cut to fit metal frame profile.
3. Coordinate and align counters as required.
4. Use angle and fabricated shelf bracket supports.

D. Counter or Work Tops:

1. Refer to specification section 12 36 61 Simulated Stone Countertops.

## **PART 3 - EXECUTION**

### **3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain work areas and storage areas to a minimum temperature of 21<sup>0</sup>C (70<sup>0</sup>F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

### **3.2 INSTALLATION**

A. General:

1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
2. Secure trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
8. Exterior Work: Joints shall be close fitted, metered, tongue and grooved, rebated, or lapped to exclude water and made up in thick white lead paste in oil.

B. Shelves:

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 600 mm (24 inch) centers between ends.
  - a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
  - b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
  - c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.
2. Install vertical slotted shelf standards, ANSI A156.9, B04103 to studs with toggle bolts through each fastener opening. Double slotted shelf standards may be used where adjacent shelves terminate.



- a. Install brackets ANSI A156.9, B04113, providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
- b. Install shelves on brackets so front edge is restrained by bracket.

--- E N D ---

**SECTION 06 61 19**  
**QUARTZ SURFACING FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Quartz countertops
2. Setting materials and accessories.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section 061663- Cementitious sheathing.
3. Section 06 20 00- Finish Carpentry.
4. Section 079200 - Joint sealants.
5. Section 102800 - Toilet Accessories.

**1.2 APPLICABLE PUBLICATIONS**

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

B. American National Standards Institute (ANSI):

- A108.5..... Installation of Ceramic Tile with Dry-Set Portland Cement Mortar  
or Latex Portland Cement Mortar
- A118.4..... Latex-Portland Cement Mortar

C. ASTM International (ASTM):

- C97..... Standard Test Methods for Absorption and Bulk Specific Gravity  
of Dimension Stone
- C99..... Standard Test Method for Modulus of Rupture of Dimension  
Stone
- C170..... Standard Test Method for Compressive Strength of Dimension  
Stone
- C241..... Standard Test Method for Abrasion Resistance of Stone  
Subjected to Foot Traffic
- 
- C531..... Standard Test Method for Linear Shrinkage and Coefficient of  
Thermal Expansion of Chemical-Resistant Mortars, Grouts,  
Monolithic Surfacing, and Polymer Concretes
- C648..... Standard Test Method for Breaking Strength of Ceramic Tile
- C650..... Standard Test Method for Resistance of Ceramic Tile to  
Chemical Substances

C672/C672M .....	Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
C880.....	Standard Test Method for Flexural Strength of Dimension Stone
C1026.....	Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
C1028.....	Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
E84 .....	Standard Test Method for Surface Burning Characteristics of Building Materials

### **1.3 SUBMITTALS**

- A. Shop Drawings: Include layout, dimensions, materials, finishes, cutouts, and attachments for each area..
- B. Samples:
  - 1. 3 x 3 inch quartz samples showing available colors.
  - 2. 3 inch long joint sealer samples showing available colors.

### **1.4 QUALITY ASSURANCE**

- A. Fabricator and Installer Qualifications: Minimum 2 years documented experience in work of this Section.
- B. Mockup:
  - 1. Construct countertop mockup, 2 6 feet wide, full depth, with splash and skirt.

### **1.5 WARRANTY**

- A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Contract Documents are based on products by Cosentino USA, Inc.

### **2.2 MATERIALS**

- A. Quartz Sheet:
  - 1. Product: Silestone or equal.
  - 2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs.
  - 3. Anti-microbial protection: - integral to sheet.
  - 4. Color: Per Section 09 06 00.
  - 5. Thickness: Per each condition; review required in the submittal.
  - 6. Physical characteristics:
    - a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
    - b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
    - c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.

- d. Bond strength: Minimum 210 psi, tested to ASTM C482.
- e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
- f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
- g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
- h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
- i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
- j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
- k. Thermal expansion:  $1.670 \times 10^{-5}$  in/in/deg F, tested to ASTM C531.
- l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
- m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
- n. Flame spread rating: Class 1, tested to ASTM E84.

## **2.3 ACCESSORIES**

- A. Adhesive: Type recommended by quartz manufacturer.
- B. Latex-Portland Cement Mortar: ANSI A118.4.
- C. Joint Sealer:
  - 1. Latisil Tile and Stone Sealant by Laticrete International, Inc. or equal
  - 2. Color: To be selected from manufacturer's full color range.

## **2.4 FABRICATION**

- A. Cut quartz panels accurately to required shapes and dimensions.
- B. Radius exposed edges.
- C. Fabricate with hairline joints.
- D. Cut holes for sinks and faucets.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Clean surfaces to receive fabrications; remove loose and foreign matter than could interfere with adhesion.

### **3.2 INSTALLATION**

- A. Install fabrications in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Adhere fabrications with continuous beads of adhesive or Set in thin set mortar bed in accordance with ANSI A 108.5.
- D. Set plumb and level. Align adjacent pieces in same plane.
- E. Install with hairline joints.
- F. Fill joints between fabrications and adjacent construction with joint sealer to match; finish smooth and flush.

### **3.3 INSTALLATION TOLERANCES**

- A. Maximum variation from level and plumb: 1/8 inch in 10 feet, noncumulative.

B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

### **3.4 CLEANING**

A. Clean fabrications in accordance with manufacturer's instructions.

### **3.5 PROTECTION**

A. Protect installed fabrications with nonstaining sheet coverings.

--- E N D ---

**SECTION 07 01 50.19  
PREPARATION FOR RE-ROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Partial roof tear-off // (on existing construction in preparation to receive new roofing membrane).
- B. Existing Membrane Roofing System: // // EPDM// // roofing membrane, with related insulation, surfacing, and components and accessories between deck and roofing membrane.

**1.2 RELATED WORK**

- A. Use of the premises and phasing requirements: Section 01 00 00 GENERAL REQUIREMENTS.
- B. Temporary construction and environmental-protection measures for reroofing preparation:  
Section 01 00 00 GENERAL REQUIREMENTS
- C. Clay roof tile section 073213
- D. HVAC equipment removal and reinstallation: Division 23 sections.
- E. Electrical equipment disconnection and reconnection: Division 26 sections.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):  
ANSI/SPRI FX-1-01(R2006) ..... Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. ASTM International (ASTM):  
C208-08 ..... Cellulosic Fiber Insulating Board  
C728-05 ..... Perlite Thermal Insulation Board  
C1177/C1177M-08..... Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing  
C1278/C1278M-07 ..... Standard Specification for Fiber-Reinforced Gypsum Panel  
D1079-09 ..... Standard Terminology Relating to Roofing and Waterproofing
- D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.  
4450-89 ..... Approved Standard for Class 1 Insulated Steel Deck Roofs  
4470-10 ..... Approved Standard for Class 1 Roof Coverings  
1-28-09 ..... Loss Prevention Data Sheet: Design Wind Loads.  
1-29-09 ..... Loss Prevention Data Sheet: Above-Deck Roof Components  
1-49-09 ..... Loss Prevention Data Sheet: Perimeter Flashing
- E. National Roofing Contractors Association: Roofing and Waterproofing Manual

#### **1.4 MATERIALS OWNERSHIP**

- A. Assume ownership of demolished materials and remove from Project site and dispose of legally, unless indicated to be reused, reinstalled, or otherwise to remain Owner's property.

#### **1.5 DEFINITIONS**

- A. Refer to ASTM D1079 and NRCA "The NRCA Roofing and Waterproofing Manual" for definition of terms.

#### **1.6 QUALITY CONTROL**

- A. Requirements of Division 07 roofing section for qualifications of roofing system and roofing insulation Installer; work of this section shall be performed by same Installer.
  - 1. Where Project requirements include removal of asbestos-containing material, Installer must be legally qualified to perform the required work.
  - 2. Where Project requirements include work affecting existing roofing system to remain under warranty, Installer must be approved by warrantor of existing roofing system.
- B. Regulatory Requirements: Comply with governing EPA notification regulations. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Reroofing Conference: Conduct conference at Project site.
  - 1. Meet with Owner; Architect-Engineer; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing.
  - 2. Review methods and procedures related to roofing system tear-off and replacement

#### **1.7 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Recover boards.
- C. List of proposed infill materials.
- D. List of proposed temporary roofing materials.
- E. Fastener pull-out test report.
- F. Photographs or Videotape: Document existing conditions of adjacent construction including site improvements.
- G. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a licensed landfill facility.
- H. Qualification Data: For Installer.
  - 1. Certificate indicating Installer is licensed to perform asbestos abatement.
  - 2. Certificate indicating Installer is approved by warrantor of existing roofing system.

## **1.8 PROJECT CONDITIONS**

- A. Owner will occupy portions of building below reroofing area. Conduct reroofing so Owner's operations will not be disrupted.
  - 1. Coordinate work activities daily with Owner.
  - 2. Provide COR with not less than one week notice of activities that may affect Owner's operations.
- B. Protect building and landscaping from damage.
- C. Maintain access to existing walkways and adjacent occupied facilities.
- D. Available Information: The following are available for Contractor reference:
  - 1. Roof Moisture Survey of existing membrane roofing system.
  - 2. Analysis of test cores from existing membrane roofing system.
  - 3. Construction Drawings and Project Manual for existing roofing system.
  - 4. Contractor is responsible for interpretation and conclusions based upon available information.
- E. Weather Limitations: Proceed with reroofing preparation only when weather conditions permit Work to proceed without water entering existing roofing system or building.
- F. Hazardous Materials: It is not expected that Contractor will encounter hazardous materials such as asbestos-containing materials.
  - 1. If hazardous material is discovered owner will remove hazardous materials before start of the Work.
  - 2. Do not disturb materials suspected of containing hazardous materials. Notify COR. Hazardous materials will be removed by Owner under a separate contract.
- G. Hazardous Materials: A report on the presence of hazardous materials is available to Contractor for review and use.
  - 1. Examine report to become aware of locations where hazardous materials are present.
  - 2. Hazardous material remediation is specified elsewhere in the Contract Documents.

## **1.9 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces affected by reroofing, by methods and with materials acceptable to warrantor.
  - 1. Notify warrantor of existing roofing system before proceeding, and upon completion of reroofing.
  - 2. Obtain documentation verifying that existing roofing system has been inspected by warrantor and warranty remains in effect. Submit documentation at Project closeout.

## **PART 2 - PRODUCTS**

### **2.1 INFILL MATERIALS**

- A. Use infill materials matching existing membrane roofing system materials.

### **2.2 TEMPORARY ROOFING MATERIALS**

- A. Design of temporary roofing and selection of materials are responsibilities of Contractor.



## **2.3 RECOVER BOARDS**

- A. Insulation Serving as Recover Board: Requirements are specified in Section 07 22 00 ROOF AND DECK INSULATION.
- B.

## **2.4 AUXILIARY REROOFING MATERIALS**

- A. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer and compatible with components of existing and new membrane roofing system.
- B. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approval's "RoofNav."
- C. Metal Flashing Sheet: Metal flashing sheet is specified in Section 07 60 00 SHEET METAL FLASHING AND TRIM.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect existing membrane roofing system that is indicated not to be reroofed.
  - 1. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
  - 2. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
- B. Coordinate with COR to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
  - 1. Comply with COR's requirements for maintaining fire watch when temporarily disabling smoke detectors.
- C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
  - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding.
  - 2. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- E. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

### **3.2 ROOF TEAR-OFF**

- A. General: Notify COR each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B.
- C. Partial Roof Tear-Off: Where indicated, remove existing roofing membrane and other membrane roofing system components down to the deck.
  - 1. Remove cover boards roof insulation and substrate boards.
- D. Partial Roof Tear-Off: Remove existing roofing membrane and immediately check for presence of moisture by visually observing cover boards roof insulation and substrate boards that will remain.
  - 1. Coordinate with COR's inspector to schedule times for tests and inspections immediately after membrane removal.
  - 2. Remove and replace wet or damp boards and roof insulation. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

### **3.3 INFILL MATERIALS INSTALLATION**

- A. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.
  - 1. Installation of infill materials is specified in Section 00 00 00 //Insert Section name and title//.
  - 2. Install new roofing membrane patch over roof infill area. If new roofing membrane is installed the same day tear-off is made, roofing membrane patch is not required.

### **3.4 TEMPORARY ROOFING MEMBRANE**

- A. Install approved temporary roofing membrane over area to be reroofed.
- B. Remove temporary roofing membrane before installing new roofing membrane.
- C. Prepare the temporary roof to receive new roofing membrane according to approved temporary roofing membrane proposal. Restore temporary roofing membrane to watertight condition. Obtain approval for temporary roof substrate from roofing membrane manufacturer and Architect-Engineer before installing new roof.

### **3.5 ROOF RE-COVER PREPARATION**

- A. Remove blisters, ridges, buckles, and other substrate irregularities from existing roofing membrane that inhibit new recover boards from conforming to substrate.
  - 1. Broom clean existing substrate.
  - 2. Coordinate with Owner's inspector to schedule times for tests and inspections before proceeding with installation of recover boards.
  - 3. Remove materials that are wet or damp. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

### 3.6 EXISTING BASE FLASHINGS

- A. Remove existing base flashings around parapets, curbs, walls, and penetrations.
  - 1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 07 60 00 SHEET METAL TO MATCH EXISTING MATERIALS IN ACCORDANCE WITH SMACNA GUIDELINES.

### 3.7 FASTENER PULL-OUT TESTING

- A. Retain independent testing and inspecting agency to conduct fastener pull-out tests according to SPRI FX-1, and submit test report to COR before installing new membrane roofing system.
  - 1. Obtain COR's approval to proceed with specified fastening pattern. COR may furnish revised fastening pattern commensurate with pull-out test results.

### 3.8 RECOVER BOARD INSTALLATION

- A. Install recover boards over //roof insulation// //roofing membrane// with long joints in continuous straight lines and end joints staggered between rows. Loosely butt recover boards together and fasten to deck.
  - 1. Fasten recover boards to resist wind-uplift pressure at corners, perimeter, and field of roof specified in Section 073213 clay roof tiles
  - 2. Install additional fasteners near board corners and edges as necessary to conform boards to substrate and to adjacent boards.

### 3.9 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
  - 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

## SECTION 07 21 13 THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION:

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

#### 1.2 RELATED WORK

- A.
- A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing insulation: Section 07 84 00, FIRESTOPPING.

#### 1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

#### 1.4 STORAGE AND HANDLING:

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

#### 1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C270-08 .....Mortar for Unit Masonry
  - C516-08 .....Vermiculite Loose Fill Thermal Insulation
  - C549-06 .....Perlite Loose Fill Insulation
  - C552-07 .....Cellular Glass Thermal Insulation.
  - C553-08 .....Mineral Fiber Blanket Thermal Insulation for Commercial and  
Industrial Applications
  - C578-08 .....Rigid, Cellular Polystyrene Thermal Insulation
  - C591-08 .....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal  
Insulation

C612-04 .....	Mineral Fiber Block and Board Thermal Insulation
C665-06 .....	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
C728-05 .....	Perlite Thermal Insulation Board
C954-07 .....	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness
C1002-07 .....	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
D312-00(R2006) .....	Asphalt Used in Roofing
E84-08.....	Surface Burning Characteristics of Building Materials
F1667-05.....	Driven Fasteners: Nails, Spikes and Staples.

## PART 2 - PRODUCTS

### 2.1 INSULATION – GENERAL:

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	

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

### 2.2 MASONRY CAVITY WALL INSULATION:

- A. SPRAY POLYURETHANE FOAM INSULATION (Closed-Cell Polyurethane Foam Insulation):  
ASTM C 1029, Type II, and with the following properties:
  1. Properties
    - a. Density: Nominal 2.0 lbs/cf per ASTM D 1622
    - b. Closed-cell content: Greater than 90 percent per ASTM D 2856
    - c. Design R-Value: R-6.7 minimum per inch thickness per ASTM C 518
    - d. Flame spread: Less than 25 per ASTM E 84
    - e. Smoke developed: Less than 450 per ASTM E 84

- f. Compressive strength: 22 psi per ASTM D 1621
  - g. Tensile strength: 28 psi per ASTM D 1623 Type C
  - h. Incorporating a zero ozone depleting blowing agent
  - i. Water vapor transmission: 1.82 perms per inch thickness per ASTM E 96
2. Manufacturers: Subject to compliance with requirements, provide products by the following:
- a. BASF Corporation.
  - b. All other manufacturers of closed cell 2.0 lbs./cf SPF will be considered and are encouraged. Formal 'certification' of installers is not mandatory, but evidence of experience with product installation will be required.

### **2.3 PERIMETER INSULATION IN CONTACT WITH SOIL:**

- A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

### **2.4 EXTERIOR FRAMING OR FURRING INSULATION:**

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

### **2.5 ACOUSTICAL INSULATION:**

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

### **2.6 FASTENERS:**

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.
- D. Fasteners shall be of type and by manufacturer recommended by insulation manufacturer.

### **2.7 ADHESIVE:**

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

### **2.8 TAPE:**

- A. Pressure sensitive adhesive on one face.

- B. Perm rating of not more than 0.50.

## **2.9 AUXILIARY MATERIALS FOR SPRAY POLYURETHANE FOAM INSULATION:**

- A. Sealant at Transitions in Substrate and Connections to Adjacent Elements: Low-modulus pre-cured silicone extrusion and sealant for bonding extrusions to substrates; Spectrem Simple Seal by Tremco or Bondaflex Silbridge 300 by May National Associates.
- B. Transition Membrane Between Spray Polyurethane Foam Insulation and Roofing and Other Adjacent Materials: Comply with both Spray Polyurethane Foam Insulation manufacturer's recommendations and material manufacturer's recommendations.
  - 1. Air-Shield by W. R. Meadows, Inc.
  - 2. Blueskin by Henry Corp
  - 3. CCW 705 by Carlisle Coatings & Waterproofing
  - 4. BASF Senershield fluid system
- C. Counter flashing for Masonry Through-Wall Flashing: One of the following and as acceptable to the spray polyurethane foam air barrier manufacturer:
  - 1. Air-Shield by W. R. Meadows, Inc.
  - 2. Blueskin TWF by Henry.
  - 3. Hyload S/A Through Wall Flashing by Hyload, Inc.
  - 4. CCW 705 by Carlisle Coatings & Waterproofing
- D. Foam stop angle: Metal or plastic angle used for foam stop:
  - 1. Cold rolled galvanized metal
  - 2. Aluminum
  - 3. Stainless steel
  - 4. Extruded plastic equal to Jam-Ex by EXO-TEC Manufacturing, Inc.
- E. Primers: Use primers when deemed necessary for SPF adhesion to substrates.
- F. Portable SPF Application Units: Class 1, nominal 2 lb per cubic foot density, closed-cell SPF
  - 1. Versi-Foam by RHH
  - 2. Touch n' Foam by Convenience Products

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

### 3.2 MASONRY CAVITY WALLS:

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate insulation application.
  - 1. Ensure that penetrating work and clean up by other trades is in place and complete.
  - 2. Prepare surfaces by air blast, vacuum, brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the spray polyurethane foam.
  - 3. Wipe down metal surfaces to remove release agents or other non-compatible coatings, ( prime if necessary to insure adhesion ), using clean sponges or rags soaked in a cleaning material compatible with the spray polyurethane foam.
  - 4. Ensure veneer anchors are in place and compatible with the spray foam.
- B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
  - 1. Prime masonry, concrete substrates with conditioning primers.
  - 2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
  - 3. Prime wood, metal, and painted substrates with primer.
  - 4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and at protrusions.
  - 5. Follow industry safety practices as outlined on [www.spraypolyurethane.com](http://www.spraypolyurethane.com).
  - 6. Read all material safety data sheets (if applicable) for being installed and coordinate requirements with other trades.
  - 7. Discuss the spray areas and plans for safely protecting workers performing the application and keeping others out of that area during the application (spraying).
- C. Protection from Spray Applied Materials on project conditions and as follows:
  - 1. Mask and cover adjacent areas to protect from over spray.
  - 2. Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
  - 3. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air if necessary.
  - 4. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
- D. Apply Spray Polyurethane Foam Insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.



**3.3 PERIMETER INSULATION:**

- A. Vertical insulation:
  - 1. Fill joints of insulation with same material used for bonding.
  - 2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
  - 3. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

**3.4 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS:**

- A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.
- B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.
- C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
- D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.
- E. Floor insulation:
  - 1. Bond insulation to concrete floors in attic by coating surfaces with hot steep asphalt applied at rate of not less than 11.5 Kg per m<sup>2</sup> (25 lbs/100 sq. ft.), and firmly bed insulation therein.
  - 2. When applied in more than one layer, bed succeeding layers in hot steep asphalt applied at the rate of not less than 11.5 Kg per m<sup>2</sup> per m<sup>2</sup> lbs/100 sq. ft.).
  - 3. Contractors option: Insulation may be installed with nonflammable adhesive in accordance with the manufacturer's printed instructions when a separate vapor retarder is used.

**3.5 ACOUSTICAL INSULATION:**

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Provide putty packs at outlets and pack insulation around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embeddings in insulation.

- F. Where sound deadening board is shown, secure // with adhesive to masonry or concrete walls // and // with screws to metal or wood framing //. Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

### **3.6 FIELD QUALITY CONTROL OF SPRAY POLYURETHANE FOAM INSULATION:**

- A. Installer self-inspection: The installer shall conduct daily inspections and record the results of these inspections on a Daily Work Record in accordance with the ABAA Quality Assurance Program. These Daily Work Records shall be made available upon request.
- B. ABAA Site Inspections: Arrange and pay for site audits by ABAA to verify conformance with the manufacturer's instructions, the ABAA Quality Assurance Program, and this Section of the project Specification.
  - 1. Audits shall be carried out per ABAA protocol. Forward written inspection reports to the Architect within 3 working days of the receipt of the audit report.
  - 2. If the inspections reveal defects, promptly remove and replace defective work at no additional cost to the Owner.

### **3.7 PROTECTION AND CLEANING:**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Clean spillage and soiling from adjacent construction of Spray Polyurethane Foam Insulation using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

--- E N D ---

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Roof and deck insulation, and /cover board on new construction ready to receive roofing or waterproofing membrane.
- B. Repairs and alteration work to existing roof insulation.

**1.2 RELATED WORK**

- A. General sustainable design documentation requirements-
- B. Wood cants, blocking, and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- C. Perimeter, rigid, and batt or blanket insulation not part of roofing system: Section 07 21 13, THERMAL INSULATION.
- D. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):  
90.1-07 ..... Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. ASTM International (ASTM):  
C208-08 ..... Cellulosic Fiber Insulating Board  
C552-07 ..... Cellular Glass Thermal Insulation  
C726-05 ..... Mineral Fiber Roof Insulation Board  
C1177/C1177M-08 ..... Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing  
C1278/C1278M-07 ..... Standard Specification for Fiber-Reinforced Gypsum Panel  
C1289-10 ..... Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board  
C1396/C1396M-09 ..... Standard Specification for Gypsum Board  
D41-05 ..... Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing  
D312-06 ..... Asphalt Used in Roofing  
D1970-09 ..... Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection  
D2178-04 ..... Asphalt Glass Felt Used in Roofing and Waterproofing

- D4586-07 ..... Standard Specification for Asphalt Roof Cement, Asbestos-Free  
 E84-09 ..... Standard Test Method for Surface Burning Characteristics of  
    Building Material  
 F1667-05 ..... Driven Fasteners: Nails, Spikes, and Staples
- D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.  
     4450-89 ..... Approved Standard for Class 1 Insulated Steel Deck Roofs  
     4470-10 ..... Approved Standard for Class 1 Roof Coverings  
     1-28-09 ..... Loss Prevention Data Sheet: Design Wind Loads.  
     1-29-09 ..... Loss Prevention Data Sheet: Above-Deck Roof Components  
     1-49-09 ..... Loss Prevention Data Sheet: Perimeter Flashing
- E. National Roofing Contractors Association: Roofing and Waterproofing Manual
- F. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog, [www.biopreferred.gov](http://www.biopreferred.gov)
- G. Underwriters Laboratories, Inc. (UL): Fire Resistance Directory (2009)
- H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):  
     DOC PS 1-09 ..... U.S. Product Standard for Construction and Industrial Plywood  
     DOC PS 2-04 ..... Performance Standard for Wood-Based Structural-Use Panels.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Thermal Performance: Provide roof insulation meeting minimum overall average R-value of 33
- B. FM Approvals: Provide roof insulation complying with requirements in FM Approvals 4450 and 4470 as part of specified roofing system, listed in FM Approvals "RoofNav" as part of roofing system meeting Fire/Windstorm Classification in Division 07 roofing section.

#### **1.5 QUALITY CONTROL**

- A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.
- B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.
- C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.
- D. Requirements of roofing system uplift pressure design for specified roofing system.
- E. Requirements of applicable FM Approval for specified roofing system insulation attachment.

#### **1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
1. Asphalt and adhesive materials, each type.
  2. Roofing cement, each type.
  3. Roof insulation, each type.

4. Substrate board, each type.
5. Cover board, each type.
6. Fastening requirements.
7. Insulation span data for flutes of metal decks.
- C. Shop Drawings: Include plans, sections, details, and attachments.
  1. Nailers, cants, and terminations.
  2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.
- D. Samples:
  1. Roof insulation, each type.
  2. Nails and fasteners, each type.
- E. Certificates:
  1. Indicating type, thermal conductance, and minimum and average thickness of insulation.  
Provide minimum overall average R-value of 33.
  2. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.
- F. Laboratory Test Reports: Thermal values of insulation products.
- G. Layout of tapered roof system showing units required.
- H. Documentation of supervisors' and inspectors' qualifications.

#### **1.7 DELIVERY, STORAGE AND MARKING**

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation requirements.

#### **1.8 QUALITY ASSURANCE:**

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.
  1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.
  2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."
  3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

## **PART 2 - PRODUCTS**

### **2.1 ADHESIVE MATERIALS**

- A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
  - 1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.
  - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Multipurpose Construction Adhesives: 70 g/L.
    - c. Fiberglass Adhesives: 80 g/L.
    - d. Contact Adhesives: 80 g/L.
    - e. Other Adhesives: 250 g/L.
    - f. Nonmembrane Roof Sealants: 300 g/L.
    - g. Sealant Primers for Nonporous Substrates: 250 g/L.
    - h. Sealant Primers for Porous Substrates: 775 g/L.
- B. Primer: ASTM D41.
- C. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- D. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- E. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- F. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- G. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II; or, D4586, Type I or Type II.

### **2.2 ROOF AND DECK INSULATION**

- A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Roof Insulation System:
  - 1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.

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

## **2.3 INSULATION ACCESSORIES**

- A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.
- B. Cants and Tapered Edge Strips:
  1. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
  2. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
    - a. Cellulosic Fiberboard: ASTM C208.
    - b. Mineral Fiberboard: ASTM C726.
    - c. Perlite Board: ASTM C728.
- C. Vapor Retarder:
  1. Glass-Fiber Felts: ASTM D2178, Type IV, asphalt impregnated.
  2. Self-Adhering Sheet Vapor Retarder: ASTM D1970, minimum of 1.0-mm- (40-mil-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive, or 0.76- to 1.0-mm- (30- to 40-mil-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm).
- D. Substrate Board:
  1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, Type X, 16 mm (5/8 inch) thick, factory primed.
- E. Cover Board:
  1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, 1/2 inch thick, factory primed.

## **2.4 FASTENERS**

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.
- B. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Comply with requirements of Division 07 roofing section.

### **3.2 PREPARATION**

- A. Comply with requirements of Division 07 roofing section.

### **3.3 SUBSTRATE BOARD INSTALLATION**

- A. Fasten substrate board to top flanges of steel deck to resist uplift pressures according to roofing system manufacturers instructions and requirements of FM Approvals listing for specified roofing system.

### 3.4 VAPOR RETARDER INSTALLATION

#### A. General:

1. Install continuous vapor retarder on roof decks where indicated.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
4. Seal penetrations with roof cement.

#### B. Steel Deck:

1. Material and method of application of roofing systems used on metal decks shall meet the requirements of FM Approvals for Class I-A Insulated Steel Roof Deck.
2. Attach substrate board and subsequent components to meet the requirements of FM Approval's "RoofNav" listing for specified system meeting Fire/Windstorm Classification indicated in Division 07 roofing section.
3. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.

### 3.5 RIGID INSULATION INSTALLATION

#### A. Insulation Installation, General:

1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
3. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate prior to installation of insulation.
4. Use same insulation as existing for roof repair and alterations unless specified otherwise.

#### B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.
2. Insulation on Metal Decks: Provide minimum thickness of insulation for metal decks recommended by the insulation manufacturer to span rib opening (flute size) of metal deck used. Support edges of insulation on metal deck ribs.
3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).



5. Use not less than two layers of insulation when insulation is 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
- C. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.
- D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- F. Cut to fit tight against blocking or penetrations.
- G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
- H. Installation Method: Per manufacturer's recommendations.
  1. Adhered Insulation:
    - a. Prime substrate as required.
    - b. Set each layer of insulation firmly in solid mopping of hot asphalt.
    - c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
    - d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
  2. Cover Board: Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset cover board joints from insulation joints minimum 150 mm (6 inches). Fasten cover boards according to //"Adhered Insulation"// //"Mechanically Fastened Insulation"// requirements.
- I. Field quality Control: Technical Representative of manufacturer shall provide a minimum of two site visits during roof and deck installation to provide flood testing and all necessary manufacturer's approvals to provide a 20 year warranty.

- - - E N D - - -

**SECTION 07 26 00  
UNDER-SLAB VAPOR BARRIER**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Products supplied under this section: Vapor barrier, seam tape, and mastic for installation under concrete slabs.

**1.2 RELATED WORK**

- A. Section 03 30 00 Cast-in-Place Concrete

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Quality control/assurance:
  - 1. Summary of test results as per paragraph 8.3 of ASTM E 1745.
  - 2. Manufacturer's samples, literature.
  - 3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - ASTM E 1745-09..... Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
  - ASTM E 154-99 (2005) ..... Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
  - ASTM E 96-05..... Standard Test Methods for Water Vapor Transmission of Materials.
  - ASTM F 1249-06..... Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
  - ASTM E 1643-09..... Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- C. American Concrete Institute (ACI):
  - ACI 302.2R-06 ..... Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

A. Vapor barrier must have all of the following qualities:

1. Permeance of less than 0.01 Perms [grains/(ft<sup>2</sup> · hr · inHg)] as tested in accordance with ASTM E 1745 Section 7.
2. Other performance criteria:
  - a. Strength: ASTM E 1745 Class A.
  - b. Thickness: 15 mils minimum

### **2.2 ACCESSORIES**

A. Seam tape:

1. Basis-of-Design: Stego Tape by Stego Industries LLC, or approved equal.

B. Vapor-proofing mastic:

1. Basis-of-Design: Stego Mastic by Stego Industries LLC, or approved equal.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

A. Ensure that base material is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

### **3.2 INSTALLATION**

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
2. Lap vapor barrier over footings and/or seal to foundation walls.
3. Overlap joints 6 inches and seal with manufacturer's tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

--- E N D ---

## **SECTION 07 32 13 CLAY ROOF TILES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies the installation of roofing tiles.
- B. Related work
  - 1. Metal Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
  - 2. Style, size, exposure, color and texture of clay tile: Section 09 06 00, SCHEDULE FOR FINISHES.
  - 3. Sealants and Applicable: Section 07 92 00, JOINT SEALANTS.

#### **1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Clay tile underlayment: Flexible moisture protection; ridge flashing. Provide test reports, installation instructions and shop drawings for installation.
- C. Shop Drawings: Details of fabricated custom shapes.
- D. Mock Up: Construct 10' x 10' mock-up using materials specified in this section by installer to do work for VA approval. Mock-up to be installed on roof and may be revised if approved by COR.
- E. Manufactures printed installation instructions for each product, including storage requirements
- F. Closeout Submittals: Warranty documents, issued and executed by tile manufacture, countersigned by contractor
- G. Installer Qualifications: Company factory trained by the manufacture specializing in installing roofing of the type specified in this section, with not fewer than three years of documented experience and a minimum of five similar projects in last three years for VA review. Submit installers qualifications.

#### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver tiles and setting materials in manufacturer's original, unopened containers clearly identifying manufacturer and the contents.
- B. Do not store tiles in flat position.

#### **1.4 WARRANTY**

- A. Clay Roof Tile Manufacturer Weather-tight Warranty: The clay roof tile manufacturer shall provide a 10 year warranty guaranteeing the Underlayment (the "Roofing and Underlayment System") to be free from defects in workmanship during the 10 year period following the certified completion date of the Roofing and Underlayment System.

#### **1.5 APPLICABLE PUBLICATIONS**

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

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

A580-06.....	Stainless Steel Wire
B99-06.....	Copper - Silicon Alloy Wire for General Applications
C270-07 .....	Mortar for Unit Masonry
C920-08 .....	Elastomeric Joint Sealants
C1167-03 .....	Clay Roof Tiles
D226-06 .....	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
D4586-07 .....	Asphalt Roof Cement, Asbestos Free
F1667-05.....	Driven Fasteners: Nails, Spikes, and Staples

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturing facility shall be located in the United States.
- B. Manufacturer shall have been in continuous operation for over 100 years.
- C. Manufacturer shall be ISO 9000 certified and meet Cradle to Cradle specifications.
- D. Acceptable Tile Manufacturer: Ludowici Roof Tile; [or](#) approved equal.
- E. Unless otherwise specified for an individual product or material, supply all products specified in this section from the same manufacturer.
- F. Manufacturer to provide 10 year warranty
- G. Roofing installer to be manufacturer trained

### **2.2 CLAY ROOF TILES**

- A. Roof Tile - General: Incombustible, vitrified tile manufactured from shale and fire clays, having less than 2.0 percent moisture absorption when tested in accordance with ASTM C1167, and meeting Grade 1, providing resistance to severe frost action, Type, I, High profile,
- B. Shapes: Eave closures, gable rake, ridge covers, top fixtures, and other shapes required.
- C. Mission Clay Roof Tile Type
  - 1. Acceptable product: 18-3/8" Straight Barrel Mission, or approved equal.
    - a. Profile: Straight Barrel pans and covers with a smooth surface. The longer tile means fewer pieces per square, creating the most economical of Ludowici's mission tile. Laid in staggered rows
    - b. Nominal size: 8.0 inches (203.2 mm) wide by 18.375 inches (466.725 mm) long
    - c. Average exposure: 11.5 inches (292 mm) wide by 15.375 inches 390.525 mm) long.
  - 2. Accessory tile pieces required:
    - a. Rolled Rake tile
    - b. Short Course Cover tile
    - c. Eave Closure tile
    - d. Top Fixture tile

- e. Circular Cover Hip tile
- f. Circular Cover Ridge tile
- g. Circular Cover Hip Starter tile
- h. Circular Cover Closed Ridge End tile
- i. Circular Cover terminal tiles

## **2.3 ROOF CEMENT**

- A. ASTM D4586, Type II.
- B. Modified bituminous types are acceptable.

## **2.4 NAILS BRADS, STAPLES AND SPIKES**

- A. ASTM F1667.
- B. Screws: No. 8 305 stainless steel, square drive, not less than 2 inches (50.8 mm) long, provided by Ludowici Roof Tile Inc. as part of roof system.

## **2.5 UNDERLAYMENT**

- A. RoofTopGuard II Premium Underlayment, Purchased from Ludowici Roof Tile, Inc. (No Substitutions Allowed)
- B. Ice Protect Plus High-Temp Self-Adhesive Modified Underlayment, purchased from Ludowici Roof Tile, Inc. (No Substitutions Allowed)

## **2.6 MORTAR**

- A. ASTM C270.
- B. Type. M

## **2.7 SEALANT**

- A. Sealant Used in Lieu of Flashing Cement: ASTM C 920 silicone; provide one of the following:
  - 1. Dow Corning 790 Silicone Building Sealant.
  - 2. GE SilProof.

## **2.8 WIRE**

- A. Stainless steel: ASTM A580, Type 302 or 304, minimum 0.74 mm (0.029 inch) diameter.
- B. Copper: ASTM B99, minimum 1.27 mm (0.05 inch) diameter.

## **PART 3 – EXECUTION**

### **3.1 JOB CONDITIONS**

- A. Do not start installation until other trades requiring traffic on roof have completed their work.
- B. Do not start installation until vent pipes and other projections through roofs and flashing materials are in place.

### **3.2 LAYING UNDERLAYMENT**

- A. Install Ice Protect Plus High-Temp Self-Adhesive Modified Underlayment per manufacturers written instructions at eave extended upslope a minimum 24" beyond interior side of exterior wall, over all hips, ridges, valleys and rakes, turned up a minimum 6" up all sidewall and headwall conditions Install RoofTopGuard II Premium Underlayment per manufacturers written instructions

### 3.3 LAYING TILE

- A. Install tile roofing in strict conformance with manufacturer's instructions. Overhang of tile at eaves should be not less than 3/4 inch (19 mm) and not more than 2 inches (51 mm). This dimension should be related to the size of gutters and should either be shown on the drawings or specified here. Lay courses parallel with eaves.
- B. Do not stretch courses.
  - 1. Do not drive fasteners tightly against tiles, to reduce risk of breakage and to allow natural deck movement.
  - 2. Allow tile to "hang" on its fasteners.
- C. Space course to finish even and parallel at top of level terminations.
- D. Fit tiles closely at ridges, around vent pipes, flashing and other like projections through roof.
- E. Secure tile by. 1 screw for each nail hole provided
- F. Use copper or stainless steel wire fastening where screws are not used through tile.
- G. Cover screws and wire fastenings in finished work.
- H. Lay tile with a head lap of at least 75 mm (3 inches).
- I. Recess eave closure of pan and cover tile at least 38 mm (1-1/2 inches) from lower end of tile.
- J. Fill laps of cover tile on ridges, and of gable rakes to cover tile with roof cement.
  - 1. Limit amount of roof cement used for leveling tile to 6 mm (1/4 inch) thickness.
  - 2. Use mortar for leveling and bedding tile where thickness exceeds 6 mm (1/4 inch).
- K. Use sealant for pointing around eave closures ridge cover joints, and top fixtures.
  - 1. Apply sealant cap bead over exposed fasteners sealing opening.
  - 2. Apply as specified in Section 07 92 00, JOINT SEALANTS.
- L. At hip and ridge install bead of adhesive at butt end of each tile, located so it is completely concealed. Install sealant as required at hip and ridge accessories to achieve watertight installation.
- M. Coordinate with Section 07 60 00, FLASHING AND SHEET METAL for installation of flashing with tile work. Keep flashing concealed except where exposed on vertical surfaces or counterflashing (cap).

### 3.4 CLEANING AND REPAIR

- A. Upon completion remove any cement splatter from tile and adjacent surfaces.
- B. Replace broken, cracked, or stained tile with discolored surface.

--- E N D ---

**SECTION 07 42 13**  
**METAL WALL PANELS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Exposed-fastener, lap-seam metal wall panels.
  - 2. Concealed-fastener, lap-seam horizontal copper wall panel.
- B. Related Sections:
  - 1. Section 05 4000, COLD-FORMED METAL FRAMING, for support framing,kit including girts, studs, and bracing.
  - 2. Section 07 6200, SHEET METAL FLASHING AND TRIM, for flashing and other sheet metal work that is not part of metal wall panel assemblies.
  - 3. Section 07 21 13, THERMAL INSULATION

**1.2 DEFINITION**

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft. (575 Pa).
  - 1. Water Leakage: As defined according to AAMA 501.1.
  - 2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water



controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

- F. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
  - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a.
    - b. Uniform pressure as indicated on Drawings.
  - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater **than 1/180 of** the span.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
  - 1. Accessories: Include details of the following items:
    - a. Flashing and trim.
    - b. Anchorage systems.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - 1. Metal R Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
  - 2. Horizontal Hidden fastener Copper Wall Panels, 12 inches by actual panel width. Include stainless steel fasteners, closures and other accessories.
  - 3. Trim and Closures: 12 inches (305 mm) long. Include fasteners and other exposed accessories.
  - 4. Accessories: 12-inch- (305-mm-) long Samples for each type of accessory.
- E. Field quality-control reports shall be issued weekly.
- F. Maintenance Data: For metal wall panels to include in maintenance manuals.
- G. Warranties: Sample of panel finish warranties.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical wall panel, as shown on Drawings; approximately one bay wide by one story high by full thickness, including insulation, supports, attachments, window, flashing and accessories.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site .
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative if applicable, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
  - 8. Review wall panel observation and repair procedures after metal wall panel installation.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect Polyisocyanurate insulation as follows:
  - 1. Factory polyethylene shrouds shall remain on insulation until use.
  - 2. Do not deliver insulation materials to Project site before installation time.
  - 3. Complete installation and concealment of polyisocyanurate materials as rapidly as possible in each area of construction.

## **1.7 PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

## **1.8 COORDINATION**

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## **1.9 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Twenty years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
  - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
  - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PANEL MATERIALS**

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 27); structural quality.
  - 2. Surface: Smooth finish.
  - 3. Exposed Coil-Coated Finish:
    - a. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 4. Surface: Smooth finish.
- B. Copper Sheet: 20 oz ASTM B 370, cold-rolled copper sheet, H00 temper.
  - 1. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
    - a. Natural finish.
- C. Panel Sealants:
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

### **2.2 FIELD-INSTALLED THERMAL INSULATION**

- A. Refer to Section 07 2100, THERMAL INSULATION.
- B. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (241 kPa), with maximum flame-spread index of 75 and smoke-developed index of 450.
- C. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type II (asphalt felt or glass-fiber mat facing), Grade 3, with maximum flame-spread index of 75 and smoke-developed index of 450, based on tests performed on unfaced core.

### **2.3 MISCELLANEOUS METAL FRAMING**

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
- C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
- D. Base or Sill: 0.079-inch (2.01-mm) nominal thickness.
- E. Hat-Shaped, Rigid Furring Channels:
  - 1. Nominal Thickness 0.025 inch
  - 2. Depth: 1-1/2 inches
- F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
  - 1. Nominal Thickness: As required to meet performance requirements.
- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## **2.5 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS**

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. R Panel Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 12 inches (305 mm) o.c. across width of panel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Northwest Metal R-Panel or comparable product by one of the following
    - a. CENTRIA Architectural Systems.
    - b. PAC-CLAD
    - c. ATAS International
  - 3. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch nominal thickness.
    - a. Exterior Finish: 3-coat fluoropolymer
    - b. Color: As indicated in Section 09 0609, COLOR SCHEDULE As selected by Architect from manufacturer's full range.
  - 4. Material: Aluminum sheet, 0.032 inch thick.
    - a. Exterior Finish: 3-coat fluoropolymer

- b. Color: As selected by Architect from manufacturer's full range.
- 5. Panel Coverage: 36 inches
- 6. Panel Height: 1.25" inch

## **2.6 CONCEALED-FASTENER, LAP-SEAM**

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel Fastener Flange into 3/4" Plywood Substrate using concealed fasteners and factory-applied sealant in fastener flange. Include accessories required for weathertight installation.
- B. 12" Lap Siding Horizontal Siding Profile, Concealed-Fastener Wall Panels:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Northwest Roof Tile and Metal, LLC. FF12 Wall Panel or comparable product by one of the following:
    - a. Berridge Manufacturing
    - b. CENTRIA Architectural Systems.
  - 2. Panel Coverage: 12 inches.
  - 3. Panel Height: 1.5 inches.

## **2.7 ACCESSORIES**

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

## **2.8 FABRICATION**

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## **2.9 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the 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 the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
  - 3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  - 4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

### **3.3 THERMAL INSULATION INSTALLATION**

- A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 2100, THERMAL INSULATION.
  - 1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.
  - 2. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.



- B. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:
1. Set vapor-retarder-faced insulation with vapor-retarder facing as indicated on Drawings. Do not obstruct ventilation spaces, except for firestopping.
  2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
  3. Install insulation straight and true in one-piece lengths. Comply with the following installation method:
    - a. Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.
  4. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

### **3.4 METAL WALL PANEL INSTALLATION**

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal wall panels.
  2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  3. Locate and space fastenings in uniform vertical and horizontal alignment.
  4. Install flashing and trim as metal wall panel work proceeds.
  5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  6. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  7. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
1. Steel Wall Panels: Use long life self tapping fasteners with washers for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  2. Prepare joints and apply sealants to comply with requirements in Section 07 9200, JOINT SEALANTS.
- E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
  6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
  7. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.
- G. Metal Liner Panels: Install panels on girts as indicated on Drawings.
- H. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install substrate board as indicated in Section 06 1600, SHEATHING, in number of layers required for fire rating, over subgirts, attached with board fasteners. Install second set of subgirts horizontally, fastened through substrate board into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.
1. Comply with UL requirements for fire-rated construction.

### **3.5 ACCESSORY INSTALLATION**

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### **3.6 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
- C. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- E. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.7 CLEANING AND PROTECTION**

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

--- E N D ---

**SECTION 07 53 23**  
**ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING**

**PART 1 GENERAL**

**1.1 GENERAL**

- A. The project, VA Hospital located in Cheyenne, Wyoming includes the provision of a complete Firestone Building Products RubberGard™ Platinum™ EPDM Adhered Membrane Roofing System.

**1.2 SUMMARY**

- A. Furnish and install elastomeric sheet roofing system, including:
1. Roofing manufacturer's requirements for the specified warranty.
  2. Preparation of roofing substrates.
  3. Wood nailers for roofing attachment.
  4. Insulation.
  5. Cover boards.
  6. Vapor retarder / air barrier.
  7. Elastomeric membrane roofing.
  8. Metal roof edging and copings.
  9. Flashings.
  10. Walkway pads.
  11. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at <http://manual.fsbp.com>.
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer

**1.3 RELATED SECTIONS**

- A. Section 06 10 00 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 07 60 00 - Flashing and Sheet Metal: Formed metal flashing and trim items associated with roofing.
- C. Section 07 72 00 - Roof Accessories: Roof hatches, vents, and manufactured curbs.
- D. Section 08 62 50 – Tubular Daylight Device.
- E. Section 22 10 00 - Plumbing Piping and Roof Drains.

## 1.4 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
- B. American Society for Testing and Materials (ASTM):
  - ASTM C 1177/C 1177M..... Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004
  - ASTM C 1289..... Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004
  - ASTM D 3273..... Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000
  - ASTM D 4637..... Standard Specification for EPDM Sheet used in Single-Ply Roof Membrane; 2004
  - ASTM D 4811..... Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing; 2004
  - ASTM E 84..... Standard Test Method for Surface Burning Characteristics of Building Materials; 2005
  - ASTM E 136..... Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004
- C. Factory Mutual Engineering and Research Corporation (FM):
  - FM 1-28..... Design Wind Loads; Factory Mutual System; 2002
  - FM 1-29..... Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2005
  - FM 4470..... Standard - Class I Roof Covers; 1986
- D. PS 1: Construction and Industrial Plywood; 1995
- E. PS 20: American Softwood Lumber Standard; 2005
- F. SPRI ES-1: Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2003. (ANSI/SPRI ES-1)

## 1.5 SUBMITTALS

- A. Product Data:
  - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
  - 2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.
- B. Shop Drawings: Provide:

1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
2. For tapered insulation, provide project-specific layout and dimensions for each board.
- C. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.
- D. Executed Warranty as a requirement of project close-out.
- E. Specimen Warranty: Submit prior to starting work.
- F. Samples: Submit samples of each product to be used.

#### **1.6 QUALITY ASSURANCE**

- A. Applicator Qualifications: Roofing installer shall have the following:
  1. Current Firestone Master Contractor status.
  2. At least five years experience in installing specified system and a minimum of ten projects utilizing similar roofing.
  3. Capability to provide payment and performance bond to building owner.
- B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
  1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
  2. Notify Architect well in advance of meeting.

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

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

#### **1.8 WARRANTY**

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Firestone 30 year Platinum Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
  1. Limit of Liability: No dollar limitation.
  2. Scope of Coverage: Repair leaks in the roofing system caused by:
    - a. Ordinary wear and tear of the elements.
    - b. Manufacturing defect in Firestone brand materials.
    - c. Defective workmanship used to install these materials.
    - d. Damage due to winds up to 100 mph.
    - e. Hail up to 2" in diameter

3. Not Covered:
  - a. Damage due to winds in excess of 100 mph
  - b. Damage due to hurricanes or tornadoes.
  - c. Hail great than 2" in diameter
  - d. Intentional damage.
  - e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products Co., Carmel, IN.  
[www.firestonebpco.com](http://www.firestonebpco.com).
  1. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
    - a. Specializing in manufacturing the roofing system to be provided.
    - b. Minimum ten years of experience manufacturing the roofing system to be provided.
    - c. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
    - d. ISO 9002 certified.
    - e. Able to provide isocyanurate insulation that is produced in own facilities.
- B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
- C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
  1. Metal roof edging products by other manufacturers are not acceptable.
  2. Field- or shop-fabricated metal roof edgings are not acceptable.
- D. Substitution Procedures: See Instructions to Bidders.
  1. Submit evidence that the proposed substitution complies with the specified requirements.

### **2.2 ROOFING SYSTEM DESCRIPTION**

- A. Roofing System:
  1. Membrane: Ethylene propylene diene monomer (EPDM).
  2. Thickness: 090 mil.
  3. Membrane Attachment: Fully adhered.
  4. Slope: Deck is sloped but not enough; provide additional slope of 1/4 inch per foot (1:48) by means of tapered insulation.
  5. Comply with applicable local building code requirements.
  5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.



6. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and 1-29, and meeting minimum requirements of FM1-90 wind uplift rating.

B. Insulation:

1. Total System R Value: 35
2. Maximum Board Thickness: 3.1 inches (76.2 mm); use as many layers as necessary; stagger joints in adjacent layers.
3. Base Layer: Firestone ISO 95+, Polyisocyanurate foam board, non-composite.
  - a. Attachment: Loose laid.
4. Top Layer: HailGard (Nailbase) Polyisocyanurate foam board composite consisting of a black glass reinforced mat facer on one side and 7/16 inch oriented strand board on the other side.
  - a. Attachment: Firestone HailGard Fasteners

## **2.3 EPDM MEMBRANE MATERIALS**

- A. Roofing and Flashing Membrane: Black cured synthetic single-ply membrane composed of ethylene propylene diene terpolymer (EPDM) with the following properties:
1. Reinforcement: None; membrane complying with ASTM D 4637 Type I.
  2. Thickness: 0.090 inch (2.2 mm).
  3. Nominal Thickness Tolerance: Plus/minus 10 percent.
  4. Sheet Width: Provide the widest available sheets to minimize field seaming.
  5. Acceptable Product: RubberGard Platinum EPDM Membrane by Firestone.
- B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- C. Use accessories and flashings of like color to the primarily specified field EPDM membrane.
- D. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D 4811 Type II, and with the following properties:
1. Thickness: 0.055 inch (1.4 mm).
  2. Acceptable Product: RubberGard EPDM FormFlash by Firestone.
- E. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil (0.9 mm) EPDM tape adhesive; QuickSeam Flashing by Firestone.
- F. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; Firestone EPDM Pipe Flashing.
- G. Self-Adhesive Lap Splice Tape: 35 mil (0.9 mm) EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer; QuickSeam Splice Tape by Firestone.
- H. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces; SA-1065 Splice Adhesive by Firestone.

- I. Bonding Adhesive: Acrylic-based, water-borne, formulated for compatibility with EPDM membrane and wide variety of substrate materials, including masonry, wood, and insulation facings; Water-Based Bonding Adhesive by Firestone.
- J. Adhesive Primer: Synthetic rubber based primer formulated for compatibility with EPDM membrane and tape adhesive, with VOC content less than 2.1 lb/gal (250 g/L); QuickPrime Plus LVOC by Firestone.
- K. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams; Lap Sealant HS by Firestone.
- L. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.
- M. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal by Firestone.
- N. Metal Plates and Strips Used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.
- O. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.
- P. Roof Walkway Pads: EPDM, 0.30 inch (7.6 mm) thick by 30 by 30 inches (760 by 760 mm) with EPDM tape adhesive strips laminated to the bottom; QuickSeam Walkway Pads by Firestone.

## **2.4 ROOF INSULATION AND COVER BOARDS**

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
  - 1. Thickness: 3.1" (76.2 mm)
  - 2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
    - a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
  - 3. R-Value (LTTR): 19.1 Thickness: 3.1, minimum.
  - 4. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
  - 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
  - 6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
  - 7. Acceptable Product: Flat and/or Tapered ISO 95+ polyiso board insulation by Firestone.
- B. Polyisocyanurate Composite Cover Board: Non-combustible, water resistant high density, closed cell polyisocyanurate core with coated glass mat facers on one side and 7/16 inch oriented strand board on the other side, complying with ASTM D 1289, Type V, and with the following additional characteristics:
  - 1. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
  - 2. Thickness: 3.0 inch (12.7mm).

3. R-Value (LTTR): 15.9.
- C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

## **2.5 METAL ACCESSORIES**

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
  1. Wind Performance:
    - a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
    - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
    - c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
  2. Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia; Firestone EdgeGard.
  3. Fascia Face Height: 5 inches (127 mm).
  4. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
  5. Length: 144 inches (3650 mm).
  6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
  7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
  8. Anchor Bar Cleat: 20 gage, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
  9. Curved Applications: Factory modified.
  10. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
  11. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
  12. Scuppers: Welded watertight.
  13. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

- B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
1. Wind Performance:
    - a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
    - b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
  2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
  3. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
  4. Dimensions:
    - a. Wall Width: As indicated on the drawings.
    - b. Piece Length: Minimum 144 inches (3650 mm).
    - c. Curved Application: Factory fabricated in true radius.
  5. Anchor/Support Cleats: 20 gage, 0.036 inch (0.9 mm) thick prepunched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72 inches (1820 mm) on center.
  6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm) long legs on corner, intersection, and end pieces.
  7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners.

## **2.6 ACCESSORY MATERIALS**

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
  2. Thickness: Same as thickness of roof insulation.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where

manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
  - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
  - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
  - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

### **3.2 EXAMINATION**

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptance of project conditions and requirements.

### **3.3 PREPARATION**

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

### **3.4 INSULATION AND COVER BOARD INSTALLATION**

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).
- E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.
- F. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

### **3.5 SINGLE-PLY MEMBRANE INSTALLATION**

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane adhered to the substrate, with edge securement as specified.
- E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6 ) using mechanically fastened

reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

### **3.6 FLASHING AND ACCESSORIES INSTALLATION**

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
  1. Follow roofing manufacturer's instructions.
  2. Remove protective plastic surface film immediately before installation.
  3. Install water block sealant under the membrane anchorage leg.
  4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
  5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
  6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
  7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
  1. Use the longest practical flashing pieces.
  2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
  3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
  4. Provide termination directly to the vertical substrate as shown on roof drawings.
- E. Roof Drains:

1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
  2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
  3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
  4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
  5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
  2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
  3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
  4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

### **3.7 FINISHING AND WALKWAY INSTALLATION**

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
1. Use specified walkway pads unless otherwise indicated.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch (25 mm) and maximum of 3.0 inches (75 mm) from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
  2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

### **3.8 FIELD QUALITY CONTROL**

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).



- B. Perform all corrections necessary for issuance of warranty.

### **3.9 CLEANING**

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

### **3.10 PROTECTION**

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

--- E N D ---

**SECTION 07 60 00**  
**FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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. Manufactured flashing, copings, roof edge metal, and fasciae: Section 07 71 00 ROOF SPECIALTIES.
- B. Membrane base flashings and stripping: Section 07 53 23, ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING and Section 07 32 13, CLAY ROOF TILES.
- C. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- D. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- E. Integral flashing components of manufactured roof specialties and accessories or equipment: Section 07 71 00, ROOF SPECIALTIES, Section 07 72 00, ROOF ACCESSORIES, Division 22, PLUMBING sections and Division 23 HVAC sections.
- F. Paint materials and application: Section 09 91 00, PAINTING.

**1.3 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. Aluminum Association (AA):
  - AA-C22A41 .....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
  - AA-C22A42 .....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
  - AA-C22A44 .....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish
- C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
  - ANSI/SPRI ES-1-03 .....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems
- D. American Architectural Manufacturers Association (AAMA):
  - AAMA 620 .....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

- AAMA 621 ..... Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
- E. ASTM International (ASTM):
- A167-99(R2009)..... Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- A653/A653M-09 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
- B32-08..... Solder Metal
- B209-07 ..... Aluminum and Aluminum-Alloy Sheet and Plate
- B370-09..... Copper Sheet and Strip for Building Construction
- D173-03 ..... Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
- D412-06 ..... Vulcanized Rubber and Thermoplastic Elastomers-Tension
- D1187-97(R2002) ..... Asphalt Base Emulsions for Use as Protective Coatings for Metal
- D1784-08 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- D3656-07 ..... Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- D4586-07 ..... Asphalt Roof Cement, Asbestos Free
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.
- G. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06 ..... Metal Finishes Manual
- H. Federal Specification (Fed. Spec):
- A-A-1925A..... Shield, Expansion; (Nail Anchors)
- UU-B-790A..... Building Paper, Vegetable Fiber
- I. International Code Commission (ICC): International Building Code, Current Edition

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49 (Verify):
1. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.
- B. Wind Design Standard: Fabricate and install //copings// //roof-edge flashings// tested per ANSI/SPRI ES-1 to resist design pressure //insert 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 (Including drip flashing for doors, window flashing, and all other areas where flashing is indicated on drawings)
  - 2. Copings
  - 3. Gravel Stop-Fascia
  - 4. Gutter and Conductors
  - 5. Expansion joints
  - 6. Fascia-cant
  - 7. Metal required at roof valleys
- 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. Nonreinforced, elastomeric sheeting
  - 5. Copper clad stainless steel
  - 6. Polyethylene coated copper
  - 7. Bituminous coated copper
  - 8. Copper covered paper
  - 9. 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. Stainless Steel: ASTM A167, Type 302B, dead soft temper.
- B. Copper ASTM B370, cold-rolled temper.
- C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m<sup>2</sup> (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m<sup>2</sup> (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.
- D. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.

- E. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m<sup>2</sup> (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- F. 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//.
- G. Galvanized Sheet: ASTM, A653.
- H. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).
- I. Copper siding at dormers

## **2.2 FLASHING ACCESSORIES**

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m<sup>2</sup>( 6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
  - 1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
  - 2. Nails:
    - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
    - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
    - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. 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. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

## **2.4 FABRICATION, GENERAL**

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
  - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
  - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
  - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
  - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
  - b. Wire brush to produce a bright surface before soldering lead coated copper.
  - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
  - d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.

3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.
5. Cleat top of roofing under clay roofing tile.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips of minimum 0.6 Kg (24 ounce) copper // 0.6 mm (0.024 inch) thick stainless steel or 1.25 mm (0.050 inch) thick aluminum as required.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper 0.8 mm (0.031 inch) thick stainless steel or 1.6 mm (0.0625 inch) thick aluminum as required.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

## 2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Stainless Steel: Finish No. 2B or 2D.
2. Aluminum:
  - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
  - b. 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.
  - c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
  - d. Mill finish.
3. Steel and Galvanized Steel:
  - a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
  - b. Manufacturer's finish:
    - 1) Baked on prime coat over a phosphate coating.
    - 2) Baked-on prime and finish coat over a phosphate coating.
    - 3) Fluorocarbon Finish: AAMA 621, 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 or galvanized steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. Window Sill Flashing and Lintel Flashing:

1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, galvanized steel, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

E. Door Sill Flashing:

1. Where concealed, use 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel or 0.5 (0.018 Inch) galvanized steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

## 2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.

1. Use 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 mm (0.018 Inch) copper, galvanized steel, or 0.5 mm (0.018 inch) stainless steel.
3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use stainless steel at pipe flashings.

- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
  - 1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
  - 2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
  - 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, galvanized steel, 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 can not be inserted in vertical surface.
  2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
  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 (Coordinate with mechanical):
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 GRAVEL STOPS

- A. General:
1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
  2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
  3. Fabricate roof flange not less than 100 mm (4 inches) wide.
  4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
  5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:

- a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
  - b. Fabricate bottom edge of formed fascia to receive edge strip.
  - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).
- B. Formed Flat Sheet Metal Gravel Stops and Fascia:
  - 1. Fabricate as shown of .05 mm (0.018 inch) thick stainless steel //0.5 Kg (20 ounce)copper//, steel, 0.5mm (0.018 Inch) galvanized steel, 1.25 mm (0.050 inch) thick aluminum.
  - 2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
  - 3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
  - 4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
  - 5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.
- C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
  - 1. Fabricate as shown of 0.4 mm (0.015 inch) thick stainless steel //0.5 Kg (16 ounce) copper// 0.8 mm (0.032 inch) thick aluminum, or 0.5mm (0.018 Inch galvanized steel..
  - 2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
  - 3. Factory fabricate prepackaged system, complete with fastenings.
  - 4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
  - 5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

## **2.10 BITUMEN STOPS**

- A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.
- B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.
- C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

## **2.11 HANGING GUTTERS**

- A. Fabricate gutters of not less than the following:
  - 1. 0.5 Kg (20oz) copper.(Base Bid)
  - 2. 0.8mm 0.032inch) thick aluminum. (Alternate)

B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

C. Building side of gutter shall be //not less than 38 mm (1 1/2 inches) higher than exterior sideD.

Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.

E. Gutter Spacers:

1. Fabricate of same material and thickness as gutter.
2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
4. Rivet and solder to gutter except rivet and seal to aluminum.

F. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Lock and solder longitudinal seam except use sealant in lieu of solder with aluminum.
3. Solder tube to gutter. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:

1. Fabricate of same metal as gutter. Use the following:
  - a. 6 by 25 mm (1/4 by 1 inch) copper.(Base Bid)
  - b. 6 by 25 mm (1/4 by 1 inch)// aluminum. (Alternate)
2. Fabricate to gutter profile.
3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

## **2.12 CONDUCTORS (DOWNSPOUTS)**

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].

1. Fabricate open face channel shape with hemmed longitudinal edges.

B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.

C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.

D. Conductor Heads:

1. Fabricate of same material as conductor.
2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.

3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
5. Extend wall edge not less than 25 mm (one inch) above front edge.
6. Solder joints for water tight assembly.
7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

### **2.13 SPLASHPANS**

- A. Fabricate splashpans from the following:
  1. 0.4 Kg (16 oz) copper.(Base Bid)
  2. 1.25 mm (0.050 inch) thick aluminum. (Alternate)
- B. Fabricate in accordance with Architectural Sheet Metal Manual Plate 35 with not less than two ribs as shown in alternate section.

### **2.14 REGLETS**

- A. Fabricate reglets of one of the following materials:
  1. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
  2. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
  3. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.
- B. Use one material type throughout
- C. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- D. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- E. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- F. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- G. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

### **2.15 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.

## **2.16 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING**

- A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.
- B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.
  1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
  2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
  3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
  4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.
- C. Fabricate sleeve base flashing with roof flange of either copper, stainless steel, or copper clad stainless steel.
  1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
  2. Extend sleeve around collar up to top of collar.
  3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
  4. Fabricate interior diameter 50 mm (2 inch) greater than collar.
- D. Fabricate hood counter flashing from same material and thickness as sleeve.
  1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
  2. Hem bottom edge of hood 13 mm (1/2 inch).
  3. Provide a 50 mm (2 inch) deep drawband.
- E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

## 2.17 GOOSENECK ROOF VENTILATORS

- A. Form of 1.3 mm (0.0508 inch) thick sheet aluminum, reinforce as necessary for rigidity, stiffness, and connection to curb, and to be watertight.
  - 1. Form lower-edge to sleeve to curb.
  - 2. Curb:
    - a. Form for 100 mm (4 inch) high sleeve to ventilator.
    - b. Form for concealed anchorage to structural curb and to bear on structural curb.
    - c. Form bottom edge of curb as counterflashing to lap base flashing.
- B. Provide open end with 1.6 mm (16 gage), stainless steel wire guard of 13 mm (1/2 inch) square mesh.
  - 1. Construct suitable aluminum angle frame to retain wire guard.
  - 2. Rivet angle frame to end of gooseneck.

## 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. 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.
  - 7. 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.
  - 8. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
  - 9. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.



10. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
11. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
12. 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.
13. 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.
14. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
15. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
16. Bitumen Stops:
  - a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
  - b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

### **3.2 THROUGH-WALL FLASHING**

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

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.

7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
  8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
  9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
  10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
  11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
  12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
  13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
  14. Continue flashing around columns:
    - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).
- B. Flashing at 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.
- C. 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.
- D. 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.
- E. 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.
- F. 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 wood nailers over bituminous roofing.
  4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

### **3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)**

- A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
  2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
  3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
  4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
  5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
  6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
  2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
  3. Where flashing is surface mounted on flat surfaces.
    - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      - 1) Locate fasteners in masonry mortar joints.
      - 2) Use screws to sheet metal or wood.
    - b. Fill joint at top with sealant.
  4. Where flashing or hood is mounted on pipe.
    - a. Secure with draw band tight against pipe.
    - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturers instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

- E. When counter flashing is a component of other flashing install as shown.

### **3.5 REGLETS**

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints on 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 GRAVEL STOPS**

- A. General:
  - 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
  - 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
  - 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
  - 4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
  - 5. Set flange in roof cement when installed over built-up roofing.
  - 6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal gravel stops and fascia:
  - 1. Install with end joints of splice plates sheets lapped three inches.
  - 2. Hook the lower edge of fascia into a continuous edge strip.
  - 3. Lock top section to bottom section for two piece fascia.
- C. Corrugated sheet gravel stops and fascia:
  - 1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
  - 2. Hook lower edge of fascia into a continuous edge strip.

### **3.7 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.

### **3.8 EXPANSION JOINT COVERS, INSULATED**

- A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.
- B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.
- C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

### **3.9 ENGINE EXHAUST PIPE OR STACK FLASHING**

- A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.
- B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.
- C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:
  1. Install insect screen to fit between bottom edge of hood and side of sleeve.
  2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

### **3.10 HANGING GUTTERS**

- A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.
  1. For copper or copper clad stainless steel gutters use brass or bronze brackets.
  2. For stainless steel gutters use stainless steel brackets.
  3. For aluminum gutters use aluminum brackets or stainless steel brackets.
  4. Use brass or stainless steel screws.

- D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.
- E. Gutter Expansion Joint:
  - 1. Locate expansion joints midway between outlet tubes.
  - 2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
  - 3. Install a cover plate over the space at expansion joint.
  - 4. Fasten cover plates to gutter section on one side of expansion joint only.
  - 5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.
- F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

### **3.11 CONDUCTORS (DOWNSPOUTS)**

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.
- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

### **3.12 SPLASH PANS**

- A. Install where downspouts discharge on low slope roofs unless shown otherwise.
- B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

### **3.13 GOOSENECK ROOF VENTILATORS**

- A. Install on structural curb not less than 200 mm (8 inch) high above roof surface.
- B. Securely anchor ventilator curb to structural curb with fasteners spaced not over 300 mm (12 inch) on center.
- C. Anchor gooseneck to curb with screws having nonprene washers at 150 mm (6 inch) on center.

--- E N D ---

**SECTION 07 60 30**  
**COPPER-CLAD STAINLESS STEEL SHEET METAL**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Provide copper-clad stainless steel for the following applications:
  - 1. Sheet metal roofing including standing seam, flat seam and batten seam types.
  - 2. Sheet metal fascia and wall panels.
  - 3. Rain drainage including gutters, downspouts, scuppers and conductors.
  - 4. Flashing including base, counter, cap, eave, valley, drip and step flashings.
  - 5. Fabricated assemblies, including dormers, cupolas, finials, and spires.

**1.2 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Section 05 50 00, Metal Fabrications.

**1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, and recommendations for each product specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale plans, elevations, and details of profiles, joints, seams, anchorages, connections and accessory items. Indicate galvanic isolation from adjacent aluminum or carbon steel if applicable.
- C. Material Samples: Submit two 6 by 6 inch flat samples of copper-clad stainless steel.
- D. Fabricated Samples: Submit full size sample of typical seam, corner and termination as acceptable to the COR, for approval of fabrication details and workmanship.
- E. Warranty: Submit manufacturer's standard 25 year warranty.

**1.4 QUALITY ASSURANCE**

- A. Fabricator: Minimum 5 years experience with projects of similar complexity.
- B. Installer: Minimum 3 years experience with projects of similar complexity. At COR's request, submit names and locations of recent projects.
- C. Industry Standards for Materials and Fabrication Details: Comply with recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual, current edition.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.



## **1.6 SEQUENCING AND SCHEDULING**

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Perform work of this section in coordination with other sections to provide the highest quality work which best fulfills the intent requirements of this work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturer: Provide CopperPlus by Engineered Materials Solutions, 39 Perry Avenue, Attleboro, MA 02703, telephone 508-342-2235, fax 508-342-2538, [www.cladit.com](http://www.cladit.com) or approved equal.
- B. Material: 10 percent thickness of copper metallurgically bonded on each side to an 80 percent core of Type 430 stainless steel, fully annealed. No adhesives or brazing alloys shall be required to achieve a permanent bond.
  - 1. Cross Section: Copper, stainless steel, copper.
  - 2. Standard Thicknesses: As recommended by manufacturer from the following standard thicknesses and weights:
    - a. 0.012 inches thick, 0.4959 pounds per square foot.
    - b. 0.016 inches thick, 0.6612 pounds per square foot.
    - c. 0.0216 inches thick, 0.8927 pounds per square foot.
    - d. 0.027 inches thick, 1.1159 pounds per square foot.
  - 3. Mechanically Fastened Joints: Copper, stainless steel, brass or bronze fasteners.
  - 4. Soldered Joints: Soft soldered using 50-50 or higher tin content solder, mild fluxes.
  - 5. Shapes: Coils, rolls or sheets up to 24 inches wide, as applicable.
- C. Accessories: Provide all clips, cleats, straps, anchors and similar items necessary to properly complete the work. Provide accessories that are compatible with sheet metal materials used and which are of sufficient size and gage to perform as intended.

### **2.2 FABRICATION**

- A. Shop fabricate work to the greatest extent possible. Fabricate work to match approved shop drawings and to provide the best possible watertight, weatherproof performance with expansion provisions in running work. Minimize oil-canning, buckling, tool marks and other defects.
- B. Fabricate work with uniform, watertight joints. Make seams as inconspicuous as possible.
- C. Isolate dissimilar materials with isolation coating recommended by the manufacturer or other permanent separation acceptable to the COR.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Installer shall examine substrates, supports, and conditions under which this work is to be

performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### **3.2 INSTALLATION**

- A. Strictly comply with manufacturer's and fabricator's instructions and recommendations and approved details.
- B. Securely anchor work and allow for thermal movement and building movement. Use concealed fasteners to the greatest extent possible. Install work to be permanently weatherproof and watertight.

### **3.3 ADJUSTING, CLEANING, PROTECTION**

- A. Adjust work to conform to appear uniform and in proper relationship with adjacent work.
- B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- C. Clean exposed surfaces using detergent and water. If solder flux residues are evident remove using mild abrasive cleanser.

----- END -----

## **SECTION 07 71 00 ROOF SPECIALTIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies roof hatches; equipment supports.

#### **1.2 RELATED WORK**

- A. Color and texture of finish: Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- C. General insulation: Section 07 21 13, THERMAL INSULATION. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

#### **1.3 QUALITY CONTROL**

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent 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: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):  
RR-G-1602D .....Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)
- C. American Society for Testing and Material (ASTM):  
A653/A653M-10 .....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process  
B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate

B221/221M-08.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes  
 C612-10 .....Mineral Fiber Block and Board Thermal Insulation  
 D1187-97(R2002) .....Asphalt-Base Emulsions for Use as Protective Coatings for  
 Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series .....Metal Finishes Manual

E. American Architectural Manufacturers Association (AAMA):

2605-11 .....High Performance Organic Coatings on Architectural Extrusions  
 and Panels.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- B. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.

### **2.2 ROOF HATCH (SCUTTLE)**

- A. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
  - 1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 2. Interior facing: Minimum 1 mm (0.04 inch) thick sheet aluminum.
  - 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
  - 4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.
  - 5. Make curb 300 mm (12 inches).
  - 6. Form cover to lap curb and cap flashing.
  - 7. Size opening as shown.
- C. Hardware:
  - 1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
  - 2. Provide pintle hinges.
  - 3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
  - 4. Covers shall automatically lock in the open position at not less than 70 degrees.
  - 5. Provide weatherstripping at cover closure.
  - 6. Galvanize all hardware items.
- D. Assembly:
  - 1. Completely shop assemble roof scuttle.
  - 2. Fully weld all joints exposed to the weather and built into the roofing.

3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.

## **2.3 EQUIPMENT SUPPORTS**

- A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.
- B. Form exterior curb with integral base, and deck closures for curbs installed on steel decking.
- C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).
- D. Fabricate curb with a minimum height of 200 mm (8 inches) above roof surface.
- E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.
- F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof specialties where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
  - b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
  - c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
  - d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).
- J. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

### **3.2 ADJUSTING**

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

### **3.3 PROTECTION**

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

--- E N D ---

## **SECTION 07 72 00 ROOF ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies copings, gravel stops, fascias, and expansion joints.

#### **1.2 RELATED WORK**

- A. Color and texture of finish:
- B. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- C. General insulation: Section 07 21 13, THERMAL INSULATION
- D. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

#### **1.3 QUALITY CONTROL**

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent 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: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):
  - B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate
  - B221/221M-08.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - C612-10 .....Mineral Fiber Block and Board Thermal Insulation
  - D1187-97 (R2002) .....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06 .....Metal Finishes Manual

- D. American Architectural Manufacturers Association (AAMA):  
2605-11 .....High Performance Organic Coatings on Architectural Extrusions  
and Panels.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- D. Insulation: ASTM C612, Class 1 or 2.
- E. Asphalt Coating: ASTM D 1187, Type I, quick setting.

### **2.2 COPINGS**

- A. Turn outer edges down each face of wall as shown.
- B. Maximum lengths of 3000 mm (10 feet).
- C. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
- D. //Copings shall be Category 5 FM rated//
- E. Provide 100 mm (four inch) wide 0.8 mm (0.032 inch) thick watertight joint covers.
- F. Provide anchor gutter bar of 0.8 mm (0.032 inch) thick with anchor holes formed for underside of joint.
- G. Provide concealed guttered splice plate of 0.8 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.
- IH Finish: // Anodized // Fluorocarbon // as specified.

### **2.3 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS**

- A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.
- B. Turn fascia down face of wall and up above roof as shown.
- C. Maximum lengths of 3000 mm (10-feet).
- D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
- E. Provide 100 mm (four inch) wide 2 mm (0.078 inch) thick watertight joint covers with 150 mm (six inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

### **2.4 EXTRUDED ALUMINUM FASCIA-CANT SYSTEM**

- A. The fascia-cant system consists of three pieces, an extruded aluminum fascia, a galvanized steel cant, and an aluminum compression clamp.
- B. Furnish in stock lengths of not more than 3000 mm (10 feet) long.

- C. Form fascia from not less than 2 mm (0.070 inch) thick aluminum. Provide four inch wide 0.8 mm (0.032-inch) thick concealed sheet aluminum joint cover plates in back of fascia.
- D. Form cant strip from galvanized steel not less than 0.8 mm (0.0299 inch) thick, to profile shown and design to hold lower edge of the fascia.
- E. Form compression clamp of not less than 0.8 mm (0.032 inch) thick aluminum designed to hold the top edge of the fascia and the built-up flashing.
- F. Internal and external corners:
  - 1. Factory fabricate and fully weld mitered joints.
  - 2. Furnish corner sections in // manufacturers standard sizes // sizes shown // with not less than 300 mm (12 inch) leg lengths. //
- G. Factory fabricated fascia sump assemblies.
  - 1. Fabricate sump assemblies with stainless steel cores and extruded aluminum cover to match fascia-cant.
  - 2. Provide stainless steel outlet, tube sized to suit downspout and solder to core to make watertight.
  - 3. Furnish sump assembly in 500 mm (20 inch) minimum lengths.
- H. Factory fabricated scupper assemblies:
  - 1. Fabricate scupper assembly with extended plates to match fascia-cant in 500 mm (20 inch) minimum lengths.
  - 2. Extend outlet opening not less than 50 mm (two inches) with drip edge.
  - 3. Fabricate with stainless steel cores or sleeve to drain water from toe of cant and flash in to built-up roofing with 100 mm (4 inch) wide flange.
- I. Finish on aluminum: // anodized // fluorocarbon // as specified.

## **2.5 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS**

- A. Fabricate in 3000 mm (10 foot) lengths with fastener openings slotting for expansion not over 600 mm (24 inch) centers.
- B. Provide four-way expansion, for joint widths shown.
- C. Mill finish on aluminum.
- D. Form waterstop or moisture seals of continuous sheets of neoprene, not less than 0.8 mm (0.032 inch) thick.
- E. Fabricate corners as one piece assembly with mitered and welded joint and least dimension legs not less than 300 mm (12 inches) long.
- F. Factory fabricate end caps and transitions to insure waterproof assembly.
- G. Three piece assembly:
  - 1. Roof expansion joint cover system consists of an extruded aluminum cover, extruded frame or curb vertical section, galvanized steel cant, and aluminum compression clamp counter flashing, complete with moisture seals. Form cover and vertical section from extruded



aluminum, 2 mm (0.080 inch) minimum thickness with spring stainless steel tension or pivot bar.

2. Form cant from galvanized steel not less than 0.8 (0.029 inch) thick formed to profile shown.
  3. Form splice plates of not less than 0.8 mm (0.032 inch) thick aluminum sheet.
  4. Form counter flashing member of 1.3 mm (0.050 inch) thick sheet aluminum, secured with screws to the top edge of the vertical section and providing compression clamp over base flashing.
  5. Provide compression gasket separating cover from curb bearing.
- H. Two piece assembly:
1. Roof expansion joint system consists of an extruded aluminum cover combination extruded aluminum frame or curb with integral adjustable counter flashing flange, and moisture seals.
  2. Form cover from extruded aluminum 2 mm (0.078 inch) minimum thickness.
  3. Form cover anchor system of stainless steel pivot bar.
  4. Form frame assembly of not less than 2 mm (0.076 inch) aluminum except for flashing portion.
  5. Provide compression gasket separating cover from curb at bearing.

## **2.6 FINISH**

- A. In accordance with NAAMM Amp 500-505.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Fluorocarbon Finish: AAMA 2605.2 high performance organic coating.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof accessories where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- F. Gravel Stops and Fascias:
  1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
  2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
  3. Lap cover plates and concealed flashing over the gravel stop and fascia not less than four inches.

4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.

G. Aluminum Coping:

1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
2. Center joint gutter bar and covers at joints and securely lock in place.
3. When snap-on system is used insure front and back edges are locked in place.

H. Fascia-Cant System:

1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown.
2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
3. Offset joints in extruded aluminum members from galvanized steel cant joints.

I. Expansion Joint Covers:

1. Install to terminate base flashing 200 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
3. Use stainless steel screws when exposed.
4. Three piece assembly:
  - a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
  - b. Install cant to wood blocking by nailing along horizontal flange every 150 mm (6 inches), with galvanized roofing nails 25 mm (one inch) long.
  - c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 450 mm (18 inches) on center.
  - d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
  - e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than four inches.
5. Two piece assembly:
  - a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
  - b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.

- c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
- d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

### **3.2 PROTECTION OF ALUMINUM**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

### **3.3 ADJUSTING**

Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

### **3.4 PROTECTION**

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

--- E N D ---

## **SECTION 07 84 00 FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.1 DESCRIPTION**

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

#### **1.2 RELATED WORK**

- A. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- B. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- C. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS // Section 23 37 00, AIR OUTLETS AND INLETS.

#### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used. All firestopping to be provided shall be through the same manufacturer.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

#### **1.4 DELIVERY AND STORAGE**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

#### **1.5 WARRANTY**

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

#### **1.6 QUALITY ASSURANCE**

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

#### **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - E84-10..... Surface Burning Characteristics of Building Materials
  - E814-11..... Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
  - Annual Issue Approval Guide Building Materials

- D. Underwriters Laboratories, Inc. (UL):
  - Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 1479-10 ..... Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
  - Annual Issue Certification Listings

## **PART 2 - PRODUCTS**

### **2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Have no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
  - 1. Classified for use with the particular type of penetrating material used.
  - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
  - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

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

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

### **3.2 PREPARATION**

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

### **3.3 INSTALLATION**

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

### **3.4 CLEAN-UP AND ACCEPTANCE OF WORK**

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

--- E N D ---

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

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

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

#### **1.2 RELATED WORK:**

- A. // Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. //
- B. // Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY. //
- C. // Firestopping penetrations: Section 07 84 00, FIRESTOPPING. //
- D. // Glazing: Section 08 80 00, GLAZING. //
- E. // 06 20 00 Finish Carpentry.
- F. // Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD. //
- G. //Plumbing Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION //.

#### **1.3 QUALITY CONTROL:**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. //Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness. //
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. // Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations: //
  - 1. //Locate test joints where indicated or, if not indicated, as directed by Contracting Officer. //
  - 2. Conduct field tests for each application indicated below:

- a. Each type of elastomeric sealant and joint substrate indicated.
  - b. Each type of non-elastomeric sealant and joint substrate indicated.
- 3. Notify COR seven days in advance of dates and times when test joints will be erected.
- 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
  - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive joint sealants, which are specified by reference to this section.

#### **1.4 SUBMITTALS:**

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

#### **1.5 PROJECT CONDITIONS:**

- A. Environmental Limitations:
  - 1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
  - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

#### **1.6 DELIVERY, HANDLING, AND STORAGE:**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.



- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

#### **1.7 DEFINITIONS:**

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

#### **1.8 WARRANTY:**

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

#### **1.9 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material.
  - C612-10 .....Mineral Fiber Block and Board Thermal Insulation.
  - C717-10 .....Standard Terminology of Building Seals and Sealants.
  - C834-10 .....Latex Sealants.
  - C919-08. ....Use of Sealants in Acoustical Applications.
  - C920-10 .....Elastomeric Joint Sealants.
  - C1021-08 .....Laboratories Engaged in Testing of Building Sealants.
  - C1193-09 .....Standard Guide for Use of Joint Sealants.
  - C1330-02 (R2007) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - D1056-07 .....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
  - E84-09.....Surface Burning Characteristics of Building Materials.
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
  - The Professionals' Guide

### **PART 2 - PRODUCTS**

#### **2.1 SEALANTS:**

- Dow Chemical Corp. Serves as basis of design.

- A. S-1:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade NS.
  - 5. Shore A hardness of 20-40
- B. S-2:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade P.
  - 5. Shore A hardness of 25-40.
- C. S-3:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type S.
  - 3. Class 25, joint movement range of plus or minus 50 percent.
  - 4. Grade NS.
  - 5. Shore A hardness of 15-25.
  - 6. Minimum elongation of 700 percent.
- D. S-4:
  - 1. ASTM C920 polyurethane or polysulfide.
  - 2. Type S.
  - 3. Class 25.
  - 4. Grade NS.
  - 5. Shore A hardness of 25-40.
- E. S-5:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type S.
  - 3. Class 25.
  - 4. Grade P.
  - 5. Shore hardness of 15-45.
- F. S-6:
  - 1. ASTM C920, silicone, neutral cure.
  - 2. Type S.
  - 3. Class: Joint movement range of plus 100 percent to minus 50 percent.
  - 4. Grade NS.
  - 5. Shore A hardness of 15-20.

6. Minimum elongation of 1200 percent.
- G. S-7:
1. ASTM C920, silicone, neutral cure.
  2. Type S.
  3. Class 25.
  4. Grade NS.
  5. Shore A hardness of 25-30.
  6. Structural glazing application.
- H. S-8:
1. ASTM C920, silicone, acetoxycure.
  2. Type S.
  3. Class 25.
  4. Grade NS.
  5. Shore A hardness of 25-30.
  6. Structural glazing application.
- I. S-9:
1. ASTM C920 silicone.
  2. Type S.
  3. Class 25.
  4. Grade NS.
  5. Shore A hardness of 25-30.
  6. Non-yellowing, mildew resistant.
- J. S-10:
1. ASTM C920, coal tar extended fuel resistance polyurethane.
  2. Type M/S.
  3. Class 25.
  4. Grade P/NS.
  5. Shore A hardness of 15-20.
- K. S-11:
1. ASTM C920 polyurethane.
  2. Type M/S.
  3. Class 25.
  4. Grade P/NS.
  5. Shore A hardness of 35 to 50.
- L. S-12:
1. ASTM C920, polyurethane.
  2. Type M/S.

3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

## **2.2 CAULKING COMPOUND:**

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

## **2.3 COLOR:**

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

## **2.4 JOINT SEALANT BACKING:**

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

## **2.5 FILLER:**

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

## **2.6 PRIMER:**

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

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

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

## **PART 3 - EXECUTION**

### **3.1 INSPECTION:**

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

### **3.2 PREPARATIONS:**

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

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  1. Apply primer prior to installation of back-up rod or bond breaker tape.
  2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.3 BACKING INSTALLATION:**

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

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

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

### **3.5 INSTALLATION:**

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

10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
  1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
  2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
  3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
  4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
  5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL:**

- A. // Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
  1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 300 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 the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

### **3.8 LOCATIONS:**

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1, S-2
  - 2. Metal to Masonry or Stone: Type S-1
  - 3. Masonry to Masonry or Stone: Type S-1
  - 4. Stone to Stone: Type S-1
  - 5. Cast Stone to Cast Stone: Type S-1
  - 6. Threshold Setting Bed: Type S-1, S-3, S-4
  - 7. Masonry Expansion and Control Joints: Type S-6
  - 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
  - 1. Flashings to Wall: Type S-6
  - 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
  - 1. Walls to Plumbing Fixtures: Type S-9
  - 2. Counter Tops to Walls: Type S-9
  - 3. Pipe Penetrations: Type S-9
- D. Horizontal Traffic Joints:
  - 1. Concrete Paving, Unit Pavers: Type S-11 or S-12
  - 2. Garage/Parking Decks: Type S-10
- E. High Temperature Joints over 204 degrees C (400 degrees F):
  - 1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8
- F. Interior Caulking:



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

--- E N D ---

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Standard and custom hollow metal doors and frames.
  - 2. Steel sidelight, borrowed lite and transom frames.
  - 3. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
  - 1. Division 01 Section "Sustainable Design Requirements" for additional LEED documentation and requirements.
  - 2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
  - 3. Division 05 Steel Framing.
  - 4. Division 08 Sections "Flush Wood Doors", "Clad Wood Doors", and "Stile and Rail Wood Doors" for wood doors in hollow metal frames.
  - 5. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
  - 6. Division 08 Sections "Door Hardware" and "Access Control Hardware" for door hardware for hollow metal doors and frames.
  - 7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
  - 8. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
  - 9. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

**1.2 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. Comply with the version year adopted by the Authority Having Jurisdiction.
- B. Steel Door Institute (SDI):
  - 1. SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
  - 2. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
  - 3. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

4. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  5. SDI A250.11 - Recommended Erection Instructions for Steel Frames.
  6. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
- C. American Society for Testing and Materials (ASTM):
1. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  3. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. The National Association Architectural Metal Manufacturers (NAAMM):
1. NAAMM/HMMA 867-06 - Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames.
- E. Business Hardware Manufacturer's Association (BHMA):
1. BHMA A156.15 - Hardware Preparation in Steel Doors and Frames.
- F. National Fire Protection Association (NFPA):
1. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
  2. NFPA 105: Standard for the Installation of Smoke Door Assemblies.
  3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
- G. Underwriters Laboratories, Inc. (UL):
1. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 10B - Fire Test of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- C. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- D. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

E. Samples for Verification:

1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.

F. Informational Submittals:

**1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C..
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.Door and frames to be stacked in a vertical upright position.

### **1.6 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

### **1.7 COORDINATION**

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

### **1.8 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Curries Company.
  - 2. Or equal as approved.

### **2.2 MATERIALS**

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral core, or vertical steel-stiffener core.
    - a. Polystyrene and Polyurethane (Insulated) Doors: Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value 11 or better.
    - b. Standard Vertical Steel-Stiffener Core: Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
    - c. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
  - 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
  - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
  - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
  - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
  - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
  - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
5. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
6. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
7. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
8. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU): 707 Series.
2. Curries Company (CU) - Steel-Stiffened: 747 Series.
3. Or equals as approved.

## 2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Masonry Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
  1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
  3. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
  4. Manufacturers Basis of Design:
    - a. Curries Company (CU) - M Series.

- b. Or equal as approved.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
  - 3. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
  - 4. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
  - 5. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
  - 6. Manufacturers Basis of Design:
    - a. Curries Company (CU) - M Series (Masonry).
    - b. Or equal as approved.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## **2.5 FRAME ANCHORS**

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
  - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## **2.6 HOLLOW METAL PANELS**

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## **2.7 LOUVERS**

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
  - 1. Blade Type: Vision proof inverted V or inverted Y.



2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
  2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## **2.8 LIGHT OPENINGS AND GLAZING**

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
- D. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.
1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

## **2.9 ACCESSORIES**

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## **2.10 FABRICATION**

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
4. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 3'6" and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
9. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
10. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
  - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
  - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
  - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
  - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
11. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
12. Jamb Anchors: Provide number and spacing of anchors as follows:
  - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Two anchors per jamb up to 60 inches high.
    - 2) Three anchors per jamb from 60 to 90 inches high.
  - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Three anchors per jamb up to 60 inches high.
    - 2) Four anchors per jamb from 60 to 90 inches high.
    - 3) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

13. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware". NONE ON ACUTE IN-PATIENT UNIT.
    - a. Do not provide door silencers on acute care wing.
  14. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## **2.11 STEEL FINISHES**

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.
- B. Factory Pre-Finishes: Factory apply electrostatic paint finish to doors and frames in accordance with ANSI A250.3 test procedure acceptance criteria for steel doors and frames with factory applied finished coatings.
1. Color to be selected by architect.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### **3.3 INSTALLATION**

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
  - 5. 5. Tamper Proof resistant, anti-ligature hardware to be used at all doors on the acute in-patient unit.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

- d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### **3.4 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

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**SECTION 08 14 23**  
**CLAD WOOD DOORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Flush solid core low pressure clad or decorative laminate doors.
  - 2. Flush solid core high pressure clad or decorative laminate doors.
  - 3. Factory fitting clad wood doors to frames and factory machining for hardware.
  - 4. Light frames and glazing installed in clad wood doors.
- B. Related Sections:
  - 1. Division 01 Section "Sustainable Design Requirements" for additional Green Globe documentation and requirements.
  - 2. Division 08 Section "Hollow Metal Doors and Frames" for clad wood doors in steel frames.
  - 3. Division 08 Section "Glazing" for glass view panels in wood doors.
  - 4. Division 08 Sections "Door Hardware" and "Access Control Hardware" for door hardware for clad wood doors.
  - 5. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.

**1.2 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. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A208.1 - Particleboard.
  - 2. ASTM E90-90 - Measurement of Airborne Sound Transmission Loss of Building Partitions.
  - 3. ASTM E 413 - Classification for Rating Sound Insulation.
  - 4. Architectural Woodwork Standards - AWS Section 9, Doors; Quality Standards of the Architectural Woodwork Institute (AWI) and Woodwork Institute (WI).
  - 5. Forestry Stewardship Council (FSC) - Guidelines for environmentally certified wood doors.
  - 6. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
  - 7. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
  - 8. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.

9. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
10. United States Green Building Council (USGBC).
11. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.
12. Window and Door Manufacturers Association - WDMA I.S. 10 Industry Standard for Testing Cellulosic Composite Materials for Use in Fenestration Products.

### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A or AWS classifications.
- C. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the clad door supplier in order to prepare the doors and frames to receive the finish hardware items.
- D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  1. Indicate dimensions and locations of mortises and holes for hardware.
  2. Indicate dimensions and locations of cutouts.
  3. Indicate fire protection ratings for fire rated doors.
- E. Samples for Initial Selection: For decorative laminate door faces.
  1. Decorative laminate, 8 by 10 inches, for each color and pattern selected.
  2. Corner sections of doors, 5 x 11 inches, with door faces and edges representing actual materials to be used.
  3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- F. Informational Submittals:
  1. Submit manufacturer's environmental documentation and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.
- G. Warranty: Sample of special warranties.

### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain clad wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors." and the following minimum values (for particle core doors):



1. NWWDA TM-7 Cycle Slam Test: 1,000,000 cycles.
  2. NWWDA TM-8 Hinge Loading Test 1,000 lbs.
  3. NWWDA TM-10 Edge Screw Holding Test 850 lbs.
  4. NWWDA TM-10 Face Screw Holding Test 650 lbs.
- C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3<sup>rd</sup> party certification agency's procedure, except for size.
  2. Temperature Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - 1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
  4. Blocking: When through-bolts are not to be used, indicate size and location of blocking in 45, 60 and 90 minute mineral core doors
- D. Security Rating for Particle Core Doors: ASTM F 476, Grade 40.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing clad wood doors.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package clad wood doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

## **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **1.7 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within door manufacturer specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Delaminating of face in decorative laminate faced doors.
  - 2. Warranty includes installation that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid Core Interior Doors: Life of installation according to manufacturer's written warranty.

## **PART 2 - PRODUCTS**

### **2.1 DOOR CONSTRUCTION, GENERAL**

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Particleboard Core Doors:
  - 1. Particleboard: ANSI A208.1, Grade M-2.
  - 2. Wood Stiles and Rails: As required to meet Extra Heavy Duty Performance level.
  - 3. Blocking: As required to meet Extra Heavy Duty Performance level.
- C. Mineral Core Doors:
  - 1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
  - 2. Blocking: Provide composite blocking with improved screw holding capability approved for use in doors of fire protection ratings indicated as needed to eliminate through-bolting hardware.
  - 3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance with outer stile matching polymer edging.
- D. Fire Rated Doors: Provide construction and core specified above as needed to provide fire ratings indicated.
  - 1. Category A Edge Construction: Provide concealed intumescent seals as required.
  - 2. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - a. Where required or specified, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
- E. Environmentally Responsible Doors: Provide where specified doors manufactured with the following environmentally responsible components:

1. Particleboard Core:
  - a. Certified Wood: Interior flush clad wood flush doors (including fire rated doors) to be manufactured in accordance with FSC principles and criteria for wood building component and have FSC Chain of Custody certification.
  - b. Recycled Content: Interior flush clad wood doors to contain a minimum of 70% recycled and recovered content as certified by Scientific Certification Systems (SCS).
  - c. Low Emitting Materials: Interior flush clad wood doors must contain no added urea-formaldehyde resins.

## **2.2 DECORATIVE LAMINATE FACED DOORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. The Maiman Company – Thermal Fused.
  2. Or equal as approved.
- B. Low Pressure Decorative Laminate (LPDL) Thermal Fused Faces:
  1. Low pressure decorative laminates faces thermally fused to cores under heat and pressure, complying with Laminating Materials Association's Product Standard and Typical Physical Properties of Decorative Overlays. LMA.2003.
  2. Color or Wood Grain Pattern:
    - a. H1334 Gentle Anigre.
  3. Exposed Edges: Impact resistant polymer edging, minimum .040" thick, applied to all four edges after faces.
    - a. Polymer Edging Color or Wood Grain Pattern: Manufacturer's standard color that most closely matches faces.
  4. Provide doors with pilot holes factory drilled for vertical edge hinges and lock sets.

## **2.3 LIGHT FRAMES AND GLAZING**

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
  1. Wood Species: Manufacturer's standard wood beads factory finished to match door face.
  2. Profile: Manufacturer's standard lipped profile. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute rating:  
 Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.

- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

## **2.4 FABRICATION**

- A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with requirements in NFPA 80 for fire rated doors.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide clad wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine doors and installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

### **3.3 ADJUSTING**

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Replace doors that do not comply with requirements. Doors may be repaired if work complies with requirements and shows no evidence of repair or refinishing.

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

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

Section specifies access doors or panels.

#### **1.2 RELATED WORK:**

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- B. Access doors in gypsum board wall or ceilings: Section 09 29 00, GYPSUM BOARD.
- C. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS // Section 23 37 00, AIR OUTLETS AND INLETS.

#### **1.3 SUBMITTALS:**

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

#### **1.4 APPLICABLE PUBLICATIONS**

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

### **PART 2 - PRODUCTS**

#### **2.1 FABRICATION, GENERAL**

- A. Fabricate components to be straight, square, flat and in same plane where required.
  - 1. Slightly round exposed edges and without burrs, snags and sharp edges.
  - 2. Exposed welds continuous and ground smooth.
  - 3. Weld in accordance with AWS D1.3.

- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. // For fire rated doors, use hinges and locks as required by fire test. //
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. // Provide anchors as required by fire test. //

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

- A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).
- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.
- C. Door Panel: Form of 0.9 mm (0.0359 inch) thick // steel // stainless steel // sheet, insulated sandwich type construction.
- D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
  - 1. Weld exposed joints in flange and grind smooth.
  - 2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
  - //3. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster. //
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with stainless steel pin.
- G. Lock:
  - 1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
  - 2. Provide latch release device operable from inside of door. Mortise case in door.

## **2.3 ACCESS DOORS, FLUSH PANEL:**

- A. Door Panel:
  - 1. Form of // 1.9 mm (0.0747 inch) thick steel // 1.5 mm (0.0598 inch) thick stainless steel // sheet.
  - 2. Reinforce to maintain flat surface.
- B. Frame:
  - 1. Form of 1.5 mm (0.0598 inch) thick // steel // stainless steel // sheet of depth and configuration to suit material and type of construction where installed.
  - 2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
  - 3. Weld exposed joints in flange and grind smooth.
- C. Hinge:

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

D. Lock:

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

## **2.4 ACCESS DOOR, RECESSED PANEL:**

A. Door Panel:

1. Form of 1.2 mm (0.0478 inch) thick steel sheet to form a 25 mm (one inch) deep recessed pan to accommodate the installation of acoustical units // acoustical plaster // or other materials where shown in walls and ceiling.
2. Reinforce as required to prevent sagging.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
2. Extend sides of frame to protect edge of acoustical units when panel is in open position.
3. Provide shims, bushings, clips and other devices necessary for installation.

C. Hinge: Continuous steel hinge with stainless steel pin or concealed hinge.

D. Lock:

1. Flush screwdriver operated cam lock.
2. Provide sleeve of plastic or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.
- //3. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas. //

## **2.5 FINISH:**

- A. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

## **2.6 SIZE:**

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

## **PART 3 - EXECUTION**

### **3.1 LOCATION:**

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



**3.2 INSTALLATION, GENERAL:**

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

**3.3 ANCHORAGE:**

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

**3.4 ADJUSTMENT:**

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

--- E N D ---

## **SECTION 08 33 00 COILING DOORS AND GRILLES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies coiling doors of sizes shown, complete as specified.

#### **1.2 RELATED WORK**

- A. Lock cylinders for cylindrical locks: Section 08 71 00, DOOR HARDWARE.
- B. Field painting: Section 09 91 00, PAINTING.
- C. Electric devices and wiring: DIVISION 26, ELECTRICAL.

#### **1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS**

- A. Coiling doors shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each type of door showing details of construction, accessories and hardware, electrical and mechanical items supporting brackets for motors, location, and ratings of motors, and safety devices.
- C. Manufacturer's Literature and Data:
  - 1. Brochures or catalog cuts, each type door or grille.
  - 2. Manufacturer's installation procedures and instructions.
  - 3. Maintenance instructions, parts lists.
- D. Certificates:
  - 1. Attesting doors, anchors and hardware will withstand the horizontal loads specified.
  - 2. Attesting oversize fire doors and hardware are identical in design, material, and construction to doors that meet the requirements for the class specified.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/A36M-08 ..... Structural Steel
  - A653/A653M-10 ..... Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process
  - B209/209M-07 ..... Aluminum and Aluminum-Alloy Sheet and Plate
  - B221/B221M-08 ..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

- C. National Electrical Manufacturers Association (NEMA):
  - ICS 1-00(R2008) ..... Industrial Control and Systems General Requirements
  - ICS 2-00(R2005) ..... Industrial Control, and Systems, Controllers, Contactors, and  
Overload Relays
  - ICS 6-93 (R2006) ..... Industrial Control and Systems Enclosures
  - MG 1-10 ..... Motors and Generators
  - ST 20-92 (RI997) ..... Dry-Type Transformers for General Applications
- D. Master Painters Institute (MPI):
  - MPI #35 ..... Exterior Bituminous Coating
  - MPI #76 ..... Quick Drying Alkyd Metal Primer
- E. National Fire Protection Association (NFPA):
  - 70-11 ..... National Electrical Code 1999 Edition
  - 80-10 ..... Fire Doors and Fire Windows
- F. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series ..... Metal Finishes Manual
- G. Underwriters Laboratories, Inc. (UL):
  - 2010 ..... Fire Resistance Directory

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

- A. Aluminum, Plate and Sheet: ASTM B209/B209M
- B. Aluminum, Extruded: ASTM B221/B221M

### **2.2 DESIGN REQUIREMENTS**

- A. Coiling doors shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. Where doors in excess of 80 sf are indicated to be manually operated, provision shall be made in the design and construction that will permit future installation of electric-power operation.
- C. The coiling door shall be superimposed over the coiling grille in a common assembly where dual installation is required.

### **2.3 FABRICATION**

- A. Curtains:
  - 1. Form of interlocking slats of aluminum of shapes standard with the manufacturer.
  - 2. Thickness of slats shall be as required to resist loads specified except not less than the following:
    - a. For doors less than 15 feet wide: 0.75 mm (0.0299 inch).
  - 3. Thickness of aluminum slats shall be as follows:
    - a. For doors less than 15 feet wide: 1 mm (0.040 inch).

C. Endlocks and Windlocks:

1. Manufacturer's stock design of galvanized malleable iron or galvanized steel or stamped cadmium steel for doors.
2. The ends of each slat for exterior doors and each alternate slat for grilles and interior doors shall have endlocks.
3. Doors shall have windlocks at ends of at least every sixth slat. Windlocks shall prevent curtain from leaving guide because of deflection from wind pressure or other forces.

D. Bottom Bar:

1. Two angles of equal weight, one on each side, standard extruded aluminum members not less than 3 mm (0.125 inch) thick.
2. Bottom bar designed to receive weather-stripping and safety device, and be securely fastened to bottom of curtain or grille.

E. Barrel and Spring Counterbalance:

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 400 (0.03 inch per foot) of span.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.
4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position.
5. At least 80 percent of the door weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood.

F. Brackets:

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with prelubricated ball bearings, shielded or sealed.

G. Hoods:

1. Steel galvanized, 0.6 mm (0.0239 inch) thick Aluminum, not less than 1 mm (0.040 inch) thick.
2. Form hood to fit contour of end brackets.
3. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 12 feet in length shall have intermediate supporting brackets.
4. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.
5. Provide a weather baffle at the lintel or inside the hood of each exterior door to minimize seepage of air through the hood enclosure.

H. Guides:

1. Manufacturer's standard formed sections or angles of steel or aluminum.
  - a. Steel sections not less than 3/16 inch thick.
  - b. Aluminum sections not less than 5 mm (0.1875 inch) thick.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.
3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.
5. Provide guide of aluminum with replaceable wear strips to prevent metal to metal contact.
6. Mounting brackets shall provide closure between guides and jambs.

I. Casket Seal:

1. Manually Operated Doors: Doors shall have a compressible and replaceable rubber, neoprene, or vinyl seal attached to bottom bar.

J. Locking:

1. Cylinder locks shall receive standard screw in cylinders. Refer to Section 08 71 00 DOOR HARDWARE. Coordinate keying with VA COR

## **2.4 MANUAL OPERATORS**

A. Push-up Operation:

1. Provide one lifting handle on each side of door and counterbalance in a manner to provide easy operation while raising or lowering the curtain by hand.
2. The maximum exertion or pull required for lift handle operation shall not exceed 1197 Pa (25 psf).
3. Provide pull-down straps or pole hooks on bottom rail of doors over 7 feet) high.

## **2.6 FINISHES**

A. Aluminum: Finish exposed metal surfaces as follows:

1. Mill finish, as fabricated.
2. AA-C22A41 medium matte, with clear anodic coating, Class I Architectural, 0.7 mils thick.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install doors in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 3/8 inch diameter bolts, near each end and spaced not over 24 inches apart.
- D. Locate control switches where shown.

**3.2 REPAIR**

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.
- B. Coiling Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

**3.3 PROTECTION**

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze or other metals not compatible with aluminum by one of the following:
  - 1. Paint the dissimilar metal with a prime coat of zinc-Molybdate or other suitable primer, followed by two coats of aluminum paint.
  - 2. Place an approved caulking compound, or a non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster or other masonry materials with a coat of bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, that may repeatedly become wet, with a coat of bituminous paint or two coats of aluminum paint.

**3.4 INSPECTION**

Upon completion, doors shall be weathertight and doors // and grilles // shall be free from warp, twist, or distortion.

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**SECTION 08 41 13  
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies aluminum entrance work including storefront construction, hung doors, and other components to make a complete assembly.

**1.2 RELATED WORK:**

- A. Glass and Glazing: Section 08 80 00, GLAZING.
- B. Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Automatic Door Operators: Section 08 71 13, AUTOMATIC DOOR OPERATORS.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: (1/2 full scale) showing construction, anchorage, reinforcement, and installation details.
  - 1. Include structural calculations for window load and all requirements there in (i.e. steel reinforcement could be required); provide as part of this specification requirement.
- C. Manufacturer's Literature and Data:
  - 1. Doors, each type.
  - 2. Entrance and Storefront construction.
- D. Samples:
  - 1. Door corner section, of each door type specified, showing vertical and top hinge edges, door closer reinforcement, internal reinforcement, and insulation, of flush panel door.
  - 2. Two samples of anodized aluminum to match window color showing finish and maximum shade range.
  - 3. Two samples of organic finish of each color specified.
- E. Manufacturer's Certificates:
  - 1. Stating that aluminum has been given specified thickness of anodizing.
  - 2. Indicating manufacturer's qualifications specified.

**1.4 QUALITY ASSURANCE:**

- A. Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
- B. Certify manufacturer regularly and presently manufactures aluminum entrances and storefronts as one of their principal products.

**1.5 DELIVERY, STORAGE AND HANDLING:**

- A. Deliver aluminum entrance and storefront material to the site in packages or containers; labeled for identification with the manufacturer's name, brand and contents.

- B. Store aluminum entrance and storefront material in weather-tight and dry storage facility.
- C. Protect from damage from handling, weather and construction operations before, during and after installation.

#### **1.6 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07 ..... Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - E283-04 ..... Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - E331-00(R2009) ..... Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
  - F468-10 ..... Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - F593-02(R2008) ..... Stainless Steel Bolts, Hex Cap Screws, and Studs
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series ..... Metal Finishes Manual
- D. American Architectural Manufacturer's Association (AAMA):
  - 2604-10 ..... High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
- E. American Welding Society (AWS):
  - D1.2-08 ..... Structural Welding Code Aluminum

#### **1.7 PERFORMANCE REQUIREMENTS:**

- A. Shapes and thickness of framing members shall be sufficient to withstand a design wind load of not less than 50 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65 (applied to overall load failure of the unit). Provide glazing beads, moldings, and trim of not less than 1.25 mm (0.050 inch) nominal thickness.
- B. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration shall not exceed 2.63 x 10<sup>-5</sup> cm per square meter (0.06 cubic feet per minute per square foot) of fixed area at a test pressure of 0.30 kPa (6.24 pounds per square foot) 80 kilometers (50 mile) per hour wind.
- C. Water Penetration: When tested at 5.24 psf water pressure for two hours, there shall be no water penetration.



## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

A. Contract Documents are based on products by Kawneer. Provide Kawneer or equal.

### **2.2 MATERIALS:**

- A. Aluminum, ASTM B209 and B221:
  - 1. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights, storefronts and transoms.
  - 2. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
  - 3. For color anodized finish, use aluminum alloy as required to produce specified color.
- B. Thermal Break: Manufacturer standard low conductive material retarding heat flow in the framework, where insulating glass is scheduled.
- C. Fasteners:
  - 1. Aluminum: ASTM F468, Alloy 2024.
  - 2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

### **2.3 FABRICATION:**

- A. Fabricate doors, of extruded aluminum sections not less than 3 mm (0.125 inch) thick. Fabricate glazing beads of aluminum not less than 1.0 mm (0.050 inch) thick.
- B. Accurately form metal parts and accurately fit and rigidly assemble joints, except those joints designed to accommodate movement. Seal joints to prevent leakage of both air and water.
- C. Make welds in aluminum in accordance with the recommended practice AWA D1.2. Use electrodes and methods recommended by the manufacturers of the metals and alloys being welded. Make welds behind finished surfaces so as to cause no distortion or discoloration of the exposed side. Clean welded joints of welding flux and dress exposed and contact surfaces.
- D. Make provisions in doors and frames to receive the specified hardware and accessories. Coordinate schedule and template for hardware specified under Section 08 71 00, DOOR HARDWARE. Where concealed closers or other mechanisms are required, provide the necessary space, cutouts, and reinforcement for secure fastening.
- E. Fit and assemble the work at the manufacturer's plant. Mark work that cannot be permanently plant-assembled to assure proper assembly in the field.

### **2.4 PROTECTION OF ALUMINUM:**

- A. Isolate aluminum from contact with dissimilar metals other than stainless steel, white bronze, or zinc by any of the following:
  - 1. Coat the dissimilar metal with two coats of heavy-bodied alkali resistant bituminous paint.
  - 2. Place caulking compound, or non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
  - 3. Paint aluminum in contact with mortar, concrete and plaster, with a coat of aluminum paint primer.

**2.5 FRAMES:**

- A. Fabricate doors, frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.
- C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- D. Fabricate framework with thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.
- E. Mullions applied to exterior glazing face to prevent removal at acute/inpatient areas – verify location.
- F. Mullions can be removable at some locations – verify with owner.

**2.6 STILE AND RAIL DOORS:**

- A. Nominal 45 mm–Flush aluminum door which are similar to the existing hollow metal doors.

**2.7 FLUSH PANEL DOORS:**

- A. Nominal 45 mm (1-3/4 inches) thick. Form from aluminum face sheets not less than 1.5 mm (0.060 inch) thick with internal impact reinforcement, laminated to the door edges and the core.
- B. Provide extruded aluminum tubular members to form the perimeter of the door. Reinforce doors internally with extruded tubular members welded in place, and extending full width of door at top, bottom, and intermediate points.
- C. Fill voids between tubular members with noncombustible mineral insulation.

**2.7 COLUMN COVERS AND TRIM**

- A. Fabricate column covers and trim shown from 1.5 mm (0.0625 inch) thick sheet aluminum of longest available lengths.
- B. Use concealed fasteners.
- C. Provide aluminum stiffener and other supporting members shown or as required to maintain the integrity of the components.

**2.8 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Finish exposed aluminum surfaces to match existing campus - Anodized Aluminum:
- C. Fluorocarbon Finish: AAMA 605.2, high performance coating. To match as closely as possible existing campus standard bronze color.

**PART 3 - EXECUTION****3.1 INSTALLATION:**

- A. Allowable Installation Tolerances: Install work plumb and true, in alignment and in relation to lines and grades shown. Variation of 3 mm (1/8 inch) in 2400 mm (eight feet), non-accumulative, is maximum permissible for plumb, level, warp, bow and alignment.

- B. Anchor aluminum frames to adjoining construction at heads, jambs and bottom and to steel supports, and bracing. Anchor frames with stainless steel or aluminum countersunk flathead, expansion bolts or machine screws, as applicable. Use aluminum clips for internal connections of adjoining frame sections.
- C. Where work is installed within masonry or concrete openings, place no parts other than built-in anchors and provision for operating devices located in the floor, until after the masonry or concrete work is completed.
- D. Install hardware specified under Section 08 71 00, DOOR HARDWARE.
- E. Install hung door operators specified under Section 08 71 13, AUTOMATIC DOOR OPERATORS.

**3.2 ADJUSTING:**

After installation of entrance and storefront work is completed, adjust and lubricate operating mechanisms to insure proper performance.

**3.3 PROTECTION, CLEANING AND REPAIRING:**

Remove all mastic smears and other unsightly marks, and repair any damaged or disfiguration of the work. Protect the installed work against damage or abuse.

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**SECTION 08 51 13  
ALUMINUM WINDOWS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Aluminum windows of type and size shown, complete with hardware, related components and accessories.
- B. Types:
  - 1. Single hung windows
  - 2. Casement
  - 3. Fixed

**1.2 DEFINITIONS**

- A. Accessories: Mullions, staff beads, casings, closures, trim, moldings, panning systems, sub-sills, clips anchors, fasteners, weather-stripping, insect screens // mechanical operators, // and other necessary components required for fabrication and installation of window units.
- B. Uncontrolled Water: Water not drained to the exterior, or water appearing on the room side of the window.

**1.3 RELATED WORK**

- A. Alternates: Section 01 23 00 for EFCO Windows Series 6600 and Series 660.
- B. Masonry: Section 04 20 00, UNIT MASONRY.
- B. Steel Subframes: Section 05 50 00, METAL FABRICATIONS.
- C. Storefront: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- D. Blinds: Section 122113, HORIZONTAL BLINDS.
- E. Glazing: Section 08 80 00, GLAZING.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Protect windows from damage during handling and construction operations before, during and after installation.
- B. Store windows under cover, setting upright.
- C. Do not stack windows flat.
- D. Do not lay building materials or equipment on windows.

**1.5 QUALITY ASSURANCE**

- A. Approval by contracting officer is required of products or service of proposed manufacturers and installers.
- B. Approval will be based on submission of certification by Contractor that:
  - 1. Manufacturer regularly and presently manufactures the specified windows as one of its principal products.

2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items and has attended a fabrication & installation school provided by the manufacture.
- C. Provide each type of window produced from one source of manufacture.
- D. Quality Certified Labels or certificate:
  1. Architectural Aluminum Manufacturers Association, "AAMA label" affixed to each window indicating compliance with specification or certified independent laboratory test reports.
  2. Certificates in lieu of label with copy of recent test report (not more than 10 years old) from an independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA 101/I.S.2 for type of window specified.

### **1.6 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  1. Minimum of 1/2 full scale // types of windows on project //.
  2. Identifying parts of window units by name and kind of metal or material, show construction, locking systems, mechanical operators, trim, installation and anchorages.
  3. Include glazing details and standards for factory glazed units.
- C. Manufacturer's Literature and Data:
  - Window.
  - Mullions & muntins
  - Sash locks, keepers, and key.
- D. Certificates:
  1. Certificates as specified in paragraph QUALITY ASSURANCE.
  2. Indicating manufacturers and installers qualifications.
  3. Manufacturer's Certification that windows delivered to project are identical to windows tested.
- E. Test Reports:
  - Copies of test reports as specified in paragraph QUALITY ASSURANCE.
- F. Samples: Provide six-inch length samples showing finishes, specified.

### **1.7 MOCK-UP**

See mock-up requirements in section 042000 for brick and window mock-up to be used for water testing.

### **1.8 WARRANTY**

Warrant windows against malfunctions due to defects in thermal breaks, hardware, materials and workmanship, subject to the terms of Article "WARRANTY OF CONSTRUCTION", FAR clause 52.246-21, except provide 10 year warranty period.

## 1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)  
90.1-07 .....Energy Standard of Buildings
- C. American Architectural Manufacturers Association (AAMA):  
101/I.S.2/A440-08 ..... Windows, Doors, and Unit Skylights  
505-09 ..... Dry Shrinkage and Composite Performance Thermal Cycling  
Test Procedures  
2605-05 ..... Superior Performing Organic Coatings on Architectural  
Aluminum Extrusions and Panels  
TIR-A8-08..... Structural Performance of Poured and Debridged Framing  
Systems
- D. American Society for Testing and Materials (ASTM):  
A653/A653M-09 ..... Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-dip Process  
E 90-09..... Test Method for Laboratory Measurement of Airborne Sound  
Transmission Loss of Building Partitions
- E. National Fenestration Rating Council (NFRC):  
NFRC 100-10 .....Determining Fenestration Product U-Factors  
NFRC 200-10 .....Determining Fenestration Product Solar Heat Gain Coefficient  
and Visible Transmittance at Normal Incidence
- F. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06 ..... Metal Finishes Manual

## PART 2- PRODUCTS

### 2.1 MANUFACTURERS

- A. Contract Documents are based on products by Kawneer. Provide Kawneer or equal.

### 2.2 MATERIALS

- A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.
- B. Sheet Steel, Galvanized: ASTM A653; G90 galvanized coating.
- C. Weather-strips: AAMA 101/I.S.2; except leaf type weather-stripping is not permitted.
- D. Insect Screening:
  - 1. Regular mesh, 18 by 18, AAMA 101/I.S.2.
  - 2. Aluminum with dark bronze anodized finish unless specified otherwise.
- E. Fasteners: AAMA 101/I.S.2. Screws, bolts, nuts, rivets and other fastening devices to be non-magnetic stainless steel.

1. Fasteners to be concealed when window is closed. Where wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
2. Stainless steel self tapping screws may be used to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.
3. Attach locking and hold-open devices to windows with concealed fasteners. Provide reinforcing plates where wall thickness is less than 3 mm (0.125 inch) thick.

F. Weather-strips: AAMA 101/I.S.2.

G. Hardware:

1. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than five feet from floor level. Locate locking devices in the vent side rail. Fastenings for locks and keepers shall be concealed or nonremovable.
2. Locking Device Strikes: Locate strikes in frame jamb. Strikes shall be adjustable for locking tension. Fabricate strikes from Type 304 stainless steel or white bronze.
3. Fabricate hinges of noncorrosive metal. Hinges may be either fully concealed when window is closed or semi-concealed with exposed knuckles. All exposed knuckle hinges shall have hospital tips, at both ends. Surface mounted hinges will not be accepted.
4. Guide Blocks: Fabricate guide blocks of injection molded nylon. Install guide block fully concealed in vent/frame sill.

## **2.3 THERMAL AND CONDENSATION PERFORMANCE**

A. Condensation Resistance Factor (CRF): Minimum CRF C 50

B. Thermal Transmittance:

1. Maximum U value class for insulating glass windows: 50 (U=0.50).
2. Maximum U value class for dual glazed windows: 70 (U=0.70), or as required by ASHRAE 90.1.

C. Solar Heat Gain Coefficient (SHGC): SHGC shall comply with State or local energy code requirement.

## **2.4 FABRICATION**

A. Fabrication to exceed or meet requirements of Physical Load Tests, Air Infiltration Test, and Water Resistance Test of AAMA 101/I.S.2.

1. Testing will be provided. See Section 04 20 00.

B. Glazing:

1. Factory or field glazing optional.
2. Glaze in accordance with Section 08 80 00, GLAZING.
3. Windows reglazable without dismantling sash framing.
4. Glaze from interior except where not accessible.

5. Provide removable fin type glazing beads.

## C. Trim:

1. Trim includes casings, closures, and panning.
2. Fabricate to shapes shown of aluminum not less than 1.6 mm (0.062 inch) thick
3. Extruded or formed sections, straight, true, and smooth on exposed surfaces. Curved sections true to line.
4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
5. Reinforce 1.6 mm (0.062 inch) thick members with not less than 3 mm (1/8-inch) thick aluminum.
6. Except for strap anchors, provide reinforcing for fastening near ends and at intervals not more than 305 mm (12 inches) between ends.
7. Design to allow unrestricted expansion and contraction of members and window frames.
8. Secure to window frames with machine screws or expansion rivets.
9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of the casing or trim cover system.

## D. Thermal-Break Construction:

1. Manufacturer's Standard.
2. Low conductance thermal barrier.
3. Capable of structurally holding sash in position and together.
4. All Thermal Break Assemblies (Pour & Debridge, Insulbar or others) shall be tested as per AAMA TIR A8 and AAMA 505 for Dry Shrinkage and Composite Performance.
5. Location of thermal barrier and design of window shall be such that, in closed position, outside air shall not come in direct contact with interior frame of the window.

## E. Mullions: AAMA 101.

## F. Subsills and Stools:

1. Fabricate to shapes shown of not less than 2 mm thick extruded aluminum.
2. One piece full length of opening with concealed anchors.
3. Sills turned up back edge not less than 1/4 inch. Front edge provide with drip.
4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
5. Do not perforate for anchorage, clip screws, or other requirements.

## G. Insect Screens:

1. AAMA 101/I.S.2.
2. Aluminum screen cloth.

**2.5 PROJECTED WINDOWS**

- A. AAMA 101/I.S.2; Type: AW-PG60 for single hung; AW-PG80 for fixed.
- B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.
- C. Hopper vents: Project-in from top and slide up from bottom.



**2.10 FIXED WINDOWS**

- A. AMMA 101/I.S.2; Type // HC25 // F-AW65. //.
- B. AAMA certified product to the AAMA 101/I.S.2. - 97 standard.

**2.11 FRAMES:**

- A. Fabricate doors, frames, mullions, transoms, frames for fixed glass and similar members from extruded aluminum not less than 3 mm (0.125 inch) thick.
- B. Provide integral stops and glass rebates and applied snap-on type trim.
- C. Use concealed screws, bolts and other fasteners. Secure cover boxes to frames in back of all lock strike cutouts.
- D. Fabricate framework with thermal breaks in frames where insulating glass is scheduled and specified under Section 08 80 00, GLAZING.

**2.12 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Finish exposed aluminum surfaces as follows to match existing campus:
  - 1. Anodized Aluminum:
    - a. Finish in accordance with AMP 501 letters and numbers.
    - b. Colored anodized Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 0.7 mils thick.
      - 1) Dyes not accepted.
      - 2) Coated Aluminum:
        - 3) Variation of more than 50 percent of maximum shade range approved will not be accepted in a single window or in adjacent windows and mullions on a continuous series.
          - a) AMP 501 and 505.
          - b) Steel: AMP 504.
          - c) Stainless steel: AMP 503.
            - 1. Concealed: 2B or 2D.
            - 2. Exposed: No. 4 unless specified otherwise.
  - E. Hardware: Finish hardware exposed when window is in the closed position: Match window color.

**PART 3 - EXECUTION****3.1 PROTECTION (DISSIMILAR MATERIALS): AAMA 101/I.S.2.****3.2 INSTALLATION, GENERAL**

- A. Install window units in accordance with manufacturer's specifications and recommendations for installation of window units, hardware, operators and other components of work.

- B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, use expansion or toggle bolts or screws, as best suited to construction material.
  - 1. Provide bolts or screws minimum 6 mm (1/4-inch) in diameter.
  - 2. Sized and spaced to resist the tensile and shear loads imposed.
  - 3. Do not use exposed fasteners on exterior, except when unavoidable for application of hardware.
  - 4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
  - 5. Locate fasteners to not disturb the thermal break construction of windows.
- C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.
- D. Anchor windows on four sides with anchor clips or fin trim.
  - 1. Do not allow anchor clips to bridge thermal breaks.
  - 2. Use separate clips for each side of thermal breaks.
  - 3. Make connections to allow for thermal and other movements.
  - 4. Do not allow building load to bear on windows.
  - 5. Use manufacturer's standard clips at corners and not over 600 mm (24 inches) on center.
  - 6. Where fin trim anchorage is shown build into adjacent construction, anchoring at corners and not over 600 mm (24 inches) on center.
- E. Sills and Stools:
  - 1. Set in bed of mortar or other compound to fully support, true to line shown.
  - 2. Do not extend sill to inside window surface or past thermal break.
  - 3. Leave space for sealants at ends and to window frame unless shown otherwise. //

### **3.3 MULLIONS CLOSURES, TRIM, AND PANNING**

- A. Cut mullion full height of opening and anchor directly to window frame on each side.
- B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.
- C. Secure to concrete or solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.
- D. Toggle bolt to hollow masonry units. Screwed to wood or metal.
- E. Fasten except for strap anchors, near ends and corners and at intervals not more than 300 mm (12 inches) between.
- F. Seal units following installation to provide weathertight system.

### **3.4 ADJUST AND CLEAN**

- A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weather-stripping for smooth operation and weathertight closure.

- B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Lubricate hardware and moving parts.
- E. Clean glass promptly after installation of windows. Remove glazing and sealant compound, dirt and other substances.
- F. Except when a window is being adjusted or tested, keep locked in the closed position during the progress of work on the project.

### **3.5 OPERATION DEVICES**

- A. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.
- B. Provide maintenance or window washer operating handles; verify quantity with owner.
- C. Provide one operating pole and one pole hanger in a room or space where pole operation of windows is required.

--- E N D ---

**SECTION 08 62 50  
TUBULAR DAYLIGHTING DEVICE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Section includes:
  - 1. Tubular daylighting device, consisting of roof dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.
  - 2. Accessories.

**1.2 RELATED WORK:**

- A. Section 075323 – Ethylene-Propylene-Diene Monomer Roofing.
- B. Section 076000 – Flashing & Sheet Metal.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
- D. Verification Samples: As requested by Architect.
- E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

**1.4 QUALITY ASSURANCE:**

- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.

**1.5 DELIVERY, STORAGE AND HANDLING:**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**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):
  - ASTM B 209..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

- ASTM E 84..... Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a
- ASTM A 463/A 463M ..... Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006
- ASTM A 653/A 653M ..... Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007
- ASTM E 283..... Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004
- ASTM E 308..... Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006
- ASTM E 330..... Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002
- ASTM E 547..... Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000
- ASTM E 1886..... Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- ASTM E 1996..... Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane
- ASTM D 635..... Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006
- ASTM D-1929 ..... Test Method for Ignition Properties of Plastics; 1996 (2001)
- C. UL 181 - Factory Made Air Ducts and Air Connectors
- D. ICC AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

### **1.7 PERFORMANCE REQUIREMENTS:**

- A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
  2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
  3. Uniform Load Test:
    - a. No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested

at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPa) if tested per ICC AC-16 Section B.

- b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

4. Fire Testing:

- a. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the 2009 International Building Code.
- b. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
- c. Smoke Density - Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.
- d. Rate of Burn and/or Extent - Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
- e. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

## **1.8 PROJECT CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **1.9 WARRANTY**

- A. Daylighting Device: Manufacturer's standard warranty for 10 years.
- B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis-of-Design Manufacturer: Solatube International, Inc., or approved equal.

### **2.2 TUBULAR DAYLIGHTING DEVICES**

- A. Tubular Daylighting Devices General : Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
- B. Brighten Up Series: Solatube Model 290 DS: 14 Inch (350 mm) Daylighting System, or approved equal:
  - 1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
    - a. Outer Dome Glazing: Type DA, 0.125 inch (3.25 mm) minimum thickness impact resistant injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.

- b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
  - c. Optional Shock Inner Dome Glazing: Type DI, 0.115 inch (2.9 mm) minimum thickness classified as CC1 material. High impact resistant injection molded acrylic required for high velocity wind zones.
  - d. LightTracker Reflector: Aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in dome to capture low angle sunlight.
2. Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
- a. Base Material: Sheet steel, corrosion resistant, meeting ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch (0.7 mm) thick.
  - b. Base Flat: Flat Type F4, no pitch 4 inches (102 mm) high.
  - c. Base Flat: Flat Type F6, no pitch 6 inches (152 mm) high.
  - d. Base Pitched: Pitched Type FP, 22.5 degrees slope from horizontal, 4 inches (102 mm) high.
  - e. Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm x 685 mm) to cover curb as specified in Section 07600.
  - f. Tile Roof No Pitch: No Pitch Type FT, 4 inches (102 mm) high. Tile Roof Counter-Flashing: corrugated aluminum 1100-0, 0.020 inch (.508 mm).
  - g. Tile Roof Pitched: Pitched Type FPT, 22.5 degrees slope from horizontal, 4 inches (102 mm) high. Tile Roof Counter-Flashing: corrugated aluminum 1100-0, 0.020 inch (.508 mm).
  - h. Flashing Insulator: Type F1. Thermal isolation material for use under flashing.
  - i. Metal Roof Flashing Kit: Type MR. Includes Butyl tape, flashing screws, speed nuts, corner washers and polyurethane sealant.
  - j. Dome Edge Protection Band: Type PB, For fire rated roofs. Aluminized steel. Nominal thickness of 0.028 inches (0.7 mm).
3. Roof Flashing Turret Extensions: Provide manufacturer's standard extensions for applications requiring:
- a. Type T02: Additional lengths of 2 inches (50 mm) extension.
  - b. Type T04: Additional lengths of 4 inches (100 mm) extension.
  - c. Type T012: Additional lengths of 12 inches (300 mm) extension.
  - d. Type T024: Additional lengths of 24 inches (600 mm) extension.
  - e. Type T036: Additional lengths of 36 inches (900 mm) extension.
  - f. Type T048: Additional lengths of 48 inches (1200 mm) extension.

4. Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
5. Reflective Extension Tube: Aluminum sheet, thickness 0.015 inch (0.4 mm).
  - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.
  - b. Color:  $a^*$  and  $b^*$  (defined by CIE  $L^*a^*b^*$  color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
  - c. Tube Diameter: Approximately 14 inches (356 mm).
6. Reflective 30 degree Adjustable tube: Aluminum sheet, thickness .015 inch (0.4 mm)
  - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.
7. Reflective 90 degree Adjustable tube: Aluminum sheet, thickness .018 inch (0.5 mm)
  - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.
  - b. Extension Tube Angle Adapter: Provide manufacturer's standard adaptors for applications requiring:
    - 1) Type A1 one 0 to 90 degree extension tube angle adapter.
    - 2) Type A2 two 0 to 90 degree extension tube angle adapters.
8. Ceiling Ring: Injection molded impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).
9. Dual Glazed Diffuser Assembly:
  - a. Lower glazing with integral injection molded acrylic Dress Ring classified as CC2 material. Nominal thickness is 0.110 inches (2.8 mm):
    - 1) Classic Vusion Diffuser: Molded acrylic plastic classified as CC2 material (nominal thickness 0.090 inches (2.29 mm) with injection molded acrylic Diffuser Trim Ring. Type L4.
    - 2) JustFrost Decorative Fixture: Full-tempered glass lens (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners. Type L9.
    - 3) TierDrop Decorative Fixture: Three layers of full-tempered frosted glass lens (nominal thickness is 0.16 inches (4 mm)). Bottom layer is continuous with two stepped full-tempered glass rings on top and decorative metal fasteners. Type L10.
    - 4) OptiView Decorative Fixture: Molded polycarbonate plastic Fresnel Lens classified as CC1 material (nominal thickness is 0.022 inches (0.61 mm)) with full-tempered



- frosted glass bezel (nominal thickness is 0.16 inches (4 mm)), and decorative 5) metal fasteners. Type L11.
- 5) VividShade Decorative Fixture: Full-tempered frosted glass lens (nominal thickness is 0.16 inches (4 mm)), integral flame retardant linen shade with translucent frosted PVC inner liner (nominal thickness 0.16 inches (0.4mm)) ,; decorative zinc plated steel (concealed) and stainless steel (exposed) fasteners. Type L12.
- b. Lower glazing with integral 2-piece aluminum/zinc alloy coated steel Fixture Mounting Ring (23 gauge; nominal thickness 0.031inches (0.787 mm)):
    - 1) AuroraGlo Decorative Fixture: Glass Bowl acid etched lens, with two-tone black/bronze painted decorative metal trim ring. Type L13.
    - 2) QuadraFrost Decorative Fixture: Hand-fabricated Metal Housing with integral full-tempered frosted glass lens inserts (nominal thickness is 0.16 inches (4 mm) each). Type L14.
  - c. Upper glazing: PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. The nominal thickness is 0.039 inches (0.99 mm).
    - 1) Natural Effect Lens: Type LN.
    - 2) Softening Effect Lens: Type LS.
10. Accessories:
- a. Lighting Fixture for 290 DS model: Bracket mounted inside system just above diffuser; UL listed.
    - 1) Universal: Type INC, for two 23 W maximum CFL, maximum total length 4-3/4 inch, ceramic screw-in lamp holder, medium base, two lamps.
    - 2) Compact Fluorescent: Type CFL, dedicated compact fluorescent fixture, for one 26 W, 4-pin lamp.
    - 3) Electrical Requirements: 110 V, 15 amp GFCI circuit for damp and wet conditions.
  - b. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use. Provided with dimmer switch and cable.
    - 1) Daylight Dimmer: Type D Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; Maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02: circuited, 4 conductor, 22 gauge cable; providing daylight output between 2 and 100 percent.
    - 2) Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer. Note: A maximum of 10 units can be connected to one switch.
    - 3) Cable: Type CA, Two conductor, 22 gauge, low voltage cable (500 ft.) for multiple unit DC connections.

- c. Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required

## **2.3 ACCESSORIES**

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.
- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

### **3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

--- E N D ---

**SECTION 08 63 00  
METAL-FRAMED SKYLIGHTS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

Section specifies field erected aluminum framed skylights.

**1.2 RELATED WORK:**

- A. Roof and Deck Insulation
- B. Clay Tile Roofing Section 07 23 13
- C. Flashing and Sheet Metal Section 7 60 00 .
- D. Field installed joint sealants in connection with metal framed skylights: Section 07 92 00, JOINT SEALANTS.

**1.3 QUALITY ASSURANCE:**

- A. Qualifications:
  - 1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
    - a. Manufacturers Qualifications: Manufacturer with five years continuous documented experience in design, and fabrication of metal framed skylights of type and size required for that project.
    - b. Installer Qualifications: An experienced installer with five years continuous documented experience who has specialized in installing metal-framed skylights similar to those indicated for this Project and who is acceptable in writing to manufacturer.
    - c. Manufacturer's product submitted has been in satisfactory and efficient use on minimum of three installations similar and equivalent to this project for past three years.
    - d. Testing Agency Qualifications: ISO 9000 Refer to Performance Requirements and Field Quality Control articles for testing requirements.
    - e. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of metal-framed skylights. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and

assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance:

- 1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.
- f. Welding: Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials and equipment of the type required for this work.
- i. Obtain "Hot Work Permit" from VA if any welding is to occur, 24 hour advance notice

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#### **1.4 SUBMITTALS:**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Product Data:
  1. Manufacturers standard details and fabrication methods.
  2. All information for accessories, and operation of skylight, including listing by NFPA 70.
  2. Data on finishing, components, and accessories.
  3. Instructions: Submit detail specifications and instructions for installation, and adjustments.
  4. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings: Show elevations of skylights at 1/4 inch and 1 1/2" scale, metal gauges, details of construction including all flashing details, methods of anchorage, glazing details, and details of installation.
- D. Warranty: Sample of warranty or special warranty, 10 year "no Leak" as specified by manufacturers warranty.
- E. Thermal Performance: Rated per applicable NFRC procedures.
  - a. Provide NFRC certified unit skylight ratings on an attached label.
  - b. Qualify under Energy Star in all 50 states and attach verifying label.

**1.5 DELIVERY, STORAGE, AND HANDLING:**

- A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.
- B. Inspect materials delivered to site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling in accordance with manufacturer's instructions. Stack materials on non-absorptive strips or wood platforms. Do not cover frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

**1.6 PROJECT CONDITIONS:**

Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors While under Specific Pressure differences Across the Specimen.
- C. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- D. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- E. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles(s) and Exposed to Cyclic Pressure Differentials.
- F. ASTM E 1996 – Standard Specifications for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

- G. National Fenestration Rating Council, NFRC 100, Procedure for Determining Fenestration Product U-factors.
- H. National Fenestration Rating Council, NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- I. National Fenestration Rating Council, NFRC 300, *Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems*.
- J. Occupational Safety & Health Administration, OSHA Standards – 29 CFR 1910.23, Guarding Floor Openings and Holes.
- K. Underwriters Laboratories Inc., UL 325, Standard for Door, Drapery, Gate, Louver and Window Operators and Systems, Fifth Edition.
- L. Glass Association of North America (GANA):
  - 2010 Edition ..... GANA Glazing Manual
  - 2008 Edition ..... GANA Sealant Manual
  - 2009 Edition ..... GANA Laminated Glazing Reference Manual
- M. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500-06 ..... Metal Finishes Manual
- N. International Organization for Standardization ISO:
  - ISO 9000 ..... International Quality Management System  
Standards and Guidelines
- O. SMANA Manual, Latest Edition

## 1.9 WARRANTY

- A. Warranty metal skylight against leaks, and structural failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to 10 years.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION:

- A Manufacturer: VELUX America Inc., P.O. Box 5001, Greenwood, SC 29648-5001; Toll Free Tel: 800-888-3589; Web: [www.VELUXusa.com](http://www.VELUXusa.com) or equivalent.
  - 1. Model VCE, size 46" by 46"

B. Design Requirements:

- 1. System shall meet or exceed all performance requirements specified.
- 2. Extruded aluminum members with a system of alternate serrations for attachment of exterior caps and glass supports.
- 3. Integral guttering system within skylight framing members for positive drainage of condensation. Integral weeping system to drain to exterior.
- 4. Flush glazed exterior joints as indicated on contract drawings.
- 5. All structural silicone shall be factory applied.

C. Wood: Kiln-dried, laminated Ponderosa Pine pre-painted with two coats of white finish.

D. Maintenance free exterior cladding: Roll formed 0.65 mm aluminum frame coverings, 0.57 mm aluminum sash coverings, prefinished, production engineered, and fabricated to fit exterior exposed surfaces.

E. Dual sealed Glazing

- a. Dual sealed thermal pane with warm edge technology, 95% argon gas, and with three layers of LoE<sup>3</sup> silver that increases visible light over standard low e coatings while lowering the solar heat gain.
  - 1. Tempered LoE<sup>3</sup> pane over a laminated tempered interior pane with a (0.030") vinyl interlayer to achieve higher snow load ratings.

F. Operators and Manual Operator Accessories

- a. Electric Motors: Standard on all electric venting skylights (VSE) 120 V, 40 watts, 60 Hz rating assembly that uses a robust chain driven system to open the skylight 11 inches. A 2.4 GHz radio frequency remote control is standard component with each VSE.

G. Fasteners: 1-1/4 inch ring shank nails provided for attaching deck seal mounting flange to roof decking. Ring shank nails are double hot dipped zinc coated.

H. Weather stripping: Factory applied neoprene and thermoplastic elastomer weather stripping throughout entire frame and sash, profiled to effect weather seal.

I. Screen: Aluminum screen profile, spring metal clip attachment, 0.28 mm glass fiber thread with PVC coating, charcoal in color.

J. Mounting System: Continuous corrosion resistant steel mounting system with a durable foam seal and rough opening alignment notches.

- a. Type EDW Flashing is a prefabricated gutter flashing system designed for use with roofing material greater than 3/4" thick, or high profile material, and for roof slopes of 15 degrees to 85 degrees. Sill flashing section consists of corrugated apron to allow form fit of high profile material.

K. Performance Requirements:

1. Structural Members: Of sizes to support design loads as indicated on structural Contract Drawings and as outlined below.
2. Deflection of framing member in a direction normal to plane of glass when subjected to a uniform load deflection test in accordance with ASTM E330, Procedure B, and per above specified structural design loads as indicated on structural contract drawings, shall not exceed 1/175 (1 inch) of its clear span for clear spans less than 20 feet .
3. Air Infiltration: When tested in accordance with ASTM E283, shall not exceed 0.06 cfm per square foot of fixed skylight surface.
4. Water Penetration: No water shall penetrate when skylight is tested in accordance with ASTM E331 at a differential static pressure of 20 percent of inward acting design wind pressure, with a minimum of 6.24 psf/.

L. Glazing Strips: ASTM C864:

1. Glass and glazing material as specified in Section 08 80 00, GLAZING.
2. Extruded EDPM rubber designed to comply with the following specifications:
  - a. Hardness: 55+/-5 Durometer.
  - b. Tensile Strength: 12410 kPa (1800 psi) minimum.
  - c. Elongation: 500 percent minimum.
  - d. Color: Black
3. Heat Aging Characteristics:
  - a. 70 hours at 100 degrees C (212 degrees F).
  - b. Hardness Change: +5 Durometer.
  - c. Tensile Change: -10 percent
  - d. Elongation Change: -20 percent
4. Weather resistance at 1 part ozone per million, 500 hours at 20% elongation: No cracks.
5. No visual checks, cracks or breaks after completion of tests.

M. Setting Blocks:

1. Extruded Type II silicone rubber designed to permit adhesion and comply with the following specifications; comply with ASTM C864:
  - a. Hardness: 80+/- Durometer
  - b. Color: Black

N. Fasteners:

1. For Exterior Cap Retainers: ASTM A193 B8 300 series stainless steel screws.



2. For Framework Connections: ASTM B211M 2024-T4 aluminum, ASTM A193 B8 300 series stainless steel, and ASTM B316 aluminum rivets, as required by connection.
  3. For Anchoring Skylight to Support Structure: ASTM A307 zinc plated steel fasteners.
- E. Flashings: Comply with Section 07 60 00, FLASHING AND SHEET METAL.

## 2.2 FABRICATION

- A. Fabricate frame with slip mortise and tendon corners that are glued and nailed for strength and stability.
- B. Fabricate frame components with precision tolerances enabling installation and movement of sash and dynamic movement of perimeter weather stripping.
- C. Provide permanent external drainage channels to manage water flow and drain to the exterior. Provide internal drainage of glazing spaces to exterior through gasketing.
- D. Assemble insect screen of rolled aluminum rectangular sections. Sections are square cut and assembled using square corner keys. Fit mesh taut and secure with vinyl spline.
- E. All units factory glazed with hot melt silicone-based exterior seal.
- F. No site fabrication needed.
- G. Rough opening to be framed per manufacturer's listed dimensions
- I. Set glass with exterior EDPM glazing strips.
- J. Use silicone setting blocks to support glass and to provide edge clearances and glass bites as outlined below, in accordance with GANA recommendations:
  1. Set blocks not less than 150 mm (6 inches) from edge of glass for support of unit.
  2. Glass Bite: Not less than 13 mm (1/2 inch) nor more than 16 mm (5/8 inch) on any side of glass unit.
  3. Maintain 6 mm (1/4 inch) edge clearance between glass and adjacent metal framework.
  4. Use rubber spacers to maintain separation of glass and adjacent metal framework.

- K. Locate weep holes in curb to positively drain condensation to exterior of skylight at each rafter connection.
- L. Dissimilar Metals: Separate dissimilar metals with bituminous paint or other separator that will prevent galvanic action.
- M. Fasteners: Conceal fasteners wherever possible. Countersink heads of exposed fasteners.
- N. Sealants:
  - 1. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
  - 2. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
  - 3. Structural silicone sealant performance requirements: ASTM C920 and manufacturers recommendations.
    - a. Hardness: Type A, 30 Durometer.
    - b. Ultimate Tensile Strength: 1172.11 kPa (170 psi).
    - c. Tensile at 150 percent Elongation: 55.1580 kPa (80 psi).
    - d. Joint Movement Capability after 14-Day Cure: +/- 50 percent.
    - e. Peel Strength aluminum, after 21 Day Cure: 599 g/mm (32 pounds per inch). //

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION:**

- A. Verify rough opening dimensions and proper orientation of skylight.
- B. . Install skylight in accordance with manufacturer's installation instructions.
- C. Use the alignment notches on the deck seal mounting system to align skylight flush with the rough opening, free of warp or twist; maintain dimensional tolerances.
- D. Attach and seal the skylight to roof sheathing by nailing through the predrilled holes in the deck seal mounting system.
- E. Apply one layer of adhesive underlayment around the perimeter of the skylight frame.

- F. Install the manufacturer's engineered perimeter flashing in accordance with manufacturer's installation instructions to achieve weather tight installation.
- G. Install sun screen products and electrical controls.
- H. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.

### **3.2 INSTALLATION:**

- A. Install skylight frame, glass and accessory items as needed in accordance with manufacturer's instructions.
- B. Install skylight system by factory trained mechanics.
- C. Erect system plumb and true in proper alignment and relation to established lines and grades as shown on approved shop drawings.
- D. Anchor skylight to structure in strict accordance with approved Shop Drawings.
- E. Use high-performance silicone sealants to seal horizontal joints between glass panels and silicone sealant to wet seal joints between snap-on cap retainers and glass.
- F. Apply sealing materials in strict accordance with sealant manufacturer's instructions. Before application, remove mortar dirt, dust, moisture and other foreign matter from surfaces it will contact. Mask adjoining surfaces to maintain a clean, neat appearance. Tool sealing compounds to fill joint and provide a smooth finish.

### **3.3 TOLERANCES:**

- A. All parts of work, when completed, shall be within the following tolerances:
  - 1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length, or 10 mm (3/8 inch) in total length.
  - 2. Maximum offset from true alignment between two members abutting end-to-end, edge-to-edge in line 1/32 inch.

### **3.4 FIELD QUALITY CONTROL:**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field quality-control tests and to prepare test reports.

- B. Sealant Adhesion Tests: Test installed sealant in a minimum of two areas and as follows:
  - 1. Test weather seal sealant as recommended in writing by sealant manufacturer.
- C. Water Penetration: Test skylights for compliance with requirements according to AAMA 503: Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 300 Pa (6.24 lbf/sq. ft.).for 2 hours.
- D. Repair or replace Work that does not meet requirements or that is damaged by testing; repair or replace to comply with specifications.

### **3.5 CLEANING:**

- A. Install skylight frame and associated metal to avoid soiling or smudging finish.
- B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Follow recommendations of skylight manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
- E. Clean glass just prior to time of final acceptance of building, subsequent to completion of installation.

### **3.6 PROTECTION:**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

- - - E N D - - -

**SECTION 087100  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
  2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
  2. Electromechanical door hardware, power supplies, back-ups and surge protection.
  3. Automatic operators.
  4. Cylinders specified for doors in other sections.
  5. To meet ADA requirements
- C. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
  2. Section 06 20 00 – Finish Carpentry.
  3. Section 08 11 13 – Hollow Metal Doors and Frames.
  4. Section 08 14 23 – Clad Wood Doors.
  5. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.
  6. Section 08 81 00 – Glass and Glazing.
  7. Section 09 90 00 – Painting and Coating.
  8. Section 28 13 00 – Access Control.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  2. ICC/IBC - International Building Code.
  3. NFPA 70 - National Electrical Code.
  4. NFPA 80 - Fire Doors and Windows.
  5. NFPA 101 - Life Safety Code.
  6. State Building Codes, Local Amendments.
  7. VA codes
- E. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series

## 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
  - 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
  - 1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
    - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    - b. Door Closers: Comply with the following maximum opening-force requirements indicated:

- 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
  - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
3. NFPA 101: Comply with the following for means of egress doors:
  - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
  - b. Thresholds: Not more than 1/2 inch high.
4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
  - a. Test Pressure: Positive pressure labeling.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.
  5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  1. Prior to installation of door hardware, arrange for manufacturers' representatives to hold a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures.



## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

## **1.6 COORDINATION**

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## **1.7 WARRANTY**

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:

1. Five years for exit hardware.
2. Ten years for manual door closers.
3. Two years for electromechanical door hardware.

## **1.8 MAINTENANCE SERVICE**

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

## **PART 2 - PRODUCTS**

### **2.1 SCHEDULED DOOR HARDWARE**

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
  1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
    - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
  2. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
    - a. Permanent cylinders, cores, and keys to be installed by Owner with assistance from the General Contractor.
- B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### **2.2 HANGING DEVICES**

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
      - 1) Out-swinging lockable doors.
      - 2) Out-swinging access controlled doors.
  5. Acceptable Manufacturers:
    - a. McKinney Products (MK).
    - b. Or equal as approved.
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.
1. Acceptable Manufacturers:
    - a. Pemko Manufacturing (PE).
    - b. Or equal as approved.
- C. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 certified pin and barrel continuous hinges with minimum 12 gauge (.105) Type 304 stainless steel hinge leaves, concealed teflon-

coated stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Fabricate hinges non-handed and U.L. listed for use on up to and including 3 hour rated doors and U.L. listed for windstorm components where applicable. Provide hinges with power transfer cutouts where indicated at electrified openings.

1. Acceptable Manufacturers:
  - a. Markar Products (MA).
  - b. Or equal as approved.

## **2.3 POWER TRANSFER DEVICES**

- A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets.

1. Acceptable Manufacturers:
  - a. Pemko Manufacturing (PE) - SER-QC (# wires) Option.
  - b. Or equal as approved.

- B. Electrified Quick Connect Stainless Steel Continuous Transfer Hinges: Provide electrified transfer stainless steel continuous hinges with electrical transfer access prep accessible without de-mounting door from the frame. Furnish with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets.

1. Acceptable Manufacturers:
  - a. Markar Products (MA) - MP-ETAP-CE (# wires) Option.
  - b. Or equal as approved.

- C. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

## **2.4 DOOR OPERATING TRIM**

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO).
  - b. Or equal as approved.

- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Coordinators fabricated from steel with nylon-coated strike plates and built-in adjustable safety release.
  - 1. Acceptable Manufacturers:
    - a. Rockwood Manufacturing (RO).
    - b. Or equal as approved.

## **2.5 CYLINDERS AND KEYING**

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
  - 1. Acceptable Manufacturers:
    - a. Stanley Best (BE) – No substitution.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  - 1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
  - 1. Existing System: Master key or grand master key locks to Owner's existing system.
  - 2. Verify with Owner.
- F. Key Quantity: Provide the following minimum number of keys:
  - 1. Top Master Key: One (1)
  - 2. Change Keys per Cylinder: Two (2)
  - 3. Master Keys (per Master Key Group): Two (2)
  - 4. Grand Master Keys (per Grand Master Key Group): Two (2)
  - 5. Construction Control Keys (where required): Two (2)

6. Permanent Control Keys (where required): Two (2)

- G. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

## **2.6 MECHANICAL LOCKS AND LATCHING DEVICES**

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) – 8200 Series.
- b. Or equal as approved.

- A. Multi-Point Locksets, Security: Three-point locking system device engineered for in-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked.

1. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) - FM7100 Series.
- b. Or equal as approved.

- B. Lock Trim Design: As specified in Hardware Sets.

## **2.7 ELECTROMECHANICAL LOCKING DEVICES**

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) - 8200 Series.
- b. Or equal as approved.

## **2.8 STAND ALONE ACCESS CONTROL LOCKING DEVICES**

- A. Stand Alone Access Control Lockets: Internal, battery-powered, self-contained ANSI Grade 1, mortise or cylindrical lock consisting of electronically motor driven locking mechanism, integrated keypad, proximity card reader, or keypad/proximity card reader combination, and specified electronic programming accessories. Locks to accept standard, interchangeable (removable) core, security and high security override cylinders. Provide keypad/proximity and proximity only products with a minimum of 2,000 user codes, key override, low-battery detection and warning, LED status indicators, and ability to program at the lock for the functions indicated.

1. Acceptable Manufacturers:
  - a. Kaba (KA) e5800 Series.
  - b. Or equal as approved.

## **2.9 AUXILIARY LOCKS**

- A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13, Series 1000, Grade 1, certified large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Acceptable Manufacturers:
  - a. Sargent Manufacturing (SA) - 8200 Series.
  - b. Or equal as approved.

- B. Ligature Resistant, Mortise Locks and Trim: ANSI/BHMA A156.13, Series 1000, Operational and Security Grade 1 mortise type push-pull locks and latches with ligature-resistant paddle trim capable of being mounted in vertical (up or down) and horizontal (sideways) positions. Locksets to be manufactured with a corrosion resistant, formed steel case and be non-handed, field-reversible for re-handing without disassembly of the lock body. Paddles and covers are manufactured from cast stainless steel or brass material. Provide optional lead-lining (lock body) and Torx® fasteners as specified in Hardware Sets.

1. Acceptable Manufacturers:
  - a. Stanley Best (BE) – SPSL Series.
  - b. Townsteel (TS) – DRX Series.
  - c. Or equal as approved.

## **2.10 LOCK AND LATCH STRIKES**

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

## **2.11 ELECTROMAGNETIC LOCKING DEVICES**

- A. Surface Electromagnetic Locks (Extra Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 1 with minimum holding force strength of 1,800 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Acceptable Manufacturers:
  - a. Securitron Door Controls (SU) – M82 Series.
  - b. Or equal as approved.

## **2.12 CONVENTIONAL EXIT DEVICES**

- A. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:
  - a. Sargent Manufacturing (SA) - 80 Series.
  - b. Or equal as approved.

## **2.13 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES**

- A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below.

1. Acceptable Manufacturers:
  - a. Sargent Manufacturing (SA) - 80 Series.
  - b. Or equal as approved.



- B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction, electric dogging, outside door trim control, exit alarm, delayed egress, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as fail secure.

## **2.14 STAND ALONE ELECTRONIC ACCESS CONTROL EXIT DEVICES**

- A. Stand Alone Access Control Exit Devices: Internal, battery-powered, self-contained ANSI A156.3, Grade 1 electronic exit device consisting of complete door trim unit with electronically motor driven locking mechanism, integrated keypad, proximity card reader, or keypad/proximity reader combination, and specified electronic programming accessories. Trim to accept standard, interchangeable (removable) core, security and high security override cylinders. Provide keypad/proximity and proximity only products with a minimum of 2,000 user codes, low-battery detection and warning, LED status indicators, and ability to program at the device for the functions indicated.

- 1. Acceptable Manufacturers:
  - a. Kaba (KA) e5800 Series.
  - b. Or equal as approved.

## **2.15 DOOR CLOSERS**

- A. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units and high impact, non-corrosive plastic covers standard.

- 1. Acceptable Manufacturers:
  - a. Norton Door Controls (NO) - 7500 Series.
  - b. Or equal as approved.

## **2.16 AUTOMATIC DOOR OPERATORS**

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

- 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

- B. Electromechanical Door Operators: Self-contained units powered by permanent magnet DC motor, with closing speed controlled mechanically by gear train, connections for power, activation and safety device wiring, and manual operation including spring closing when power is off.

- C. Electrohydraulic Door Operators: Self-contained low-pressure units with separate cylinders for power and checking, connections for power, activation, and safety device wiring and manual operation including spring closing when power is off.
- D. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- E. Standard: Certified ANSI/BHMA A156.19.
  - 1. Performance Requirements:
    - a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
    - b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- F. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.
- G. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
  - 1. On-off switch to control power to be key switch operated.
- H. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- I. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- J. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.
- K. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.
  - 1. Acceptable Manufacturers:
    - a. Norton Door Controls (NO) - 6900 PowerMatic Series.
    - b. Or equal as approved.

## **2.17 ARCHITECTURAL TRIM**

### **A. Door Protective Trim**

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
  - a. Stainless Steel: .050-inch thick, with countersunk screw holes (CSK).
4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO).
  - b. Or equal as approved.

## **2.18 DOOR STOPS AND HOLDERS**

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Acceptable Manufacturers:
    - a. Rockwood Manufacturing (RO).
    - b. Or equal as approved.
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:
  - a. Rixson Door Controls (RF).
  - b. Or equal as approved.

## **2.19 ARCHITECTURAL SEALS**

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: :Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
  1. Pemko Manufacturing (PE).
  2. Door and Hardware Systems Inc. (DH).

## **2.20 ELECTRONIC ACCESSORIES**

- A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.
  1. Acceptable Manufacturers:
    - a. Securitron Door Controls (SU) - PB Series.
    - b. Or equal as approved.
- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design

complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

- a. Securitron Door Controls (SU) - DPS Series.
- b. Or equal as approved.

C. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

- a. Securitron Door Controls (SU) – ACU Power Series.
- b. Or equal as approved.

## **2.21 FABRICATION**

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## **2.22 FINISHES**

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Antimicrobial Finishes: Where specified, finishes on locksets, latchsets, exit devices and push/pull trim to incorporate an FDA recognized. Silver Ion, antimicrobial coating (MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### **3.2 PREPARATION**

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### **3.3 INSTALLATION**

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### **3.5 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### **3.7 DEMONSTRATION**

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### **3.8 DOOR HARDWARE SCHEDULE**

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:

1. MK - McKinney

2. MR - Markar
3. PE - Pemko
4. RO - Rockwood
5. SA - Sargent
6. DH - Door and Hardware Systems Inc
7. BE - Stanley Security Solutions Inc (BE)
8. HS - HES
9. KA - Kaba Ilco
10. SU - Securitron
11. RF - Rixson
12. NO - Norton
13. TS - Townsteel

C. Hardware Schedule Notes:

1. Provide torx fasteners for all hardware as available.
2. Provide break away seal or install perimeter seal in no more than 8"/12" strips as required by VA Mental Health Facility guidelines.
3. Provide only ligature-resistant hardware at acute care side.
4. Supplier shall coordinate all hardware requirements for aluminum door by others with aluminum storefront supplier.
5. Supplier shall coordinate all hardware requirements for electronic access controlled doors with general, electrical, and security contractors, including location and quantity of power supplies.
6. Verify and match Owner's existing key system or provide new as directed by Owner.
7. Access control software, cards, programming, control panels, wiring, installation, and function testing is all by others.
8. In general, provide non-removable pin (NRP) feature for hinges at all outswinging, lockable doors.
9. \* indicates opening has power requirements.

D. Hardware Schedule:

Hardware Set 1\*

Doors: 101A

1	Continuous Wire Hinge	HT CFMSLF-HD1 SER-CC		PE
1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Exit Device	36 56 72 AD8413 ETB	US32D	SA
1	Exit Device	36 AD8410 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Concealed Overhead Stop	6-X36 Torx	630	RF
1	Door Closer (surface,	CPS7570 7778 Security Torx Screws 6891, as required	689	NO



	stop arm)			
2	Door Switch	SEE SECTION 087113		
1	Automatic Operator	SEE SECTION 087113		
1	Threshold	271A FHSL14		PE
1	Manufacturer's standard weatherseal			
2	Sweep	315CN x torx		PE
1	Relay	RLP-12/24		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser Diagram			

Notes: Verify system description with Owner/Security Contractor.

#### Hardware Set 2

Doors: 120B

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Exit Device	TB 36 AD8504 x less trim	US32D	SA
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Exit Trim	E5810BWL62641 x Torx	626	KA
1	Door Closer (surface, stop arm)	CPS7570 7778 Security Torx Screws 6891, as required	689	NO
1	Threshold	271A FHSL14		PE
1	Manufacturer's standard weatherseal			
1	Sweep	315CN x torx		PE

Notes: Door is normally closed and locked. Exterior access by presenting valid card to reader in trim. Free egress at all times.

#### Hardware Set 3

Doors: 157A, 157B, 157C, 157D

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Exit Device	TB 36 56 72 AD8504 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Door Closer (surface, stop arm)	CPS7570 7778 Security Torx Screws 6891, as required	689	NO
1	Threshold	271A FHSL14		PE
1	Manufacturer's standard weatherseal			
1	Sweep	315CN x torx		PE

#### Hardware Set 4\*

Doors: 101B

1	Continuous Wire Hinge	HT CFMSLF-HD1 SER-CC		PE
1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Exit Device	TB 36 56 72 AD8413 ETB	US32D	SA
1	Exit Device	TB 36 AD8410 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Door Closer (surface, stop arm)	CPS7570 7788 Security Torx Screws 6891, as required	689	NO
2	Door Switch	SEE SECTION 087113		
1	Automatic Operator	SEE SECTION 087113		
2	Wall Stop	406 TORX	US32D	RO
1	Manufacturer's standard weatherseal			
2	Sweep	315CN x torx		PE
1	Relay	RLP-12/24		SU
1	Push Button	PB4L-2		SU
2	Delayed Egress Lock	IMXDA		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser Diagram			

Notes: Delayed Egress Opening: Doors are normally closed and locked. Exterior access by presenting valid card to wall-mounted reader or by remote unlocking at Reception. Authorized egress by remote unlocking at Reception. Emergency delayed egress by door movement. Mag locks are tied to the fire alarm system and release upon loss of power. Verify functioning of low energy operator from vestibule and waiting sides.

#### Hardware Set 5

Doors: 178, 179

1	Continuous Hinge	FM-300 Torx Screws HT MB	630	MR
1	Store Door Lock	36 72 75 8226 LNB	US32D	SA
2	Cylinder Core	Match existing	626	BE
1	Door Closer (surface, stop arm w/ HO)	CPS7570T Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Threshold	171A FHSL14 x torx		PE
1	Gasketing	303AS x torx		PE
1	Sweep	315CN x torx		PE

#### Hardware Set 6\*

Doors: 105B, 106B

1	Continuous Hinge	FM-300 Torx Screws HT MB	630	MR
1	Continuous Wire Hinge	FM-300 Torx Screws HT MB MP-ETAP-CE	630	MR
1	Exit Device	36 MD8610	US32D	SA
1	Exit Device	36 56 72 MD8613 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
2	Door Closer (surface, stop arm w/ HO)	CPS7570T Security Torx Screws	689	NO
2	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Threshold	171A FHSL14 x torx		PE
1	Gasketing	303AS x torx		PE
2	Sweep	315CN x torx		PE
2	Astragal	305CN x torx		PE
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU

Notes: Doors are normally closed and locked. Exterior access by presenting valid card to wall-mounted reader. Free egress at all times.

Hardware Set 7\*

Doors: 102B

1	Continuous Wire Hinge	FM-300 Torx Screws HT MB MP-ETAP-CE	630	MR
1	Exit Device	12 TB 36 56 8804 x less trim	US32D	SA
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Exit Trim	E5810BWL62641 x Torx	626	KA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Gasketing	S773D		PE
1	Relay	RLP-12/24		SU
1	Push Button	PB4L-2		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser Diagram			

Notes: Door is normally closed and locked. Exterior access by presenting valid card to reader in trim or by remote unlocking at Reception. Free egress at all times.

Hardware Set 8

Doors: 108A, 108B

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Exit Device	TB 36 8804 x less trim	US32D	SA
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Exit Trim	E5810BWL62641 x Torx	626	KA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

Notes: Door is normally closed and locked. Exterior access by presenting valid card to reader in trim. Free egress at all times.

#### Hardware Set 9

Doors: 117

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Exit Device	12 TB 36 8804 x less trim	US32D	SA
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Exit Trim	E5810BWL62641 x Torx	626	KA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

Notes: Door is normally closed and locked. Exterior access by presenting valid card to reader in trim. Free egress at all times.

#### Hardware Set 10\*

Doors: 100B, 102A

2	Continuous Wire Hinge	FM-300 Torx Screws HT MB MP-ETAP-CE	630	MR
1	Exit Device	12 TB 36 56 NB8710 ETB	US32D	SA
1	Exit Device	12 TB 36 56 72 NB8713 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Door Switch	SEE SECTION 087113		
2	Automatic Operator	SEE SECTION 087113		
2	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Gasketing	S773D		PE
1	Astragal	S772D		PE

1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR	SU
1	Wiring & Riser Diagram		

Notes: Doors are normally closed and locked. Card reader on Waiting side and push plate on Link side initiates latch retraction and cycling of both low energy operators. Free egress from Link side at all times.

#### Hardware Set 11

Doors: 105A, 106A

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Exit Device	12 TB 36 72 86 8804 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
1	Door Closer (surface, stop arm)	CPS7570 Security Torx Screws	689	NO
1	Gasketing	S773D		PE

#### Hardware Set 12

Doors: 112, 113, 114, 115B, 130, 131C

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Lock	E5866BWL62641 x Torx	626	KA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

Notes: Door is normally closed and locked. Exterior access by presenting valid card to card reader lock. Free egress at all times.

#### Hardware Set 12A

Doors: 134A

2	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Lock	E5866BWL62641 x Torx	626	KA
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO

Notes: Door is normally closed and locked. Exterior access by presenting valid card to card reader lock. Free egress at all times.

#### Hardware Set 13

Doors: 115A

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Lock	E5866BWL62641 x Torx	626	KA
1	Door Closer (surface, stop arm)	CLP7570 Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

#### Hardware Set 14\*

Doors: 131A, 131B

1	Continuous Wire Hinge	FM-300 Torx Screws HT MB MP-ETAP-CE	630	MR
1	Fail Secure Electric Lock	LX 36 72 8271-12V LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Breakaway Cush-n-Seal	105B	DB	DH
1	Relay	RLP-12/24		SU
1	Position Switch	DPS-M-BK		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU

Notes: Door is normally closed and locked. Exterior access by presenting valid card to wall-mounted reader. If door 131A is open, door 131B cannot be opened. If door 131B is open, door 131A cannot be opened. Free egress from Nurse Work 131A and Nurse Work 131 sides.

#### Hardware Set 15 (Not used)

#### Hardware Set 16

Doors: 107, 109, 110, 111, 149, 150

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Storeroom Lock	36 72 8204 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO

1 Gasketing	S773D		PE
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#### Hardware Set 17

Doors: 122, 123, 124, 126, 127

3 Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1 Office Lock	36 72 8205 LNB	US26D	SA
1 Cylinder Core	Match existing	626	BE
1 Wall Stop	406 TORX	US32D	RO
3 Silencer	608		RO

#### Hardware Set 18

Doors: 145, 146, 147, 148, 151, 152, 153, 154, 155, 156

1 Continuous Hinge	FM-300 Torx Screws HT MB	630	MR
1 Office Lock	36 72 8205 LNB	US26D	SA
1 Cylinder Core	Match existing	626	BE
1 Concealed Overhead Stop	1-X36 Torx	630	RF
1 Breakaway Cush-n-Seal	105B	DB	DH

#### Hardware Set 19

Doors: 116

3 Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1 Office Lock	36 72 8205 LNB	US26D	SA
1 Cylinder Core	Match existing	626	BE
1 Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1 Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1 Wall Stop	406 TORX	US32D	RO
1 Gasketing	S773D		PE

#### Hardware Set 20

Doors: 120A

3 Heavyweight Hinge	HTA786 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1 Passage Set	36 8215 LNB	US26D	SA
1 Wall Stop	406 TORX	US32D	RO
3 Silencer	608		RO

#### Hardware Set 21

Doors: 145A, 146A, 147A, 148A, 151A, 152A, 153A, 154A, 155A, 156A

1	Continuous Hinge	FM-300 Torx Screws HT MB	630	MR
1	Passage Set	36 8215 LNB	US26D	SA
1	Concealed Overhead Stop	1-X36 Torx	630	RF
1	Breakaway Cush-n-Seal	105B	DB	DH

#### Hardware Set 22

(Not used)

#### Hardware Set 23

Doors: 121, 139, 141, 142, 143, 144

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Classroom Lock	36 72 8237 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Wall Stop	406 TORX	US32D	RO
3	Silencer	608		RO

#### Hardware Set 24

Doors: 135

1	Continuous Hinge	FM-300 Torx Screws HT MB	630	MR
1	Classroom Lock	36 72 8237 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Concealed Overhead Stop	1-X36 Torx	630	RF
3	Silencer	608		RO

#### Hardware Set 25

Doors: 136, 137

3	Heavyweight Hinge	HTA786 NRP 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
1	Classroom Lock	36 72 8237 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

#### Hardware Set 26

Doors: 104, 118, 119, 129, 140

3	Heavyweight Hinge	HTA786 4-1/2" x 4-1/2" TXS-Steel	US26D	MK
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1	Privacy, Occupancy Indicator	36 49 8265 LNB	US26D	SA
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Gasketing	S773D		PE

#### Hardware Set 27\*

Doors: 158A, 158B

2	Continuous Wire Hinge	FM-300 Torx Screws HT MB MP-ETAP-CE	630	MR
1	Exit Device	TB 36 NB8710 ETB	US32D	SA
1	Exit Device	TB 36 72 NB8713 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
2	Magnetic Lock	M82B		SU
2	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
2	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
2	Wall Stop	406 TORX	US32D	RO
2	Silencer	608		RO
1	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Relay	RLP-12/24		SU
1	Push Button	PB4L-2		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser Diagram			

Notes: Panic button in Sally Port rings Nurses' Station and Police Station. Camera outside both sets of doors to Sally Port. Entry by valid card at wall-mounted reader or by remote unlocking at Nurses' Station.

#### Hardware Set 28\*

Doors: 162

1	Continuous Wire Hinge	HT CFMSLF-HD1 SER-CC		PE
1	Exit Device	TB 36 56 72 AD8504 ETB	US32D	SA
1	Cylinder Core	Match existing	626	BE
2	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Door Closer (surface)	PR7570 Security Torx Screws	689	NO
1	Threshold	271A FHSL14		PE
1	Sweep	315CN x torx		PE
1	Delayed Egress Lock	IMXDA		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser			

## Diagram

Notes: Delayed Egress Opening. Verify exact system description and requirements with Owner.

### Hardware Set 29\*

Doors: 177

1	Continuous Wire Hinge	HT CFMSLF-HD1 SER-CC		PE
1	Exit Device	AL TB 36 56 AD8504 ETB	US32D	SA
2	Cylinder Core	Match existing	626	BE
2	Wall-mounted Reader	E587062641 x Torx x flush mounting	626	KA
1	Door Closer (surface, stop arm)	CPS7570 7778 Security Torx Screws 6891	689	NO
1	Threshold	271A FHSL14		PE
1	Sweep	315CN x torx		PE
1	Delayed Egress Lock	IMXDA		SU
1	Power Supply	AQU12 or 24 x AMP x OUTPUT x 8C/IR		SU
1	Wiring & Riser Diagram			

Notes: Delayed Egress/Alarmed Opening. Verify exact system description and requirements with Owner.

### Hardware Set 30

Doors: 159

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Card Reader Lock	E5866BWL62641 x Torx	626	KA
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
3	Silencer	608		RO

Notes: NOTE TO ARCHITECT/OWNER: Anti-ligature design is not available with Kaba lock. Option: Wall-mounted reader, anti-ligature mechanical lock, electric strike or mag lock?

### Hardware Set 31

Doors: 161

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	One-sided Mortise Deadlock	36 72 8220	US26D	SA
1	Rim/Mortise Cylinder	Match existing	626	BE
1	Flush Pull	94L x torx	US32D	RO

1	Concealed Overhead Stop	1-X36 Torx	630	RF
1	Breakaway Cush-n-Seal	105B	DB	DH

Notes: NOTE TO ARCHITECT/OWNER: Kaba reader required? See note from previous hardware set for door 159. Inside door operation/trim required? Closer? If so, overhead concealed security?

#### Hardware Set 32

Doors: 169, 170

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Storeroom Lock, Cyl OS/Lever IS	36 72 8206 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Flush Pull	94L x torx	US32D	RO
1	Surface Closer	(PS)7570ST Security Torx Screws	689	NO
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Breakaway Cush-n-Seal	105B	DB	DH

Notes: Coordinate mounting locations of mortise lock and flush pull.

#### Hardware Set 33

Doors: 163, 164, 166, 167, 168

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Behavioral Health Mortise Lock	SPSL-ML-R 16F SH (Classroom)	630	BE
1	Concealed Overhead Stop	1-X36 Torx	630	RF
3	Silencer	608		RO

#### Hardware Set 34

Doors: 160

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Storeroom Lock, 3-point, no i.s. trim	3P 36 72 8235 LNB	US26D	SA
1	Cylinder Core	Match existing	626	BE
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Wall Stop	406 TORX	US32D	RO
1	Breakaway Cush-n-Seal	105B	DB	DH

Hardware Set 35

Doors: 171, 172, 173, 174, 175, 176

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Behavioral Health Female Privacy Lock	SPSL-ML-LTF-16F	630	BE
1	Wall Stop	406 TORX	US32D	RO
1	Door Holder	Advise	US26D	
1	Breakaway Cush-n- Seal	105B	DB	DH

Notes: Door swings 180 degrees against wall and is held in place.

Hardware Set 36

Doors: 165

1	Continuous Hinge	HT CFMSLF-HD1		PE
1	Behavioral Health Mortise Lock	SPSL-ML-A 16F SH (Institutional Privacy)	630	BE
1	Concealed Overhead Stop	1-X36 Torx	630	RF
1	Kickplate	K1050 12" x 2" LDW TORX 4BE CSK	US32D	RO
1	Breakaway Cush-n- Seal	105B	DB	DH

Hardware Set 37

Doors: 100A, 100C

1 Reuse existing

Hardware set 38

Doors: 134B

1	Rim/Mortise Cylinder	Match existing	626	BE
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Hardware set 39

Miscellaneous Hardware

1	Key Box	3200 hinged door, recessed, color as selected		KX
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---END---

**SECTION 08 71 13**  
**AUTOMATIC DOOR OPERATORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies equipment, controls and accessories for automatic operation of swing and sliding doors.

**1.2 RELATED WORK**

- A. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- B. Door hardware; Section 08 71 00, DOOR HARDWARE.
- C. Section 28 13 00, ACCESS CONTROL.
- D. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- E. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.
- F. Section 28 31 00, FIRE DETECTION AND ALARM.

**1.3 QUALITY ASSURANCE**

- A. Automatic door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
- B. One type of automatic door equipment shall be used throughout the building.
- C. Equipment installer shall have specialized experience and shall be approved by the manufacturer.

**1.4 WARRANTY**

- A. Automatic door operators shall be subject to the terms of the "Warranty of Construction" Article of Section 00 72 00, GENERAL CONDITIONS, except that the Warranty period shall be two years in lieu of one year.

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on automatic door operators.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
- C. Shop Drawings:
  - 1. Showing location of controls and safety devices in relationship to each automatically operated door.
  - 2. Showing layout, profiles, product components, including anchorage, accessories, as applicable.

3. Submit templates, wiring diagrams, fabrication details and other information to coordinate the proper installation of the automatic door operators.

D. Submit in writing to Resident Engineer that items listed in Article 1.3 are in compliance.

## **1.7 DESIGN CRITERIA**

- A. As a minimum automatic door equipment shall comply with the requirements of BHMA 156.10. Except as otherwise noted on drawings, provide operators which will move the doors from the fully closed to fully opened position in // three // five // seven // seconds maximum time interval, when speed adjustment is at maximum setting.
- B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.
- C. Electrical Wiring, Connections and Equipment: Provide all motor, starter, controls, associated devices, and interconnecting wiring required for the installation. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

## **1.8 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Builders Hardware Manufacturers Association, Inc. (BHMA):  
A156.10-05.....Power Operated Pedestrian Doors (BHMA 1601)
- C. National Fire Protection Association (NFPA):  
101-09 .....Life Safety Code
- D. Underwriters Laboratory (UL):  
325-10 .....Door, Drapery, Gate, Louver, and Window Operators and  
Systems

## **1.9 DELIVERY AND STORAGE**

- A. Delivery shall be in factory's original, unopened, undamaged container with identification labels attached.

## **PART 2 - PRODUCTS**

### **2.1 SWING DOOR OPERATORS**

- A. General: Swing door operators shall be of institutional type, door panel size 600 mm to 1250 mm (3'-0" to 5'-0") width, weight not to exceed 300 kg (600 pounds), electric operated for overhead mounting within the header or transom. Furnish metal mounting supports, brackets and other accessories necessary for the installation of operators at the head of the door frames. The motor on automatic door operator shall be provided with an interlock so that the motor will not operate when doors are electrically locked from opening.
- B. Operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall be capable of recycling doors instantaneously to full open position from any point in the closing cycle when control switch is activated. Operators

shall, when automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.

- C. Operator, enclosed in housing, shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power, or controlled by hydraulic closer in electro-hydraulic operators. System shall operate as manual door control in event of power failure. Opening and closing speeds shall be adjustable:
  - 1. Operator Housing: Housing shall be a minimum of 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems. All structural sections shall have a minimum thickness of 3.2 mm (0.125 inch) and be fabricated of a minimum of 6063-T5 aluminum alloy.
  - 2. Power Operator: Completely assembled and sealed unit which shall include gear drive transmission, mechanical spring and bearings, all located in aluminum case and filled with special lubricant for extreme temperature conditions. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.
  - 3. Connecting hardware shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing. Door shall not pivot on shaft of operator.
  - 4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. All connecting harnesses shall have interlocking plugs.

## **2.2 MICROPROCESSOR CONTROLS**

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1–30 seconds), LED indications for sensor input signals and operator status and power assist close options. Control shall be capable of receiving activation signals from any device with normally open dry contact output. All activation modes shall provide fully adjustable opening speed:
- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and stops the opening direction of the door if an obstruction is sensed. The motor shall include a recycle feature that reopens the door if an obstruction is sensed at any point during the closing cycle. The control shall include a standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated in the architectural drawings.

## 2.4 POWER UNITS

Each power unit shall be self-contained, electric operated and independent of the door operator. Capacity and size of power circuits shall be in accordance with automatic door operator manufacturer's specifications and Division 26 – ELECTRICAL.

## 2.5 DOOR CONTROLS

- A. Opening and closing actions of doors shall be actuated by controls and safety devices specified, and conform to ANSI 156.10. Controls shall cause doors to open instantly when control device is actuated; hold doors in open positions; then, cause doors to close, unless safety device or reactivated control interrupts operation.
- B. Manual Controls:
  - 1. Push Plate Wall Switch: Recess type, stainless steel push plate minimum 100 mm by 100 mm (four-inch by four-inch), with 13 mm (1/2-inch) high letters "To Operate Door--Push" engraved on face of plate.

## 2.6 SAFETY DEVICES

- A. General: Area over which doors swing or slide shall be a safety section and anyone standing in path of door's movement shall be protected by a safety device.
- B. Each swing door shall have installed on the pull side a presence sensor to detect any person standing in the door swing path and prevent the door from opening.
- C. Time delay switches shall be adjustable between 3 to 60 seconds and shall control closing cycle of doors.
- D. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment, in finish work.
- B. Install power units in locations shown. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and must function properly for the type of traffic (pedestrians, carts, stretchers and wheelchairs) expected to pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.



- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the Resident Engineer.

### **3.2 INSTRUCTIONS**

- A. Following the installation and final adjustments of the door operators, the installer shall fully instruct VA personnel for // 2 hours // 4 hours // on the operating, servicing and safety requirements for the swing and sliding automatic door operators.
- B. Coordinate instruction to VA personnel with VA COR.

--- E N D ---

## **SECTION 08 80 00**

### **GLAZING**

#### **PART 1 – GENERAL**

##### **1.1 SUMMARY**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.
- B. Section Includes:
  - 1. Transparent and translucent glass glazing for general and special purpose applications including; coated, float, heat-strengthened, impact resistant, insulating, low emissivity, laminated, spandrel and tempered glass.
  - 2. Work Results: Manufacture, handle, deliver and install glazing systems as shown on the architectural drawings or as otherwise specified and in accordance with the requirements of the contract documents.

##### **1.2 RELATED WORK**

- A Aluminum storefronts: Section 084113
- B. Aluminum windows: Section 085113
- C. Hollow metal doors: Section 081113
- D. Clad wood doors: Section 081423

##### **1.3 REFERENCES**

- A. Abbreviations and Acronyms:
  - 1. AAMA American Architectural Manufacturers Association
  - 2. ANSI American National Standards Institute
  - 3. ASTM Formerly the American Society for Testing and Materials
  - 4. CPSC Consumer Products Safety Commission
  - 5. FT Fully Tempered
  - 6. GANA Glass Association of North America
  - 7. HS Heat-strengthened
  - 8. ICC International Code Council
  - 9. IGCC Insulating Glass Certification Council
  - 10. IGMA Insulating Glass Manufacturers Alliance
  - 11. LBNL Lawrence Berkeley National Laboratories
  - 12. LEED Leadership in Energy & Environmental Design
  - 13. Low-E Low emissivity
  - 14. LSG Light to Solar Gain
  - 15. NFRC National Fenestration Rating Council
  - 16. SHGC Solar Heat Gain Coefficient
  - 17. SC Shading Coefficient

- 18. USGBC            The U.S. Green Building Council
- 19. VLT             Visible Light Transmittance

B. Definitions:

- 1. Deterioration of Coated Glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
- 2. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.
- 3. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delaminating material obstructing vision through glass and blemishes exceeding those allowed by referenced laminated glass standards.
- 4. Interspace or Airspace: The space between lites of any insulating glass unit that contains dehydrated air or a specified gas.
- 5. Manufacturer: A firm that produces primary glass or fabricated glass products as defined in referenced glazing publications.

C. Reference Standards: This section does not require compliance with standards, but is merely a listing of those used. If compliance is required, statements will be included in the appropriate Section.

- 1. ASTM C 1036 Standard Specification for Flat Glass
- 2. ASTM C 1048 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated
- 3. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass
- 4. ASTM C 1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
- 5. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation (*replaces ASTM E773, E774 CBA, CAN / CGSB 12.8*)
- 6. ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units
- 7. ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position

8. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings
9. ASTM C 1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate
10. ANSI Z97.1 Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings
11. CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.
- B. Samples: Submit 12-inch (305 mm) long samples of each type of glass indicated except for clear monolithic glass products, and 12-inch (305 mm) long samples of each color required, except black, for each type of sealant or gasket exposed to view.
- C. Test and Evaluation Reports: Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.
- D. Manufacturer Reports: Submit Glass Fabricator's Shop Drawing Review indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.
- E. Sustainable Design Submittals: Submit manufacturer's documentation verifying product content, origin or other attributes for projects requiring special sustainability provisions, to meet the USGBC's LEED requirements or other sustainable goals.
- F. Warranties:
  1. Provide a written 10-year warranty from date of manufacture for sputter coated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
  2. Provide a written 5-year warranty from date of manufacture for laminated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
  3. Provide a written 10-year warranty (vertical application) or 5-year warranty (sloped application) from date of manufacture for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
  4. Provide a written 5-year warranty from date of manufacture for Viraspan ceramic frit. Warranty covers deterioration due to normal conditions of use and not to handling,

installing, and cleaning practices contrary to the glass manufacturer's published instructions.

5. Provide a written 5-year warranty from date of manufacture for Solarscreen Reflective Spandrel Glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
7. Provide a written 5-year warranty from date of manufacture for fully tempered glass that has been Heat Soaked. Warrants that heat soaked tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions at a rate exceeding 0.5% (5/1000) for a period of five years from the date of manufacture.

## **1.5 QUALITY ASSURANCE**

- A. Qualifications:
  1. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.
- B. Mock-ups: Before glazing, build mockups for each glass product indicated in section 2.5 Product Schedule to verify selections and to demonstrate aesthetic effects and qualities of materials and execution.
  1. Construction: Build mockups with glass and glazing systems specified for the project, including typical lite size, framing systems and glazing methods – see mock-up requirements in section 042000.
  2. Scheduling: Notify architect seven days in advance of dates and times when mockups will be available for viewing.
  3. Quality Assurance: Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work. Accepted mockups may become part of the completed work if undisturbed at the time of substantial completion.
- C. Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or in Article 1.2 References.
  1. GANA Glazing Manual
  2. GANA Engineering Standards Manual
  3. GANA Laminated Glazing Reference Manual

## **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Storage and Handling Requirements:

1. Protect glass from edge damage during handling. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.
2. Storage and Protection: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

## **1.7 SITE CONDITIONS**

- A. Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.
  1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40°F (4.4°C).

## **PART 2 – PRODUCTS**

### **2.1 DESCRIPTION**

- A. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.

### **2.2 PERFORMANCE / DESIGN CRITERIA**

- A. Glass Strength: Analysis shall comply with ASTM E 1300 Determining Load Resistance of Glass in Buildings. Provide glass products in the thickness and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions.
  1. Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:
    - a. 8 breaks per 1000 for glass installed vertically or not 15 degrees or more from the vertical plane and under wind action.
    - b. 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.
  2. Deflection must be limited to prevent disengagement from the frame and be less than or equal to 1" (25mm).
- B. Thermal and Optical Performance: Provide glass products with performance properties specified in 2.5 Product Schedule. Performance properties to be manufacturer's published data as determined according to the following procedures:
  1. Center of glass U-Value: NFRC 100 methodology using LBNL WINDOW 5.2 computer program.

2. Center of glass solar heat gain coefficient: NFRC 200 methodology using LBNL-35298 WINDOW 5.2 computer program.
3. Solar optical properties: NFRC 300

## 2.3 FABRICATION

### A. Flat Glass:

1. Shall comply with ASTM C1036 Standard Specification for Flat Glass, Type 1, Class 1 (clear) or Class 2 (tinted, heat-absorbing and light reducing) and Quality q3
2. ASTM C 1048 Heat Treated Flat Glass, Kind HS or FT (remove ASTM Standard C 1048 if annealed glass), Condition A (uncoated), B (spandrel glass, one surface coated), or C (other coated glass)
  - a. Heat Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
  - b. Maximum peak to valley rollerwave 0.003" (0.08mm) in the central area and 0.008" (0.20mm) within 10.5" (267mm) of the leading and trailing edge.
  - c. Maximum bow and warp 1/32" per lineal foot (0.79mm).
  - d. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
  - e. Heat Soak all fully tempered glass to prevent the potential for spontaneous breakage due to nickel sulfide inclusions in the glass.

### B. Insulating Glass:

1. Shall comply with ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
  - a. Units shall be certified for compliance by the IGCC in accordance with the above ASTM test method.
2. The unit overall thickness tolerance shall be -1/16" (1.59mm) / +1/32" (0.79mm). Unit constructed with patterned or laminated glass shall be +/-1/16" (1.59mm).
3. Shall comply with ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units
4. Shall comply with ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position
5. Sealed Insulating Glass Units to be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone.
  - a. The minimum thickness of the secondary seal shall be 1/16" (1.59mm).
  - b. The target width of the primary seal shall be 5/32" (3.97mm).
  - c. There shall be no voids or skips in the primary seal.
  - d. Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1/16" (1.59mm) by maximum length of 2" (51mm) with gaps

separated by at least 18" (457mm). Continuous contact between the primary seal and the secondary seal is desired.

- e. Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.

- 6. To provide a hermetically sealed and dehydrated space, lites shall be separated by an aluminum spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint.

C. Laminated Glass:

- 1. Shall comply with ASTM 1172 Standard Specification for Laminated Architectural Flat Glass.
- 2. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
- 3. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

D. Coated Vision Glass:

- 1. Shall comply with ASTM C 1376 Standard for Pyrolytic and Vacuum Deposition Coatings on Glass
- 2. Coated products to be magnetically sputtered vacuum deposition (MSVD)
- 3. Edge Deletion – When low-e coatings are used within an insulating unit, coating shall be edge deleted to completely seal the coating within the unit.
  - a. The edge deletion should be uniform in appearance (visually straight) and remove 95% of the coating.

E. Ceramic Coated Glass Products:

- 1. Shall comply with ASTM C 1048 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated, Condition B
- 2. Silk-screen pattern should be no more than 0.0625" (1.59 mm) off parallel from locating glass edge and no more than 0.0125" (3.18 mm) from edges other than locating glass edge.
- 3. There shall be a maximum of a 0.03125" (0.79 mm) variation in dot, hole or line location.

## 2.4 ACCESSORIES

- A. Glazing Materials: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

- 1. Setting blocks to be 100% silicone with a durometer hardness of 85±5.

## 2.5 PRODUCT SCHEDULE



- A. All products shall comply with ASTM Standards and requirements in Article 2.3 Materials.
- B. **IGU 1: - Viracon's (or equal) Laminated Insulating Low-E Coated Glass with removable 7/16" interior pane (integral blind condition): 1-1/16" VUE1-50 Laminated Insulating Coated Glass.**
1. Exterior Glass Laminated Insulated Unit
    - a. Exterior Glass Ply: 3/16" Clear Heat Strengthened
    - b. .060 clear pvb
    - c. Interior Glass Ply of exterior laminate: 3/16" Clear Heat Strengthened
    - d. Coating: VUE1-50 #4
    - e. Airspace: 7/16" airspace
    - f. Silicone: Black or Gray Silicone
  2. Interior glass pane
    - a. 3/16" Clear Heat Strengthened
  3. Interior removable 7/16" laminate in Kawneer System
    - a. Exterior Glass Ply: 3/16" Clear Heat Strengthened
    - b. .060 clear pvb
    - c. Interior Glass Ply: 3/16" Clear heat Strengthened
  4. Performance Requirements
    - a. Minimum Visible Light Transmittance: 40%
    - b. Maximum Exterior (Vis-Out) Reflectance: 15%
    - c. Winter U-Value: .30
    - d. Summer U-Value: .30
    - e. Solar Heat Gain Coefficient: .30
- C. **IGU 2: - Viracon's (or equal) Double Laminated Insulating Low-E Coated Glass: 1-5/16" VUE1-50 Double Laminated Insulating Coated Glass.**
1. Exterior Glass Laminated Insulated Unit
    - a. Exterior Glass Ply: 3/16" Clear Heat Strengthened
    - b. .060 clear pvb
    - c. Interior Glass Ply of exterior laminate: 3/16" Clear Heat Strengthened
    - d. Coating: VUE1-50 #4
    - e. Airspace: 7/16" airspace
    - f. Silicone: Black or Gray Silicone
  2. Interior glass laminate
    - a. 3/16" Clear Heat Strengthened
    - b. .030 clear pvb
    - c. 3/16" Clear Heat Strengthened
  3. Performance Requirements

- a. Minimum Visible Light Transmittance: 40%
- b. Maximum Exterior (Vis-Out) Reflectance: 15%
- c. Winter U-Value: .30
- d. Summer U-Value: .30
- e. Solar Heat Gain Coefficient: .30

**D. IGU3: - Viracon's (or equal) Laminated Insulating Low-E Spandrel Glass: 1-1/16" VUE1-50 Insulating Coated Glass.**

- 1. Exterior Glass Laminate
  - a. Exterior Glass Ply: 3/16" Clear Heat Strengthened
  - b. .060 clear pvb
  - c. Interior Glass Ply of exterior laminate: 3/16" Clear Heat Strengthened
  - d. Coating: Viracon's VUE1-50 #4
  - e. Airspace: 7/16"
  - f. Silicone: Black or Gray Silicone
- 2. Monolithic Interior Glass Pane
  - a. 3/16" Clear with standard ceramic frit paint #6 full coverage
- 3. Performance Requirements
  - a. Winter U-Value: .30
  - b. Summer U-Value: .30

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions:
  - 1. Verify prepared openings for glazing are correctly sized and within tolerance. Verify that the minimum required face and edge clearances are being followed.
  - 2. Verify that a functioning weep system is present.
  - 3. Do not proceed with glazing until unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Surface Preparation: Immediately before glazing, clean glazing channels and other framing members receiving glass. Remove coatings not firmly bonded to substrates.
- B. Demolition / Removal: Remove and replace glass that is broken, chipped, cracked or damaged in any way.

#### **3.3 INSTALLATION**

- A. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials including those in the GANA Glazing Manual except where more stringent requirements are indicated.

- B. Prevent glass from contact with contaminating substances that result from construction operations such as weld splatter, fire-safing or plastering.

#### **3.4 CLEANING**

- A. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers.

--- E N D ---

## SECTION 08 90 00 LOUVERS AND VENTS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

This section specifies fixed and operable wall louvers, door louvers and wall vents.

#### 1.2 RELATED WORK

- A. Louvers in steel doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

#### 1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:  
Each type, showing material, finish, size of members, // operating devices, // method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:  
Each type of louver and vent.

#### 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 – September 2011
- C. American Society for Testing and Materials (ASTM):  
  - A167-99(R2009) .....Stainless and Heat-Resisting Chromium - Nickel Steel Plate, Sheet, and Strip
  - A1008/A1008M-10 .....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
  - B209/B209M-03(R2007) .....Aluminum and Aluminum Alloy, Sheet and Plate
  - B221-08.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B221M-07.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06 .....Metal Finishes Manual
- E. National Fire Protection Association (NFPA):  
90A-09.....Installation of Air Conditioning and Ventilating Systems
- F. American Architectural Manufacturers Association (AAMA):  
2605-11 .....High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):

500-L-07 ..... Testing Louvers

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Carbon Steel: ASTM A1008/A1008M.
- B. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
  - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
  - 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.
- C. Inorganic Zinc Primer: MPI No. 19.

### **2.2 EXTERIOR WALL LOUVERS**

- A. General:
  - 1. Provide // fixed type louvers of size and design shown.
  - 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
  - 3. Furnish louvers with sill extension or separate sill as shown.
  - 4. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics:
  - 1. Weather louvers shall have a minimum of \_\_\_\_\_ percent free area and shall pass \_\_\_\_\_ mm/s (fpm) free area velocity at a pressure drop not exceeding \_\_\_\_\_ mm (inch) water gage and carry not more than \_\_\_\_\_ g (ounces) of water per m<sup>2</sup> (square foot) of free area for 15 minutes when tested per AMCA Standard 500-L.
  - 2. Louvers shall bear AMCA certified rating seals for air performance and water penetration ratings.
- C. Galvanized Steel Louvers:
  - 1. General: Frames, sills and mullions (sliding interlocking type); 2 mm (0.081-inch) thick extruded aluminum. Blades shall be // or // drainable // type and have reinforcing bosses.
  - 2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames shall not exceed 1700 mm (66 inches) wide. When openings exceed 1700 mm (66 inches), provide twin louvers separated by mullion members.
  - 3. Louvers, operable: Louver frame opening sizes, single louver sizes and mullion requirements shall be as specified for fixed louvers.
    - a. Blades: Attach blades to frame with aluminum pivot pins through nylon bearings. Fasten each blade to stainless steel operation arms that are connected to minimum 3 mm (1/8-

inch) thick stainless steel operating // bar // handle // arranged for simultaneous operation of blades.

- D. Stainless Steel Louvers: From stainless steel louvers using 1.6 mm (0.063-inch) thick sheet for frames, blades, sills and mullions.
  - 1. Louver shall have fixed 45 degree // standard // drainable // blades with water baffle. Make overall frame size 13 mm (1/2-inch) less than opening, unless otherwise shown.
  - 2. Single louver sections shall not exceed 1700 mm (66 inches) in width. For openings larger than 1700 mm (66 inches) wide, provide multiple sections not larger than 1700 mm (66 inches) wide separated by mullions.

## **2.3 CLOSURE ANGLES AND CLOSURE PLATES**

- A. Fabricate from 2 mm (0.074-inch) thick galvanized steel.
- 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 specified.

## **2.4 WIRE GUARDS**

- A. Provide wire guards on inside of all exterior louvers, except on exhaust air louvers.
- B. Fabricate frames from // 2 mm (0.081-inch) thick extruded or sheet aluminum // 1.5 mm (0.059-inch) thick stainless steel // designed to retain wire mesh.
- C. Wire mesh shall be woven from not less than // 1.6 mm (0.063-inch) diameter aluminum wire // 1.3 mm (0.05-inch) diameter stainless steel wire // in 13 mm (1/2-inch) square mesh.
- D. Miter corners and join by concealed corner clips or locks extending about 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over four feet in height with a mid-rail constructed as specified for frame components.
- E. Fasten frames to outside of louvers with aluminum or stainless steel devices designed to allow removal and replacement without damage to the wire guard or the louver.

## **2.5 EXTERIOR DOOR LOUVERS**

- A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum. Miter frames at corners and join by concealed corner brackets.
- B. Equip louvers on outside with wire guards, except omit wire guards for louvers in doors located completely below enclosed areaways.

## **2.6 WALL VENTS**

- A. Fabricate exterior wall vents from either 4.7 mm (0.187-inch) thick aluminum plate of 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.
- B. Vents shall have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

- C. Vent Frames In Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

## **2.7 AIR INTAKE VENTS**

- A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from galvanized steel , ASTM B221. Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.
- B. // Provide aluminum closures where shown for inside face of dummy vents.//
- C. Provide 0.8 m (0.032-inch) thick aluminum sleeves // in cavity walls // where shown //.

## **2.8 BRICK VENTS**

- A. Vents shall be of size shown formed of approximately 3 mm (0.125 inch) thick cast aluminum, or 3 mm (0.125) inch extruded aluminum.
- B. Provide vents complete with aluminum screen frame with corrosion resistant insect screening mounted on back of vent.
- C. Provide vents with required anchors.

## **2.9 FINISH**

- A. Sheet Steel: Baked-on or oven dried shop prime coat.
  - 1. Paint interior surfaces of lightproof louvers with two additional finish shop coats of baked-on flat black enamel.
  - 2. Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING.
- B. Steel: Surfaces of steel work, for which no other finish is specified, shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

## **2.10 PROTECTION**

- A. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- B. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. // Strippable plastic coating on // colored anodized // organic // finish is not approved.//

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers // and vents // to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Generally, set wall louvers // and vents // in masonry walls during progress of the work. If wall louvers // and vents // are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

### **3.2 CLEANING AND ADJUSTING**

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components

--- E N D ---



**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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, plaster bases or other building boards.

**1.2 RELATED WORK**

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Sections 09 51 00, ACOUSTICAL CEILINGS and 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. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Studs, runners and accessories.
  - 2. Hanger inserts.
  - 3. Channels (Rolled steel).
  - 4. Furring channels.
  - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
  - 1. Typical ceiling suspension system.
  - 2. Typical metal stud and furring construction system including details around openings and corner details.
  - 3. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.
- D. Test Results: Fire rating test designation, each fire rating required for each assembly.

## 1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

## 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
  - A123-09.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
  - A653/A653M-09 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
  - C11-10 ..... Terminology Relating to Gypsum and Related Building Materials and Systems
  - C635-07 ..... Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
  - C636-06 ..... Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - C645-09 ..... Non-Structural Steel Framing Members
  - C754-09 ..... Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - C841-03(R2008) ..... Installation of Interior Lathing and Furring
  - C954-07 ..... Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
  - C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - E580-09.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

## PART 2 - PRODUCTS

### 2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

### 2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes as shown.
  - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).

2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
  1. Conform to rated wall construction.
  2. C-H Studs.
  3. E Studs.
  4. J Runners.
  5. Steel Jamb-Strut.

### **2.3 FURRING CHANNELS**

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
  1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
  2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
  1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
  2. Web furring depth to suit thickness of insulation with slotted perforations.
- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

### **2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used. Powder actuated attachment is not allowed.
- F. Tie Wire and Hanger Wire:
  1. ASTM A641, soft temper, Class 1 coating.
  2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:

1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.
- I. Provide 18 gauge sheet metal strips where blocking is indicated on the drawings or required.

## **2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)**

- 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 (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions // and insulated exterior wall furring. //
- F. Openings:
  1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

### **3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

### 3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

### 3.5 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
  - 1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
  - 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- C. Steel decking without concrete topping:
  - 1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
  - 2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
- D. 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.
- E. Installing Ceiling Bracing System:
  - 1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
  - 2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
- //3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580. //

**3.6 TOLERANCES**

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

--- E N D ---

**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.
- C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- D. Lay in gypsum board ceiling panels: 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, including bullnose.
  2. Finishing materials.
  3. Laminating adhesive.
  4. Gypsum board, each type.
- C. Shop Drawings:
1. Typical gypsum board installation, showing corner details, edge trim details and the like.
  2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
  3. Typical shaft wall assembly.
  4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
- D. Samples:
1. 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.
- F. Mock-Up
  - 1. Shall construct 9 x 9 foot mock up panel with class 3 finish provided, if accepted by COR mock up to remain in building.

## **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):
  - C11-08 ..... Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-02 ..... Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-08 ..... Application and Finishing of Gypsum Board
  - C919-08 ..... Sealants in Acoustical Applications
  - C954-07 ..... Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
  - C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1047-05 ..... Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - C1177-06 ..... Glass Mat Gypsum Substrate for Use as Sheathing
  - C1658-06 ..... Glass Mat Gypsum Panels
  - C1396-06 ..... Gypsum Board
  - E84-08..... Surface Burning Characteristics of Building Materials
- C. Underwriters Laboratories Inc. (UL):
  - Latest Edition ..... Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
  - Latest Editions..... Certification Listings

## **PART 2 – PRODUCTS**

### **2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Coreboard or Shaft Wall Liner Panels.
  - 1. ASTM C1396, Type X.
  - 2. ASTM C1658: Glass Mat Gypsum Panels,
  - 3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.
- D. Gypsum cores shall contain a minimum of 95 percent post-industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

### **2.2 ABUSE-RESISTANT GYPSUM BOARD**

- A. ASTM C 1629/C 1629M, Level 2 & Level 3.
- B. Basis of Design: USG Mold Tough VHI.
  - 1. Core: **5/8 inch**, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274
  - 4. Abuse Performance Levels:
    - a. Abrasion Resistance – Level 2
    - b. Indentation Resistance – Level 2
    - c. Soft Body Impact – Level 3
    - d. Hard Body Impact – Level 3.

### **2.3 GYPSUM SHEATHING BOARD**

- A. ASTM C1177, Type X.

### **2.4 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

### **2.5 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.

## **2.6 FINISHING MATERIALS AND LAMINATING ADHESIVE**

- A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

## **PART 3 – EXECUTION**

### **3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
  - 1. Two sides of partitions:
    - a. Fire rated partitions.
    - b. Smoke partitions.
    - c. Sound rated partitions.
    - d. Full height partitions shown (FHP).
    - e. Corridor partitions.
  - 2. One side of partitions or furring:
    - a. Inside of exterior wall furring or stud construction.
    - b. Room side of room without suspended ceilings.
    - c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
  - 3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
  - 1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
  - 2. At ceiling of suspended gypsum board ceilings.
  - 3. At existing ceilings.

### **3.2 INSTALLING GYPSUM BOARD**

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. 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.
  - 1. Coordinate installation with fire resistance installation for rated walls.
- 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 except gypsum board shall be applied vertically over "Z" furring channels.
  - 5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
  - 6. 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.
  - 8. Installing Two Layer Assembly Over Sound Deadening Board:
    - a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
    - b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
  - 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.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
  - 1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
  - 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
  - 3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes

protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

**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 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 CAVITY SHAFT WALL**

- A. Gypsum Board:
  1. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
  2. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.
- B. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

### **3.5 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
  - 1. Gypsum board is fastened and held close to framing or furring.
  - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- 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 smoke barrier, fire rated and sound rated and gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the // smoke barrier, // fire rated // and sound rated // construction/ Sanding is not required of non-decorated surfaces.

### **3.6 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non-decorated surface to provide smoke tight construction and STC equivalent to the sound rated construction .

### **3.7 INACCESSIBLE CEILINGS**

- A. At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

--- E N D ---

## SECTION 09 51 00 ACOUSTICAL CEILINGS

### PART 1- GENERAL

#### 1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

#### 1.2 SUBMITTAL

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified.
  - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

#### 1.3 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

#### 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-03 .....Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/A653M-07 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
  - C423-07 ..... Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C634-02 (E2007) ..... Standard Terminology Relating to Environmental Acoustics
  - C635-04 ..... Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
  - C636-06 ..... Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - E84-07 ..... Surface Burning Characteristics of Building Materials

E119-07.....	Fire Tests of Building Construction and Materials
E413-04.....	Classification for Rating Sound Insulation.
E580-06.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005).....	Classification for Acoustical Ceiling Products

## **PART 2- PRODUCTS**

### **2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, intermediate-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
    - c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
  - 3. Use aluminum suspension in kitchens.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units.

### **2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

### **2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

### **2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:



1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
2. Nailing type option for wood forms:
  - a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
  - b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
3. Flush ceiling insert type:
  - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
  - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
  - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:
  1. Galvanized steel.
  2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  3. Designed to rigidly secure framing members together.
  4. Designed to sustain twice the loads imposed by hangers or items supported.
- D. Tile Splines: ASTM C635.

## 2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

## 2.6 ADHESIVE

- A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.
- B. Developing minimum strength of 7 kg/m<sup>2</sup> (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

## 2.7 ACOUSTICAL UNITS

- A. General:
  1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
  2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.

3. Class A Flame Spread: ASTM 84
4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES. // Colored units integrally colored throughout.//
7. Lay-in panels: Sizes as shown, with tegular edges.
8. Adhesive applied tile: 12 by 12 inch size, having tegular edges.

## 2.9 ACCESS IDENTIFICATION

- A. Markers:
  1. Use colored markers with pressure sensitive adhesive on one side.
  2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:
 

Color.....	Service
Red.....	Sprinkler System: Valves and Controls
Green .....	Domestic Water: Valves and Controls
Yellow.....	Chilled Water and Heating Water
Orange .....	Ductwork: Fire Dampers
Blue .....	Ductwork: Dampers and Controls
Black .....	Gas: Laboratory, Medical, Air and Vacuum

## PART 3 EXECUTION

### 3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
  1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
  2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
  1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
  2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

### 3.2 CEILING SUSPENSION SYSTEM INSTALLATION

#### A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

#### B. Anchorage to Structure:

1. Steel:
  - a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
    - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
    - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
  - b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
  - c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

#### C. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

D. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:

1. Construct system in accordance with ASTM applicable to project seismic zone.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

### 3.3 ACOUSTICAL UNIT INSTALLATION

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Tile in concealed grid upward access suspension system:
  1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
  2. Make corners and arises full, and without worn or broken places.
  3. Locate acoustical units providing access as specified under Article, ACCESS.
- D. Adhesive applied tile:
  1. Condition of surface shall be in accordance with ASTM D1779, Note 1, Cleanliness of Surface, and Note 4, Rigidity of Base Surface.
  2. Size or seal surface as recommended by manufacturer of adhesive and allow to dry before installing units.
- E. Markers:
  1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  2. Attach colored markers to exposed grid on opposite sides of the units providing access.
  3. Attach marker on exposed ceiling surface of upward access acoustical unit.

### 3.4 CLEAN-UP AND COMPLETION

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

--- E N D ---



## **SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies the installation of vinyl or rubber base.

#### **1.2 RELATED WORK**

- A. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

#### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Base and stair material manufacturer's recommendations for adhesives.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Base: 150 mm (6 inches) long, each type and color.
  - 2. Adhesive: Literature indicating each type.

#### **1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

#### **1.5 STORAGE**

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - F1344-10 ..... Rubber Floor Tile
  - F1859-10 ..... Rubber Sheet Floor Covering without Backing
  - F1860-10 ..... Rubber Sheet Floor Covering with Backing
  - F1861-08 ..... Resilient Wall Base
- C. Federal Specifications (Fed. Spec.):
  - RR-T-650E ..... Treads, Metallic and Non-Metallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

Use only products by the same manufacturer and from the same production run.

### **2.2 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Thermoplastics, Group 2-layered. Style B-cove.
  - 1. Use pre-formed interior and exterior corners.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

### **2.3 SHEET RUBBER FLOORING**

- A. ASTM F1344, F1859 or F1860, 900 mm (36 inches) wide, 3 mm (1/8 inch) thick, smooth face, material.
- B. Use rubber flooring made with a minimum of 90% consumer rubber where possible.

### **2.4 PRIMER (FOR CONCRETE FLOORS)**

As recommended by the adhesive and tile manufacturer.

### **2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

Provide products with latex or polyvinyl acetate resins in the mix.

### **2.6 ADHESIVES**

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

## **PART 3 - EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

### **3.2 INSTALLATION REQUIREMENTS**

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

### **3.3 PREPARATION**

- A. Examine surfaces on which material is to be installed.

- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.

### **3.4 BASE INSTALLATION**

- A. Location:
  - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, furniture island cabinets and where other equipment occurs.
  - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
  - 1. Start with pre-formed interior and exterior corners.
  - 2. Apply adhesive uniformly with no bare spots.
  - 3. Set base with joints aligned and butted to touch for entire height.
  - 4. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
    - a. Short pieces to save material will not be permitted.
    - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Roll base for complete adhesion.

### **3.5 SHEET RUBBER INSTALLATION.**

- A. Prepare surfaces to receive sheet rubber in accordance with applicable portions of paragraph, preparation.
- B. Layout of Sheet Rubber:
  - 1. Use minimum number of joints compatible with material direction and symmetrical joint location.
- C. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Roll sheet rubber to assure adhesion.

### **3.6 CLEANING AND PROTECTION**

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
  - 1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.



- 2. Do not polish tread and sheet rubber materials.
- D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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**SECTION 09 65 16**  
**RESILIENT SHEET FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section specifies the installation of sheet flooring with backing and integral cove base.
- B. Grades of resilient sheet vinyl floor covering without backing having vinyl plastic wear layer with backing.
- C. Installation of sheet flooring including following:
  - 1. Heat welded seams.
  - 2. Integral cove base: Installed at intersection of floor and vertical surfaces where indicated and edge installation.

**1.2 RELATED WORK**

- A. Concrete floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Resilient base over base of lockers, equipment and casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- C. Unbacked vinyl (homogenous) sheet flooring with welded seams: Section 09 65 16, RESILIENT SHEET FLOORING.

**1.3 QUALITY CONTROL-QUALIFICATIONS:**

- A. The COR shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
  - 1. Heat welded seaming is manufacturer's prescribed method of installation.
  - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
  - 3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet the following physical and fire characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Infection Control Sheet Flooring containing Nano Silver and Nano Titanium Dioxide Technology
  - 2. Classification: 28 mill, Type I, Grade 1, embossed, TECH (Technologically Explored Ceramic Hard surface) commercial grade wear layer.
  - 3. Size: 6'6" x 66'
  - 4. Nominal Thickness: 0.079" (2mm)
  - 5. Backing: 2-ply coating technology PVC backing system with fiberglass inner layer.
  - 6. Test data:
    - a. Critical Radiant Flux (Flammability): Meets or exceeds ASTM D648-03, Class I

- b. Smoke Generation: ASTM-662-03 Passes Class 1.
  - c. Static Load Limit: ASTM F970, 800 lbs applied
  - d. Chemical Resistance: Complies with ASTM F925-02. Pass. No change
  - e. Slip Resistance James Test: ASTM2047-99 in compliance with ADA requirements. Dry >0.8, Wet >0.8
  - f. Wear Resistance: ASTM 3884-01 >100,000 cycles, 1,000 g. load, S-33 Taber Abrasion Test
  - g. Anti-Bacterial: Silver Knight Technology - ISO 277447 MRSA >99% Reduction, VRE >99% Reduction, ESDL >99% Reduction
  - h. Dimensional Stability: EN 434 <0.20%
  - i. Light Fastness: EN 20105 B02 - 6
  - j. 15 year limited commercial warranty
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

#### **1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
  - 1. Description of resilient material and accessories to be provided.
  - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Sheet material, (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod (12 inches) square for each type, pattern and color.
  - 2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
  - 3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
  - 4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
  - 5. Edge strips: 150 mm (6 inches) long each type.
  - 6. Adhesive, underlayment and primer: Pint container, each type.

#### **1.5 PROJECT CONDITIONS**

- A. Maintain temperature of floor materials and room, where work occurs, above 18 ° C (65 °F) and below 38 °C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 °C (55 °F).

- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.
- D. Verify floor is ready to receive flooring. Conduct testing per ASTM D4263 or ASTM F1869. Moisture content to meet flooring manufactures requirements.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.
- D. Store sheet flooring on end.
- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
  - E648-09..... Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.
  - E662-09..... Specific Optical Density of Smoke Generated by Solid Materials.
  - F710-08..... Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
  - F1303-04..... Sheet Vinyl Floor Covering with Backing.
  - F1869-04 ..... Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
  - F1913-04 ..... Sheet Vinyl Flooring without Backing
  - F2170-09 ..... Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
  - Recommended Work Practices for Removal of Resilient Floor Coverings.

## **1.8 SCHEDULING**

- A. Interior finish work such as plastering, drywall finishing, concrete, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

## **1.9 WARRANTY**

- A. Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include fifteen (15) years .

## **PART 2 – PRODUCTS**

### **2.1 SHEET VINYL FLOOR COVERINGS**

- A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam backed sheet flooring is not acceptable.
- B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).
- C. Each color and pattern of sheet flooring shall be of same production run.

### **2.2 WELDING ROD**

- A. Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

### **2.3 APPLICATION MATERIALS AND ACCESSORIES**

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.
- C. Base Accessories:
  - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
  - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.
  - 3. Other Accessories: Transition strips.

### **2.4 SHEET FLOORING**

- A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.
- B. Minimum nominal thickness 2 mm (0.08 inch); 1800 mm (6 ft) minimum width.
- C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke density: less than 450 per ASTM E662.
- E. Color and pattern of sheet flooring of the same production run.

## **2.5 ADHESIVES**

- A. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use.  
VOC not to exceed 50g/L

## **2.6 BASE CAP STRIP AND COVE STRIP**

- A. Extruded vinyl compatible with the sheet flooring.
- B. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring
- C. Cove strip 70 mm (2-3/4 inch) radius, in Acute In-Patient Unit Rooms & Seclusion room.

## **2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

## **2.8 PRIMER (FOR CONCRETE SUBFLOORS)**

- A. As recommended by the adhesive or sheet flooring manufacturer.

## **2.9 EDGE STRIPS**

- A. Extruded aluminum, mill finish, mechanically cleaned.
- B. 28 mm (1-1/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.
- C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between.

## **2.10 SEALANT**

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

## **PART 3 – EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 36 °C (65 °F.)
- D. Building is permanently enclosed.
- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.
- F. Flooring to be kept in heated space a minimum of 48 hours prior to installation.

### **3.2 SUBFLOOR PREPARATION**

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
  - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.

2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
  1. Do not use adhesive for filling or leveling purposes.
  2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
  1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3lb of water/1000 sq. ft.) in 24 hours.
  2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.

### **3.3 INSTALLATION OF FLOORING**

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

- G. Inform the Resident Engineer of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
  - 1. Air pockets or loose edges will not be accepted.
  - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
  - 1. Locate edge strips under center lines of doors unless otherwise indicated.
  - 2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.
- M. Integral Cove Base Installation:
  - 1. Set preformed fillet strip to receive base.
  - 2. Install the base with adhesive, terminate exposed edge with the cap strip.
  - 3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
  - 4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
  - 5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

### **3.4 INSTALLATION OF INTEGRAL COVED BASE**

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 4 inches high.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

### **3.5 WELDING**

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.



- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

### **3.6 CLEANING**

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- D. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

### **3.7 PROTECTION:**

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the installation of solid vinyl tile flooring, vinyl composition tile flooring, rubber tile flooring, and accessories.

**1.2 RELATED WORK**

- A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Description of each product.
  2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
  3. Application and installation instructions.
- C. Samples:
1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
  2. Edge Strips: 150 mm (6 inches) long, each type.
  3. Feature Strips: 150 mm (6 inches) long.
- D. Shop Drawings:
1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
  2. Edge strip locations showing types and detail cross sections.
- E. Test Reports:
1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
  2. Tested per ASTM F510.

**1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

**1.5 STORAGE**

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

## 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - D4078-02 (2008).....Water Emulsion Floor Finish
  - E648-10.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
  - E662-09.....Specific Optical Density of Smoke Generated by Solid Materials
  - E1155-96 (R2008) .....Determining Floor Flatness and Floor Levelness Numbers
  - F510-93 (R 2008).....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
  - F710-08.....Preparing Concrete Floors to Receive Resilient Flooring
  - F1066-04 (R2010).....Vinyl Composition Floor Tile
  - F1344-10.....Rubber Floor Tile
  - F1700-04 (R2010).....Solid Vinyl Floor Tile
- C. Resilient Floor Covering Institute (RFCI):
  - IP #2.....Installation Practice for Vinyl Composition Tile (VCT)
- D. Federal Specifications (Fed. Spec.):
  - SS-T-312.....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.
- D. Smoke density: Less than 450 per ASTM E662.

### 2.2 VINYL COMPOSITION TILE

- A. Class 2 (through pattern) 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout thickness.

### 2.3 SOLID VINYL-TILE

- A. ASTM F1700, 300 mm (12 by 12 inches) square, 3 mm (1/8 inch) thick, homogenous throughout.
- B. Color and Pattern uniformly distributed throughout thickness.
- C. Where solid vinyl tiles are specified, seek products with recycled content.

### 2.4 RUBBER TILE

- A. ASTM F1344, Class 1, homogenous rubber tile, B, through mottled, 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout tile.

- C. Molded pattern wearing surface base thickness 3 mm (1/8 inch) thick.
- D. Where rubber tile is used provide tiles with a minimum of 90% post consumer rubber.

## **2.5 ADHESIVES**

- A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.
- B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.
- C. Use Epoxy in areas with coved bases and edge strips.

## **2.6 PRIMER (FOR CONCRETE SUBFLOORS)**

As recommended by the adhesive and tile manufacturer.

## **2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

## **2.8 POLISH AND CLEANERS**

- A. Cleaners RFCI CL-1.
- B. Polish: ASTM D4078.

## **2.9 EDGE STRIPS**

- A. 28 mm (1-1/8 inch) wide unless shown otherwise.
- B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.
- C. Extruded aluminum, mill finish, mechanically cleaned:
  - 1. Drill and counter sink edge strip for flat head screws.
  - 2. Space holes near ends and approximately 225 mm (9 inches) on center between.
- D. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

## **2.10 SCREWS**

Stainless steel flat head screw.

## **2.11 FEATURE STRIPS**

- A. Use same material as floor tile.
- B. Sizes and shapes as shown.

## **PART 3 - EXECUTION**

### **3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

### 3.2 SUBFLOOR PREPARATION

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:  
FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints and other irregularities in concrete with leveling compound:
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.
- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- E. Concrete Subfloor Testing:  
Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.
- //H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. //

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
  - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
  - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
  - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
  - 1. Apply adhesive uniformly with no bare spots.
    - a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.

- b. More than 5 percent of the joints not touching will not be accepted.
- 2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
- 3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.
- F. Installation of Edge Strips:
  - 1. Locate edge strips under center line of doors unless otherwise shown.
  - 2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
  - 3. Where tile edge is exposed, butt edge strip to touch along tile edge.
  - 4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

### **3.4 CLEANING AND PROTECTION**

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean and polish materials in the following order:
  - 1. For the first two weeks sweep and damp mopped only.
  - 2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.
  - 3. Apply polish to the floors in accordance with the polish manufacturer's instructions.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.
- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

### **3.6 LOCATION**

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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**SECTION 09 65 66**  
**RESILIENT ATHLETIC FLOORING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Rubber sheet flooring in the Seclusion room.
- B. Related Sections:
  - 1. Section 096513, "Resilient Base and Accessories" for wall base and accessories installed with flooring.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show installation details and locations of the following:
  - 1. Seam locations for sheet flooring.
- D. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch- (150-mm-) square Samples of same thickness and material indicated for the Work.
- E. Qualification Data: For qualified sheet vinyl flooring Installer.
- F. Maintenance Data: For flooring to include in maintenance manuals.

**1.3 QUALITY ASSURANCE**

- A. Sheet Vinyl Flooring Installer Qualifications: An experienced Installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store rolls upright.

**1.5 FIELD CONDITIONS**

- A. Adhesively Applied Products:
  - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
  - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
  - 3. Close spaces to traffic during flooring installation.

4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
  - B. Do not apply flooring until space is enclosed and weatherproof; wet work in space is complete and dry; and all overhead work, including mechanical systems, lighting and athletic equipment is complete.
  - C. Install flooring after other finishing operations, including painting, have been completed.
- 1.6 COORDINATION**
- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.
- 1.7 EXTRA MATERIALS**
- A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of flooring installed.

## **PART 2 - PRODUCTS**

### **2.1 RUBBER SHEET FLOORING <Insert drawing designation>**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Amarco Products – CerraMarble sheet floor with coved base. Metal termination strip to be secured with epoxy:
- B. Description: Rubber athletic flooring provided as rolled goods for adhered installation.
- C. Material: Recycled-rubber compound, Rubber wear layer and rubber shock-absorbent layer, vulcanized together.
- D. Traffic-Surface Texture: Smooth.
- E. Roll Size: Not less than 48 inches wide by longest length that is practical to minimize splicing during installation.
- F. Thickness: 3/8 inch.
- G. Color and Pattern: As indicated on Finish Schedule and Finish Plan.
- H. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; and for use where flooring corners and edges do not abut vertical surfaces.
  1. Border Color and Pattern: Matching floor tile

### **2.2 ACCESSORIES**

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
  1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- C. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.
  - 1. VOC content: Provide products with VOC content not more than 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
  - 3. Moisture Testing:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
  - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

- G. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.3 FLOORING INSTALLATION, GENERAL**

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

### **3.4 SHEET FLOORING INSTALLATION**

- A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.
- B. Lay out sheet flooring as follows:
  - 1. Maintain uniformity of flooring direction.
  - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (150 mm) away from parallel joints in flooring substrates.
  - 3. Match edges of flooring for color shading at seams.
  - 4. Locate seams per final Shop Drawings.
- C. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
  - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- D. Vinyl Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
  - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.
  - 2. Chemically Bonded Seams: Comply with ASTM F 693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.

### **3.5 CLEANING AND PROTECTING**

- A. Perform the following operations immediately after completing flooring installation:
  - 1. Remove adhesive and other blemishes from flooring surfaces.
  - 2. Sweep and vacuum flooring thoroughly.
  - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

--- E N D ---

## **SECTION 09 68 00 CARPETING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

#### **1.2 RELATED WORK**

- A. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

#### **1.3 QUALITY ASSURANCE**

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
  - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
  - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
  - 1. Carpet: "Production Quality" samples 12 x 12 inches of carpets, showing quality, pattern and color specified in SCHEDULE FOR FINISHES.
  - 2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
  - 3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.
- D. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.
- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

#### **1.5 DELIVERY AND STORAGE**

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.

- C. Store in a clean, dry, well-ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

## **1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

## **1.7 WARRANTY**

- A. Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to 20 years.

## **1.8 APPLICABLE PUBLICATIONS**

- A. Publication listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  - ANSI/NSF 140-10 ..... Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):
  - AATCC 16-04..... Colorfastness to Light
  - AATCC 129-10..... Colorfastness to Ozone in the Atmosphere under High Humidities
  - AATCC 134-11 ..... Electric Static Propensity of Carpets
  - AATCC 165-08..... Colorfastness to Crocking: Textile Floor Conerings-AATCC Crockmeter Method
- D. American Society for Testing and Materials (ASTM):
  - ASTM D1335-05 ..... Tuft Bind of Pile Yarn Floor Coverings
  - ASTM D3278-96 (R2004) ..... Flash Point of Liquids by Small Scale Closed-Cup Apparatus
  - ASTM D5116-10 ..... Determinations of Organic Emissions from Indoor Materials/Products
  - ASTM D5252-05 ..... Operation of the Hexapod Tumble Drum Tester
  - ASTM D5417-05 ..... Operation of the Vettermann Drum Tester
  - ASTM E648-10..... Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E. The Carpet and Rug Institute (CRI):
  - CRI 104-11..... Installation of Commercial Carpet

## **PART 2 – PRODUCTS**

### **2.1 CARPET**

- A. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
2. Manufacturers standard construction commercial carpet:
  - a. Broadloom; maximum width to minimum use
  - b. Modular Tile: 660 mm (24 inches) square tile.
3. Provide static control to permanently control static build upto less than 2.1 kV when tested at 20 +/- 2 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134-06.
4. Pile Height: Maximum 3/32" low-5/32" High
5. Pile Fiber: Nylon with recycled content 25 percent minimum (federally registered trademark) Type 6 fiber, 100% recyclable and must be considered unbranded. Cradle to Cradle Certification required.
6. Lifetime stain warranty must be provided by the same manufacturer of the carpet.
7. Dye method must be 100% Solution Dyed Nylon
8. Minimum of 24 dpf ensuring strength of fiber  
Manufacturer must provide an interactive on-line training course.
9. Pile Type: Multi Level Loop.
10. Backing materials: Manufacturer's unitary backing designed for glue-down installation using recovered materials. Antifungal and Antibacterial ASTM E 2471 Standard Test Method for Use of Seeded Agar for Screening Assessment of Antimicrobial Activity in Carpet. Minimum allowable growth ratings for a "passing result" on washed and unwashed carpet samples after 72 hours incubation are complete to partial inhibition (high) on shaven primary and unshaven fiber layers. Or, if AATCC 174 Parts 2&3 (AATCC 171 Washed) is used, must pass both Part 2 and Part 3 of AATCC 174 with a minimum of 90% reduction both gram negative and gram positive bacteria and no macroscopic growth.
11. Secondary backing must contain 40% recycled content and 100% recyclable. 100 percent Virgin PCV shall not be used in secondary backing and must be a PVC Free product.
12. Tiles must be mergable. No dye lot restrictions for current or future orders.
13. Appearance Retention Rating (ARR): Carpet shall be tested and have the minimum 3.5-4.0 Severe ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
14. Tuft Bind: Minimum force of 40 N (10 lb) required to pull a tuft or loop free from carpet backing. Test per ASTM D1335.
15. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.

16. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
17. Delamination Strength: Minimum of 440 N/m (2.5 lb/inch) between secondary backing.
18. Flammability and Critical Radiant Flux Requirements:
  - a. Test Carpet in accordance with ASTM E 648-08.
  - b. Class I: Not less than 0.45 watts per square centimeter.
  - c. Class II: Not less than 0.22 watts per square centimeter.
  - d. Carpet in corridors, exits and Medical Facilities: Class I.
19. Density: Average Pile Yarn Density (APYD):
  - a. Corridors, lobbies, entrances, common areas or multipurpose rooms, open offices, waiting areas and dining areas: Minimum APYD 6000.
  - b. Other areas: Minimum APYD 4000.
20. VOC Limits: Use carpet and carpet adhesive that comply with the following limits for VOC content when tested according to ASTM D 5116:
  - a. Carpet, Total VOCs: 0.5 mg/sq.m x hr.
  - b. Carpet, 4-PC (4-Phenylcyclohexene): 0.05 mg/sq.m x hr.
  - c. Carpet, Formaldehyde: 0.05 mg/sq.m x hr.
  - d. Carpet, Styrene: 0.4 mg/sq.m x hr.
  - e. Adhesive, Total VOCs: 10.00 mg/sq.m x hr.
  - f. Adhesive, Formaldehyde: 0.05 mg/sq.m x hr.
  - g. Adhesive, 2-Ethyl-1-Hexanol: 3.00 mg/sq.m x hr.
- B. Shall meet platinum level of ANSI/NSF 140.
- C. Color, Texture, and Pattern: SCHEDULE FOR FINISHES.

## **2.2 ADHESIVE AND CONCRETE PRIMER**

- A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining.

## **2.3 SEAMING TAPE**

- A. Permanently resistant to carpet cleaning solutions, steam, and water.
- B. Recommended by carpet manufacturer.

## **2.4 EDGE STRIPS (MOLDING)**

- A. Metal:
  1. Hammered surface aluminum, pinless, clamp down type designed for the carpet being installed.
  2. Floor flange not less than 38 mm (1-1/2 inches) wide, face not less than 16 mm (5/8 inch) wide.

3. Finish: Clear anodic coating unless specified installed with epoxy-
- B. Vinyl Edge Strip:
  1. Beveled floor flange minimum 50 mm (2 inches) wide.
  2. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
  3. Color as specified in SCHEDULE FOR FINISHES.
- C. Carpet Base Top Edge Strip:
  1. Vinyl "J" strip wall flange minimum of 38 mm (1-1/2 inches) wide with cap beveled from wall to finish flush with carpet being installed.
  2. Color as specified in SCHEDULE FOR FINISHES.

## **2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected.

## **PART 3 – EXECUTION**

### **3.1 SURFACE PREPARATION**

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents.
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
  1. Do not use adhesive for filling or leveling purposes.
  2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

### **3.2 CARPET INSTALLATION**

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 direct glue down installation.
  1. Relax carpet in accordance with Section 6.4.
  2. Comply with indoor air quality recommendations noted in Section 6.5.
  3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.



- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
  - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
  - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.
- G. Broadloom Carpet:
  - 1. Install per CRI 104, Section 8.
  - 2. Lay broadloom carpet lengthwise in longest dimension of space, with minimum seams, uniformly spaced to provide a tight smooth finish, free from movement when subjected to traffic.
  - 3. Use tape-seaming method to join sheet carpet edges. Do not leave visible seams.
- H. Carpet Modules:
  - 1. Install per CRI 104, Section 13, Adhesive Application.
  - 2. Lay carpet modules with pile in same direction unless specified otherwise in SCHEDULE FOR FINISHES.
  - 3. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
  - 4. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

### **3.3 EDGE STRIPS INSTALLATION**

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.
- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.
- D. Carpet Base Top Edge Strip Installation:
  - 1. Place carpet molding at top edge of carpet where turned up as base.
  - 2. Install molding in accordance with manufacturer's instructions.

### **3.4 PROTECTION AND CLEANING**

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

- - - E N D - - -

**SECTION 09 76 50**  
**QUARTZ WALL FINISHES – THIN SET**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Quartz interior wall finishes.
  - 2. Quartz interior floor finishes at showers and waiting room.
  - 3. Setting materials and accessories.
- B. Related Sections:
  - 1. Division 1: Administrative, procedural, and temporary work requirements.
  - 2. Section 061663- Cementitious Sheathing.
  - 3. Section 092900 - Gypsum board..

**1.2 REFERENCES**

- 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 National Standards Institute (ANSI):
  - A108.4..... Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
  - A108.5..... Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar
  - A108.10..... Installation of Grout in Tilework
  - A118.3..... Chemical Resistant, Water Cleanable, Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
  - A118.4..... Latex-Portland Cement Mortar
  - A118.6..... Ceramic Tile Grouts
- C. ASTM International (ASTM):
  - C97..... Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
  - C99..... Standard Test Method for Modulus of Rupture of Dimension Stone
  - C170..... Standard Test Method for Compressive Strength of Dimension Stone
  - C241..... Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
  - C482..... Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement

C484.....	Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile
C531.....	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
C648.....	Standard Test Method for Breaking Strength of Ceramic Tile
C650.....	Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
C672/C672M .....	Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
C880.....	Standard Test Method for Flexural Strength of Dimension Stone
C1026.....	Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
C1028.....	Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
E84 .....	Standard Test Method for Surface Burning Characteristics of Building Materials

### **1.3 SUBMITTALS**

#### **A. Samples:**

1. 3 x 3 inch quartz samples showing available colors.
2. 3/8 x 3/8 x 3 inch grout samples showing available colors.
3. 3 inch long joint sealer samples showing available colors.

#### **B. Closeout Submittals:**

1. Maintenance Data: Include recommended cleaning materials and procedures, and list of materials detrimental to quartz.

### **1.4 QUALITY ASSURANCE**

#### **A. Fabricator and Installer Qualifications: Minimum 2 years documented experience in work of this Section.**

#### **B. Mockup:**

1. Construct wall finish mockup, 3 feet wide x 3 feet high.
2. Verify with owner if full shower mock-up preferred.
3. Locate where directed.
4. Approved mockup may remain as part of the Work.

### **1.5 WARRANTY**

#### **A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.**

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURERS**

A. Basis of Design: Products by Cosentino USA, Inc.

### **2.2 MATERIALS - QUARTZ**

A. Quartz Sheet:

1. Product: Silestone or equal.
2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs.
3. Anti-microbial protection: Microban® by Microban® International, Inc., integral to sheet.
4. Color: To be selected from manufacturer's full color range.
5. Physical characteristics:
  - a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
  - b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
  - c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.
  - d. Bond strength: Minimum 210 psi, tested to ASTM C482.
  - e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
  - f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
  - g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
  - h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
  - i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
  - j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
  - k. Thermal expansion:  $1.670 \times 10^{-5}$  in/in/deg F, tested to ASTM C531.
  - l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
  - m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
  - n. Flame spread rating: Class 1, tested to ASTM E84.

### **2.3 MATERIALS - MORTAR**

A. Latex-Portland Cement Mortar: ANSI A118.

B. Epoxy Mortar: ANSI A118.3.

### **2.4 MATERIALS - GROUT**

A. Grout:

1. ANSI A118.6, unsanded.
2. Color: To be selected from manufacturer's full color range.

### **2.5 ACCESSORIES**

A. Joint Sealer:

1. Latisil Tile and Stone Sealant by Laticrete® International, Inc.
2. Color: To be selected from manufacturer's full color range.

## **2.6 FABRICATION**

- A. Cut panels accurately to required shapes and dimensions.
- B. Fabricate with 3/8 inch joints.
- C. Cut flooring to fit at perimeter and around penetrations with maximum 1/4 inch gaps.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Clean surfaces to receive panels; remove loose and foreign matter than could interfere with adhesion.
- B. Remove ridges and projections. Fill voids and depressions with patching compound compatible with setting materials.
- C. Allowable Substrate Tolerances:
  - 1. Maximum variation in substrate surface: 1/8 inch in 8 feet.
  - 2. Maximum height of abrupt irregularities: 1/32 inch.

### **3.2 INSTALLATION**

- A. Install panels in accordance with manufacturer's instructions.
- B. Set in thin set mortar bed in accordance with ANSI A 108.5. Epoxy mortar by spot application method in accordance with ANSI A108.4.
- C. Install with hairline joints.
- D. Allow mortar to set for a minimum of 24 hours.
- E. Grout joints in accordance with ANSI A108.10; finish smooth and flush.
- F. Option: Apply joint sealer to joints; finish smooth and flush.
- G. Provide control joints at changes in plane, changes in backup material, at joints between panels and adjacent construction, over joints in substrate, and at maximum per manufacturer. Fill with joint sealer; finish flush and smooth.

### **3.3 INSTALLATION TOLERANCES**

- A. Maximum variation from level and plumb: 1/4 inch in 10 feet, noncumulative.
- B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.
- C. Maximum variation in joint width: Plus or minus 1/16 inch.

### **3.4 CLEANING**

- A. Clean panels in accordance with manufacturer's instructions.

--- E N D ---

## **SECTION 09 91 00 PAINTING**

### **PART 1-GENERAL**

#### **1.1 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

#### **1.2 RELATED WORK**

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, , Division 12 - FURNISHINGS, , , Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY sections.
- B. Contractor option: Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.

#### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
  - 3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
  - 4. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.

- b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - c. Product type and color.
  - d. Name of project.
- 5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- D. Sample of identity markers if used.
- E. Manufacturers' Certificates indicating compliance with specified requirements:
  - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
  - 2. High temperature aluminum paint.
  - 3. Epoxy coating.
  - 4. Intumescent clear coating or fire retardant paint.
  - 5. Plastic floor coating.

#### **1.4 DELIVERY AND STORAGE**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.
  - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
  - 1. Federal Specification Number, where applicable, and name of material.
  - 2. Surface upon which material is to be applied.
  - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

#### **1.5 MOCK-UP PANEL**

- A. Before starting application of water paint mixtures, / cementitious paint, apply paint as specified to an area, not to exceed 100 ft<sup>2</sup>, selected by VA COR.
- B. Finish and texture approved by VA COR will be used as a standard of quality for remainder of work.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):

- ACGIH TLV-BKLT-2008.....Threshold Limit Values (TLV) for Chemical Substances and  
Physical Agents and Biological Exposure Indices (BEIs)
- ACGIH TLV-DOC-2008.....Documentation of Threshold Limit Values and Biological Exposure  
Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
- A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
- D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
- A-A-1555 .....Water Paint, Powder (Cementitious, White and Colors) (WPC)  
(cancelled)
- A-A-3120 .....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):
- TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete  
and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
- No. 1-07 .....Aluminum Paint (AP)
- No. 4-07 .....Interior/ Exterior Latex Block Filler
- No. 5-07 .....Exterior Alkyd Wood Primer
- No. 7-07 .....Exterior Oil Wood Primer
- No. 8-07 .....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
- No. 9-07 .....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
- No. 10-07 .....Exterior Latex, Flat (AE)
- No. 11-07 .....Exterior Latex, Semi-Gloss (AE)
- No. 18-07 .....Organic Zinc Rich Primer
- No. 22-07 .....Aluminum Paint, High Heat (up to 590° - 1100°F) (HR)
- No. 26-07 .....Cementitious Galvanized Metal Primer
- No. 27-07 .....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
- No. 31-07 .....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 36-07 .....Knot Sealer
- No. 43-07 .....Interior Satin Latex, MPI Gloss Level 4
- No. 44-07 .....Interior Low Sheen Latex, MPI Gloss Level 2
- No. 45-07 .....Interior Primer Sealer
- No. 46-07 .....Interior Enamel Undercoat
- No. 47-07 .....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
- No. 48-07 .....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
- No. 49-07 .....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)



- No. 50-07 ..... Interior Latex Primer Sealer
- No. 51-07 ..... Interior Alkyd, Eggshell, MPI Gloss Level 3
- No. 52-07 ..... Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-07 ..... Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-07 ..... Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
- No. 59-07 ..... Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE)
- No. 60-07 ..... Interior/Exterior Latex Porch & Floor Paint, Low Gloss
- No. 66-07 ..... Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC)
- No. 67-07 ..... Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR)
- No. 68-07 ..... Interior/ Exterior Latex Porch & Floor Paint, Gloss
- No. 71-07 ..... Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-07 ..... Interior Alkyd Varnish, Semi-Gloss
- No. 77-07 ..... Epoxy Cold Cured, Gloss (EC)
- No. 79-07 ..... Marine Alkyd Metal Primer
- No. 90-07 ..... Interior Wood Stain, Semi-Transparent (WS)
- No. 91-07 ..... Wood Filler Paste
- No. 94-07 ..... Exterior Alkyd, Semi-Gloss (EO)
- No. 95-07 ..... Fast Drying Metal Primer
- No. 98-07 ..... High Build Epoxy Coating
- No. 101-07 ..... Epoxy Anti-Corrosive Metal Primer
- No. 108-07 ..... High Build Epoxy Coating, Low Gloss (EC)
- No. 114-07 ..... Interior Latex, Gloss (LE) and (LG)
- No. 119-07 ..... Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-07 ..... Non-Cementitious Galvanized Primer
- No. 138-07 ..... Interior High Performance Latex, MPI Gloss Level 2 (LF)
- No. 139-07 ..... Interior High Performance Latex, MPI Gloss Level 3 (LL)
- No. 140-07 ..... Interior High Performance Latex, MPI Gloss Level 4
- No. 141-07 ..... Interior High Performance Latex (SG) MPI Gloss Level 5
- H. Steel Structures Painting Council (SSPC):
- SSPC SP 1-04 (R2004) ..... Solvent Cleaning
- SSPC SP 2-04 (R2004) ..... Hand Tool Cleaning
- SSPC SP 3-04 (R2004) ..... Power Tool Cleaning

## PART 2 - PRODUCTS

### 2.1 MATERIALS

S-W EXTERIOR LATEX WOOD PRIMER, B42W8041 **MPI 39**

S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series **MPI 134**

ProMar 200 Zero VOC Primer (B30W2600), 0 g/l, **MPI- 50X**

S-W A-100 Exterior Latex Satin, A82 Series **MPI 15**

S-W Pro Industrial Zero VOC Semi-Gloss Acrylic B66W651 Series MPI 141  
 ProMar 200 Zero VOC eggshell (B20-2600 Series), 0g/l, **MPI-52X**  
 ProIndustrial Zero VOC Waterborne Catalyzed Epoxy B73-300 Semi-Gloss MPI 115

## 2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

## 2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Lead-Base Paint:
    - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
    - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
    - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
  - 3. Asbestos: Materials shall not contain asbestos.
  - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 6. Use high performance acrylic paints in place of alkyd paints, where possible.
  - 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

## PART 3 - EXECUTION

### 3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

**B. Atmospheric and Surface Conditions:**

1. Do not apply coating when air or substrate conditions are:
  - a. Less than 3 degrees C (5 degrees F) above dew point.
  - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
  - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
  - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
6. Varnishing:
  - a. Apply in clean areas and in still air.
  - b. Before varnishing vacuum and dust area.
  - c. Immediately before varnishing wipe down surfaces with a tack rag.

**3.2 SURFACE PREPARATION**

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
  1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
  3. See other sections of specifications for specified surface conditions and prime coat.
  4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Wood:
  1. Sand to a smooth even surface and then dust off.
  2. Sand surfaces showing raised grain smooth between each coat.
  3. Wipe surface with a tack rag prior to applying finish.
  4. Surface painted with an opaque finish:
    - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.

- b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
- 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
- 6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
- 7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
  - a. Thin filler in accordance with manufacturer's instructions for application.
  - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- D. Ferrous Metals:
  - 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
  - 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
  - 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
    - a. This includes flat head countersunk screws used for permanent anchors.
    - b. Do not fill screws of item intended for removal such as glazing beads.
  - 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  - 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- E. // Zinc-Coated (Galvanized) Metal, // Aluminum, // Copper and Copper Alloys // Surfaces Specified Painted:
  - 1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
  - 2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.
- F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
  2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
  3. Remove loose mortar in masonry work.
  4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING // Section 04 05 16, MASONRY GROUTING//. Do not fill weep holes. Finish to match adjacent surfaces.
  5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals.
  6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.
- G. Gypsum Plaster and Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
  2. Remove dust, dirt, and other deterrents to paint adhesion.
  3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

### 3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

### 3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- I. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

### 3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Wood:
  - 1. Use same kind of primer specified for exposed face surface.
    - a. Exterior wood: S-W Exterior Latex Wood Primer, B42W8041 MPI 39
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series MPI 134
- G. Gypsum Board:
  - 1. PRIMER: PROMAR 200 ZERO VOC PRIMER (B30W2600), 0 G/L, MPI- 50X

### 3.6 EXTERIOR FINISHES

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## B. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
2. Portion of sash runs of double hung wood windows, concealed by sash when in a closed position: Apply two coats of ASTM D260 mixed with not more than 0.12L (1/4 pint) of dryer per 3.89L (gallon).
3. Two coats of S-W A-100 Exterior Latex Satin, A82 Series MPI 15

## C. Steel and Ferrous Metal, // Including Tern //:

1. Two coats of S-W Pro Industrial Zero VOC Semi-Gloss Acrylic B66W651 Series MPI 1412.

## 1. General:

- a. Where specified in Section 09 06 00, SCHEDULE FOR FINISHES or shown.
- b. Mix as specified in manufacturer's printed directions.
- c. Do not mix more paint at one time than can be used within four hours after mixing. Discard paint that has started to set.
- d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
- e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
2. Use two coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious (CEP)), unless specified otherwise.

**3.7 INTERIOR FINISHES**

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in drawings (RE:Finish schedule).

## B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
  - b. Two coats of S-W Pro Industrial Zero VOC Semi-Gloss Acrylic B66W651 Series MPI 141

## C. Gypsum Board: Satin Finish

1. One coat of ProMar 200 Zero VOC Primer (B30W2600), 0 g/l, **MPI- 50X**
2. Two coats of ProMar 200 Zero VOC eggshell (B20-2600 Series), 0g/l, **MPI-52X**

## D. Gypsum Board High Performance:

1. One coat ProMar 200 Zero VOC Primer (B30W2600), 0 g/l, **MPI- 50X**
2. Two coats ProIndustrial Zero VOC Waterborne Catalyzed Epoxy B73-300 Semi-Gloss MPI 115

**3.14 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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## **SECTION 10 21 23 CUBICLE CURTAIN TRACKS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies cubicle curtain track (C.C.T.).

#### **1.2 RELATED WORK**

Steel shapes for suspending track assembly: Section 05 50 00, METAL FABRICATIONS and  
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. Samples:
  - 1. One 12 inch long piece of cubicle curtain track with carrier access and end stop.
  - 2. One curtain carrier.
  - 3. Specified fabric 12 inch by 12 inch square.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
  - Cubicle curtain track.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.
- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  - B456-03(R2009) .....Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series .....Metal Finishes Manual

### **PART 2 - PRODUCTS**

#### **2.1 CUBICLE CURTAIN TRACKS**

- A. Surface mounted

1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
  2. Provide anti-ligative design.
- B. Curtain Carriers: Provide break-away anti-ligature designs. Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (onefoot) of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- D. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.
- E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.
- F. Fabric:
1. Abaco, color Sand, by the Cubicle Curtain Factory for non-shower areas.
  2. Shower Curtains: Safeguard, color Dune by Cubicle Curtain Factoryl.

## 2.2 FASTENERS

- A. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).
- B. Metal Clips: Anchor curtain tracks to gypsum board ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

## 2.3 FINISHES

- A. Chrome/Nickel Plating: Satin finish as specified, ASTM B546, minimum thickness of chromium plate as follows:
1. 0.4 mil on steel.

## 2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4800 mm (16 feet) without joints. Form corner bend on a 300 mm (12 inch) radius.
- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.

- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and hangers plumb and securely anchor to the ceiling gypsum board.
- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.
- D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.
- E. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- F. Remove damaged or defective components and replace with new components or repair to the original condition.

#### **3.2 ACCEPTANCE**

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

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## SECTION 10 26 00 WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

This section specifies wall guards (crash rails or bumper guards), handrail/wall guard combinations, corner guards and door/door frame protectors // and high impact wall covering //.

#### 1.2 RELATED WORK

- A. Structural steel corner guards: Section 05 50 00, METAL FABRICATIONS.
- B. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.
- C.

#### 1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Handrail/Wall Guard Combinations – acute care area only.
  - 2. Wall Guards.
  - 3. Corner Guards.
  - 4. Door/Door Frame Protectors.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

#### 1.4 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A167-99(R2009) .....Stainless and Heat-Resisting Chromium-Nickel Steel Plate,  
Sheet, and Strip
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire,  
Shapes, and Tubes
  - D256-06 ..... Impact Resistance of Plastics

- D635-06 .....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- E84-09.....Surface Burning Characteristics of Building Materials
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06 .....Metal Finishes Manual
- D. National Fire Protection Association (NFPA):
- 80-10 .....Standard for Fire Doors and Windows
- E. Society of American Automotive Engineers (SAE):
- J 1545-05 .....Instrumental Color Difference Measurement for Exterior Finishes.
- F. Underwriters Laboratories Inc. (UL):
- Annual Issue .....Building Materials Directory

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Resilient Material:
1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
    - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
    - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
    - c. Rated self extinguishing when tested in accordance with ASTM D635.
    - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
    - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
    - f. Same finish on exposed surfaces.

### **2.2 CORNER GUARDS**

- A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 30 mm (1-1/4 inch radius).
1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Design retainer used for flush mounted type to act as a stop for adjacent wall finish material. Provide appropriate mounting hardware, cushions and base plates as required.
  2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
  3. Flush mounted corner guards installed on any fire rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.

- a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
- b. All exposed metal in fire rated assemblies shall have a paintable finish.

## **2.5 FASTENERS AND ANCHORS**

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.
- C. Provide 18 gage sheet metal backing where wall guards are to be installed.

## **2.6 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum:
  - 1. Exposed aluminum: AAC22A31 chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mil thick.
  - 2. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Stainless Steel: NAAMM finish Number 4.
- D. Resilient Material: Embossed texture and color in accordance with SAE J 1545. Submit manufacture color options..

## **PART 3 - INSTALLATION**

### **3.1 RESILIENT CORNER GUARDS**

Install corner guards as shown on plans on walls in accordance with manufacturer's instructions.

### **3.2 STAINLESS STEEL CORNER GUARDS**

- A. Mount guards on external corners of interior walls, partitions and columns as shown.
- B. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, // anchor corner guards as shown on drawings. // Provide continuous 16 gage perforated, galvanized Z-shape steel anchors welded to back edges of corner guards and // wired to metal studs // expansion bolted to concrete or masonry with four 9.5 mm (3/8-inch) diameter bolts, spaced 400 mm (16 inches) on centers // Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards shall overlap finish plaster surfaces.
  - 1. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

### **3.3 RESILIENT HANDRAIL WALL GUARD COMBINATIONS AND RESILIENT WALL GUARDS (CRASH RAIL) //**

Secure guards to walls with // mounting cushions // brackets // and fasteners in accordance with manufacturer's details and instructions.

**3.4 DOOR, DOOR FRAME PROTECTION AND HIGH IMPACT WALL COVERING**

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturers specific instructions.
- C. Apply with adhesive in controlled environment according to manufacture's recommendations.
- D. Protection installed on fire rated doors and frames shall be installed according to NFPA 80 and installation procedures listed in UL Building Materials Directory; or, equal listing by other approved independent testing laboratory establishing the procedures.

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**SECTION 10 28 00  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Toilet tissue dispenser.
  - 2. Grab Bars
  - 3. Shower curtain rods
  - 4. Clothes hooks, robe or coat.
  - 5. Towel bars.
  - 6. Metal framed mirror
  - 7. Mop racks.
- B. This section also specifies custom fabricated items used in toilets and related spaces.

**1.2 RELATED WORK**

- A. Custom fabricated accessories: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.
- B. Shower curtain break away pendant chain hooks: Section 10 21 23, CUBICLES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified.
  - 2. Metal framed mirrors.
  - 3. Shower Curtain rods, showing required length for each location.
  - 4. Grab bars, showing design and each different type of anchorage.
  - 5. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.
- C. Samples:
  - 1. One of each type of accessory specified.
  - 2. After approval, samples may be used in the work.
- D. Manufacturer's Literature and Data:
  - 1. All accessories specified.
  - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
  - 3. Show working operations of spindle for toilet tissue dispensers.



4. Mop racks.
- E. Manufacturer's Certificates:
  1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, PhisoHex and solutions containing hexachlorophene.
  2. Anodized finish as specified.

#### **1.4 QUALITY ASSURANCE**

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

#### **1.5 PACKAGING AND DELIVERY**

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages or containers; labeled for identification with manufacturer's name, brand, and contents.

#### **1.6 STORAGE**

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 

A167-99(R2009) .....	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
A176-99(R2009) .....	Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
A269-10.....	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A312/A312M-09 .....	Seamless and Welded Austenitic Stainless Steel Pipes
A653/A653M-10 .....	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
B221-08.....	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

- B456-03(R2009) ..... Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C1036-06 ..... Flat Glass
- C1048-04 ..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
- D635-10 ..... Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position
- F446-85(R2009)..... Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
- D3453-07 ..... Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications
- D3690-02(R2009) ..... Vinyl-Coated and Urethane-Coated Upholstery Fabrics
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series ..... Metal Finishes Manual
- D. American Welding Society (AWS):
  - D10.4-86 (R2000) ..... Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
  - A-A-3002 ..... Mirrors, Glass
  - FF-S-107C (2) ..... Screw, Tapping and Drive
  - FF-S-107C ..... Screw, Tapping and Drive.
  - WW-P-541E(1)..... Plumbing Fixtures (Accessories, Land Use) Detail Specification

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
  - 1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
  - 2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass:
  - 1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
  - 2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.

3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

- G. Foam Rubber: ASTM D3453, Grade BD, Type 2.
- H. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.
- I. Plywood: PS1, Grade CD.

## **2.2 FASTENERS**

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
  1. ASME B18.6.4.
  2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be joined.
- H. In all rooms, provide 18 gage backing for all accessories.

## **2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  1. AA-C22A41// Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32 Mechanical finish, medium satin. //
  1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  2. Stainless Steel: NAAMM AMP 503, finish number 4.
  3. Ferrous Metal:
    - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
    - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.
  4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

## **2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.

- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents.  
Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

## **2.5 FLUSH COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS**

- A. Recessed type
  - B. Dispensing capacity for minimum 400 sheets of any type of folded paper toweling.
- C. Fabricate of stainless steel.
- D. Form face frames, from one piece.
- E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.
- F. Provide removable waste receptacle approximately 24 liter (6.3 gallon) capacity,

## **2.6 WASTE RECEPTACLES**

- A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.
- B. Fabricate of stainless steel.
- C. Form face frame from one piece.
- D. Provide removable waste receptacle of approximately (12 gallon) capacity, fabricated of stainless steel.
- E. Waste receptacle key locked in place.

## **2.7 TOILET TISSUE DISPENSERS**

- A. Double roll surface mounted type Or recessed as required
- B. Mount on continuous backplate.
- C. Removable spindle ABS plastic or chrome plated plastic.
- D. Wood rollers are not acceptable.

## **2.8 ANTILIGATURE TOILET TISSUE DISPENSERS**

- A. Single roll surface mounted type.
- B. Concealed mounting.
- C. ½" x 4.5" long stainless steel rod with pivot joint
- D. Rod releases when excessive load is applied.

## **2.9 SANITARY NAPKIN DISPOSALS**

- A. Surface Mounted type

- B. Cover is drawn one-piece construction secured with full-length stainless steel piano hinge.
- C. Minimum 3.8 L (1.0 Gal.) capacity
- D. Recessed type in Mental Health and Behavioral Nursing Units:

## 2.10 GRAB BARS

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor, swing up and on metal // toilet // dressing // shower // partitions.
- D. Bars:
  - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
    - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
    - b. Nylon coated bars, minimum 1.5 mm (0.0598 inch) thick.
  - 2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
  - 3. Continuous weld intermediate support to the grab bar.
  - 4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.
- E. Flange for Concealed Mounting:
  - 1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
  - 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. Flange for Exposed Mounting:
  - 1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
  - 2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
  - 3. Where mounted on metal partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.
  - 4. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, not more than 5 mm (3/8 inch) from edge of flange.
- G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.

H. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on metal partitions.

- I. Antiligature shelf welded to bottom of grab bar to prevent items from being tied around bar (Refer to drawings for location).

## **2.11 SHOWER CURTAIN RODS**

- A. Stainless steel tubing, ASTM A569, minimum 1.27 mm (0.050 inch) wall thickness, 32 mm (1 1/4 inch) outside diameter.
- B. Flanges, stainless steel rings, 66 mm (2 5/8 inch) minimum outside diameter, with 2 holes opposite each other for 6 mm (1/4 inch) stainless steel fastening bolts. Provide a set screw within the curvature of each flange for securing the rod.
- C. Intermediate support for rods over 1800 mm (six feet) long. Provide adjustable ceiling flanges with set screws, tubular hangers and stirrups.
- D. Shower curtain rods:
  1. Option: Ceiling mounted hospital cubicle curtain tracks as specified in Section 10 21 23, CUBICLES, with break away pendant chain hooks.

## **2.12 CLOTHES HOOKS-ROBE OR COAT**

- A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.
- C. Clothes hooks in acute/in-patient areas trips down upon excessive force being applied.

## **2.13 TOWEL BARS**

- A. Fed. Spec. WW-P-541/8B, Type IV, Bar, Surface mounted; Class 1, towel.
- B. Either stainless steel, or chromium plated copper alloy.
- C. Bar Length: 450 and 600 mm (18 and 24 inches) as shown.
- D. Finish of brackets or supports same as bar.

## **2.14 METAL FRAMED MIRRORS**

- A. Fed. Spec. A-A-3002 metal frame; chromium finished steel, anodized aluminum or stainless steel, type 302 or 304.
- B. Mirror Glass:
  1. Minimum 6 mm (1/4 inch) thick.
  2. Set mirror in a protective vinyl glazing tape.

3. Use bright polished stainless steel for mirrors in acute care bathrooms, areas.

C. Frames:

1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide.  
Fabricate with square corners.
2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:
  - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
  - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
4. Attached Shelf for Mirrors (RRTP only):
  - a. Fabricate shelf of the same material and finish as the mirror frame.
  - b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
  - c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
  - d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member.  
Form stainless steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

## 2.15 MOP RACKS

- A. Minimum 1.0M (40 inches) long with five holders.

B. Clamps:

1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

C. Support:

1. Minimum of 1 mm (0.0375 inch) thick painted steel hat shape channel to hold clamps away from wall as shown.

- 2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.
- D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.
- E. Finish on stainless Steel: AMP 503-No. 4.

## **2.16 UNDER COUNTER PROTECTIVE ENCLOSURE**

- A. Basis of design: Truebro (IPS)
- B. Coordinate size and profile design as required for each condition.
- C. Submit manufacturer standard colors for COR selection.

## **2.17 PRODUCTS-GENERAL**

- A. Owner is providing:
  - 1. Soap Dispensers – RRTP side.
  - 2. Paper Towel Dispensers – RRTP side.
  - 3. Plastic Waste Paper Baskets.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Resident Engineer the exact location of accessories.

### **3.2 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. // Expansion bolt to concrete or solid masonry. //
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.
- I. Install wall mirrors in acute/inpatient areas with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.



**3.3 SCHEDULE OF ACCESSORIES****3.4 CLEANING**

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

--- E N D ---

## **SECTION 10 44 13 FIRE EXTINGUISHER CABINETS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section covers recessed fire extinguisher cabinets.

#### **1.2 RELATED WORK**

- A. Acrylic glazing: Section 08 80 00, GLAZING.
- B. Field Painting: Section 09 91 00, PAINTING.

#### **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

#### **1.4 APPLICATION PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):  
D4802-10 ..... Poly (Methyl Methacrylate) Acrylic Plastic Sheet

### **PART 2 - PRODUCTS**

#### **2.1 FIRE EXTINGUISHER CABINET**

Recessed type with flat trim of size and design shown. Cabinet located in fire-rated wall to be one-hour construction.

#### **2.2 FABRICATION**

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
  - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish1.
  - 2. Design doors to open 180 degrees.
  - 3. Provide continuous hinge, pull handle, and adjustable roller catch.
  - 4. Provide anti-ligature designed cabinet for locations within acute/inpatient areas.

#### **2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

### **PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

---END---

**SECTION 12 21 13**  
**HORIZONTAL BLINDS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Horizontal blinds with aluminum slats.
- B. Related Sections include the following:
  - 1. Section 06 10 00, ROUGH CARPENTRY, for wood blocking and grounds for mounting horizontal louver blinds and accessories.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds and blind operators.
- C. Samples for Verification: For each type and color of horizontal louver blind indicated.
  - 1. Slats: Not less than 12 inches (300 mm) long.
  - 2. Tapes: Full width, not less than 6 inches (150 mm) long.
  - 3. Horizontal Louver Blind: Full-size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
  - 4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.
  - 5. Cornice: Full-size unit, not less than 12 inches (300 mm) wide.
- D. Window Treatment Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.
- E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

**1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Flame-Resistance Ratings: Passes NFPA 701.
- C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.
- D. Mockups: Build mockups as part of the window assembly (integral blind condition) to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Blind will be installed into the window by the window manufacture.

#### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### **PART 2 - PRODUCTS**

#### **2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS**

- A. Basis of Design: Subject to compliance with requirements, the following manufactures are acceptable or equal:
  1. Hunter Douglas.
  2. Levolor, a Newell Rubbermaid Company.
  3. WACI.
- B. Products: Subject to compliance with requirements for each condition as follows:
  1. Integral blind between insulated glazing unit (exterior) and interior glazing pane. Coordinate as required with aluminum window manufacture.
  2. Standard mounting on interior of aluminum window frame.
  3. Provide manual operation for all blinds.
  4. Provide anti-ligature manual operator at acute/inpatient areas.
- C. Tilt-Control: Right and left side of Vertical Rail respectively unless otherwise indicated.
- D. Colors, Textures, Patterns, and Gloss: [As selected by Architect from manufacturer's full range.]

### **PART 3 - EXECUTION**

#### **3.1 ADJUSTING**

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

#### **3.2 CLEANING AND PROTECTION**

- A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

### **3.3 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

- - -E N D - - -

**SECTION 12 21 13**  
**HORIZONTAL BLINDS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Horizontal blinds with aluminum slats.
- B. Related Sections include the following:
  - 1. Section 06 10 00, ROUGH CARPENTRY, for blocking and grounds for mounting horizontal louver blinds and accessories.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds and blind operators.
- C. Samples for Verification: For each type and color of horizontal louver blind indicated.
  - 1. Slat: Not less than 12 inches (300 mm) long.
  - 2. Tapes: Full width, not less than 6 inches (150 mm) long.
  - 3. Horizontal Louver Blind: Full-size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
  - 4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.
  - 5. Cornice: Full-size unit, not less than 12 inches (300 mm) wide.
  - 6. Color selection chart, for color selection by COR.
- D. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

**1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Flame-Resistance Ratings: Passes NFPA 701.
- C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.
- D. Mockups: Build mockups as part of the window assembly testing in Section 04 20 00 (integral blind condition) to verify selections made

under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Blind will be installed into the window by the window manufacture.

#### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### **PART 2 - PRODUCTS**

#### **2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS**

- A. Basis of Design: Subject to compliance with requirements, the following manufactures are acceptable or equal:
  1. Hunter Douglas.
  2. Levolor, a Newell Rubbermaid Company.
  3. WACI.
- B. Products: Subject to compliance with requirements for each condition as follows:
  1. Integral blind between insulated glazing unit (exterior) and interior glazing pane. Coordinate as required with aluminum window manufacture.
  2. Standard mounting on interior of aluminum window frame.
  3. Provide manual operation for all blinds.
  4. Provide anti-ligature manual operator at acute/inpatient areas.
- C. Tilt-Control: Right and left side of Vertical Rail respectively unless otherwise indicated.
- D. As selected by COR from manufacturer's full range.



**PART 3 - EXECUTION**

**3.1 ADJUSTING**

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

**3.2 CLEANING AND PROTECTION**

- A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by COR, before time of Substantial Completion.

**3.3 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

- - -E N D - - -

## **SECTION 12 24 00 WINDOW SHADES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

Cloth shades and // horizontal // venetian blinds are specified in this section. Window shades shall be furnished complete, including brackets, fittings and hardware.

#### **1.2 RELATED WORK**

- A. Color of shade cloth and color of venetian blinds:

#### **1.3 QUALITY CONTROL**

Manufacturer's Qualification: Venetian blind manufacturer shall provide evidence that the manufacture of blinds are a major product, and that the blinds have performed satisfactorily on similar installations.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
1. Shade cloth, each type, 600 mm (24 inch) square, including cord and ring, showing color, finish and texture.
  2. Venetian blind slats, 300 mm (12 inches) long, including cord and tape, showing color and finish.
- C. Manufacturer's literature and data; showing details of construction and hardware for:
- Cloth and window shades
- Venetian blinds

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- AA-V-00200B ..... Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories
- C. American Society for Testing and Materials (ASTM):
- A167-99(R2009) ..... Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- B221/B221M-08 ..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- D635-10 ..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- D648-07 ..... Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D1784-08 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated  
Poly (Vinyl Chloride) (CPVC) Compounds

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Shade Cloth: // translucent // opaque.//
- B. Staples (For Cloth Window Shades): Nonferrous metal or zinc-coated steel.
- C. Stainless Steel: ASTM A167
- D. Cords for Venetian Blinds: No. 4 braided nylon or No. 4-1/2 braided cotton having not less than 175 pounds breaking strength.
- E. Extruded Aluminum: ASTM B221/B221M.

### **2.2 VENETIAN BLINDS**

Fed. Spec. AA-V-00200, // Type I, 50 mm (two inch slat) // Type II, 25 mm (one inch slats) // fabricated of aluminum. Pre-production sample is not required.

### **2.3 VENETIAN BLINDS AND SHADES ENCLOSED IN WINDOWS**

Shades or blinds inside of windows panes shall be used at Mental Health and Behavioral Nursing Units. There shall be no cords or ropes attached and curtains shall not be used. Hardware should be flush with the walls so that it can't be used to secure a nose. Hardware should also be tamper proof to prevent removal for use as a weapon or for self harm.

### **2.4 FASTENINGS**

Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

<b>Type of Fastening</b>	<b>Structural Material</b>
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw	Sheet Metal
Screw or bolt in expansion shields	Solid masonry
Toggle bolts	Hollow blocks, wallboard and plaster

### **2.5 FABRICATION**

- A. Fabricate // cloth shades // venetian blinds to fit measurements of finished openings obtained at site.
- B. Cloth Window Shades: Rolling type, constructed of shade cloth mounted on rollers. Shade cloth shall have plain sides, and with hem at bottom to accommodate wood slat. Separate shades are

required for each individual sash within opening. Length of shades shall exceed height of window approximately 300 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:

1. Provide rollers with spindles, nylon bearings, tempered steel springs, and all other related accessories required for positive action. Provide rollers of diameter recommended by shade manufacturer. Staple shade cloth to wood rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade will hang plumb. Space staples not over 90 mm (3-1/2 inches) on centers. Use of tacks is prohibited.
  2. Wood slats shall be smooth, tapered, and inserted in the bottom hem of the shade cloth.
  3. Eyelets shall have clear openings large enough to accommodate cords. Edges of eyelets shall not cut into cloth when set.
  4. Cords shall be of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.
- C. Venetian Blinds: Venetian blinds shall have // 25 mm (one inch) // 50 mm (two inch) // width horizontal slats positioned within ladder tapes. Multiple blinds in openings are to be of same type and divided at mullions.
1. Head-rails shall fully enclose operating mechanism on three sides and ends.
  2. Bottom rails shall be fully enclosed to prevent contact of tapes and sill at underside.
- //3. In lobbies, bottom rails and head boxes shall be aluminum. //
4. Finish concealed metal work of head-rails including concealed mechanism, with one shop coat of paint. Do not paint parts that have non-rusting finish, or parts where motion of friction occurs.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Cloth Window Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions. // In existing buildings, provide brackets similar to those on existing windows.//
1. Locate rollers in level position as high as practicable at heads of windows to prevent infiltration of light over rollers.
  2. Where extension brackets are necessary, on mullions or elsewhere, for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
  3. Place brackets and rollers so that shades will not interfere with window and screen hardware.
  4. // Mount shades at wire mesh window guards on head rails of hinged frame. //
  5. // Mount shades at detention, or protection screens on head rail (room side) of hinged frame, with face brackets located approximately 38 mm (1-1/2 inches) from outside edges. //

6. Shade installation methods not specifically described, are subject to approval of Resident Engineer.
- B. Venetian Blinds: Support blinds in level position by brackets and intermediate supports that will permit easy removal and replacement of units without damage to blind, or adjacent surfaces. Provide at least two fasteners for each bracket or other support.
  1. Install blinds between jambs on window openings with steel trim. Mount brackets on trim reveal, flush with face of trim and secure with steel screws.
  2. Install blinds between jambs on window openings with wood trim. Mount brackets on trim or on wood plaster-mold set against plaster or other wall finish, and secure in place with screws.
  3. Mount brackets and intermediate supports of lobby blinds on face of trim members, and secure with stainless steel standard tap or thread-forming machine screws, or by cadmium-plated molley or toggle bolts. Screws and bolts shall penetrate through and lock behind steel sub-frame.
  4. Where blinds abut glass partitions of Vestibules, extend head rails to trim at head of partition frame with slats sufficiently long to clear transom bars.
  5. Provide one brush (for each 1 to 50 blind) of an approved type, suitable for cleaning blinds.

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**SECTION 123661**  
**SIMULATED STONE COUNTERTOPS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Quartz agglomerate countertops and backsplashes.
- B. Related Sections:
  - 1. Section 224000, "Plumbing Fixtures" for sinks and plumbing fittings.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For countertop materials and sinks. – Include manufacturer's specifications for materials, finishes, construction details, and recommendations for maintenance.
- C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and show locations and sizes of cutouts for plumbing fixtures accessories and other items installed in countertops.
- D. Warranty: Sample of warranty.
  - 1. Provide manufacturer's written warranty covering materials and installation (workmanship) stating obligations, remedies, limitations and exclusions.
- E. Samples for Verification: For the following products:
  - 1. Countertop material, 6 inches square, for each color.

**1.3 PROJECT CONDITIONS**

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed and before countertop fabrication has begun. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- B. Environmental Limitations: Do not deliver or install countertops until building is enclosed and wet work is complete.

**1.4 COORDINATION**

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes. Also coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation.

**PART 2 - PRODUCTS**

**2.1 QUARTZ AGGLOMERATE COUNTERTOPS**

- A. Configuration: Provide countertops with the following front and backsplash style:
  - 1. Front: 3/4" thick quartz agglomerate with anti-microbial protection: - integral to sheet - 1-1/2-inch laminated bullnose

2. Backsplash: Straight, slightly eased at corner 3/4-inch thick, quartz agglomerate with eased edge.
3. End splash: Matching backsplash
- B. Backsplashes: Straight, slightly eased at corner 3/4-inch thick, quartz agglomerate with eased edge, 4 inches in height.
- C. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  1. Fabricate with loose backsplashes for field assembly.
  2. Accurately cut holes and drill countertops to received plumbing, fixtures, soap dispensers and other accessories. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.

## **2.2 COUNTERTOP MATERIALS**

- A. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
  1. Recycled Content: pre-consumer or post-consumer recycled content.
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Adhesives: Use adhesives that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- D. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1. In addition material should include anti-microbial protection: - integral to sheet
  1. Manufacturers: Subject to compliance with requirements of contract documents as judged by architect, provided by manufacturer listed or equal:
    - a. Cosentino USA.
  2. Colors and Patterns:
    - a. For acute care showers, Silestone, Blanco City.
    - b. For countertops, Silestone, Toffee.
    - c. Grout to be selected from manufacturer's full range of colors.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install fabrications in accordance with manufacturer's instructions and approved shop drawings.
- B. Adhere fabrications with continuous beads of adhesive.
- C. Set plumb and level. Align adjacent pieces in same plane.
- D. Install backsplashes and end splashes to comply with manufactures written instructions for adhesives, sealers, fabrication and finishing.

### **3.2      INSTALLATION TOLERANCES**

- A.    Install countertops level to a tolerance of 1/8 inch in 8 feet.
- B.    Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

### **3.3      CLEANING**

- A.    Clean fabrication in accordance with manufacturer's instructions.

### **3.4      PROTECTION**

- A.    Protect installed fabrication with non-staining sheet coverings.

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**SECTION 12 48 13**  
**ENTRANCE FLOOR MATS AND FRAMES**

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

- A. This section includes the following:
  - 1. Entrance mats in recessed frames.
- B. Related sections include the following:
  - 1. Section 03 30 00, CAST-IN-PLACE CONCRETE, for slab depression for recessed mats and frames.

**1.2 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show the following:
  - 1. Items penetrating floor mats and frames, including the following:
    - a. Door control devices.
  - 2. Perimeter floor moldings.
- C. Samples for Verification: For each type of product indicated.
  - 1. Tread Rail: 12-inch- (300-mm-) long Sample of each type and color.
  - 2. Frame Members: 12-inch- (300-mm-) long anodized clear aluminum.
- D. Maintenance Data: For floor mats and frames to include in maintenance manuals.

**1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

**1.4 PROJECT CONDITIONS**

- A. Field Measurements: Indicate measurements on Shop Drawings that have been verified from field measurements.

**1.5 COORDINATION**

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

**PART 2 - PRODUCTS**

**2.1 RECESSED FLOOR MATS**

- A. Recessed Floor Mats: Waterhog Premier Floor Mat Tiles.
  - 1. Depth: 7/16 inches.
  - 2. Size: 18 inches by 18 inches square.
  - 3. Color: Khaki.

4. Mat Size: As indicated. Coordinate with placement of concrete floor slab.
- B. Recessed Frames:
  1. Anodized aluminum clear finish.
- C. Structural Performance: Provide floor mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
  1. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m).

## **2.2 CONCRETE FILL AND GROUT MATERIALS**

- A. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

## **2.3 FABRICATION**

- A. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
  1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- B. Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

## **2.4. ALUMINUM FINISHES**

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install recessed mats to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
  1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
  2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

- B. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.
  - 1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer

### **3.3 PROTECTION**

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion

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**SECTION 21 13 13**  
**WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation for all portions of the Building.

**1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 33 10 00, WATER UTILITIES.
- C. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
- D. Section 09 91 00, PAINTING.
- E. Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS, Dry sprinklers, fire pumps, etc.
- F. Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.
- F. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.
- G. Section 21 05 11 COMMON WORK RESULTS FOR FIRE SUPPRESSION

**1.3 QUALITY ASSURANCE**

- A. Installer Reliability: The installer shall possess a valid State of Wyoming fire sprinkler license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:
  - 1. Qualifications:

- a. Provide a copy of the installing contractors fire sprinkler contractors license.
  - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.
3. Manufacturers Data Sheets:
  - a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
  - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.
5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals shall include, but not be limited to, the following:
  - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
  - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
  - c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
  - d. Certificates shall document all parts of the installation.
  - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.

1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
  - a. Light Hazard Occupancies: Patient care, treatment, and customary access areas.
  - b. Ordinary Hazard Group 1 Occupancies: Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets.
  - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, pharmacy and associated storage, laundry, kitchens, kitchen storage areas, retail stores, retail store storage rooms, storage areas, building management storage, boiler plants, energy centers, warehouse spaces, file storage areas for the entire area of the space up to 140 square meters (1500 square feet) and Supply Processing and Distribution (SPD).
  - d. Request clarification from the Government for any hazard classification not identified.
3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
4. Water Supply: Base water supply on a flow test of:
  - a. Location:               Flow Hydrant – South East of Building 1-A  
                                   Test Hydrant – East of Building 45
  - b. Static pressure:           110 psi
  - b. Residual pressure:       102 psi
  - d. Flow:                       1,465 gallons per minute
  - e. Date: February 9, 2012 Time 13:27 hours
5. Zoning:
  - a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.
  - b. Sprinkler zones shall conform to the smoke barrier zones shown on the drawings.

#### **1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):

- 13-2007 ..... Installation of Sprinkler Systems
- 101-2009 ..... Safety to Life from Fire in Buildings and Structures (Life Safety Code)

- C. Underwriters Laboratories, Inc. (UL):  
Fire Protection Equipment Directory – 2012
- D. Factory Mutual Engineering Corporation (FM):  
Approval Guide – Latest Online Edition
- E. Foundation for Cross-Connection Control and Hydraulic Research-2005

## **PART 2 PRODUCTS**

### **2.1 PIPING & FITTINGS**

- A. Sprinkler systems in accordance with NFPA 13.

### **2.2 VALVES**

- A. Valves in accordance with NFPA 13.
- B. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.
- C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).
- D. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

### **2.3 FIRE DEPARTMENT SIAMESE CONNECTION**

- A. Brass, exterior fire department connection with brass escutcheon plate, and a minimum of two 65 mm (2-1/2 inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler". Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

### **2.4 SPRINKLERS**

- A. All sprinklers except "institutional" type sprinklers shall be FM approved. "Institutional" type sprinklers in Mental Health and Behavior Units shall be UL listed or FM approved quick response type. Maximum break away strength shall be certified by the manufacturer to be no more than 39 kPa (85 pounds). Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.

### **2.5 SPRINKLER CABINET**

Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

## **2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS**

Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

## **2.7 SWITCHES:**

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

## **2.8 GAUGES**

Provide gauges as required by NFPA 13.

## **2.9 PIPE HANGERS AND SUPPORTS**

Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

## **2.10 WALL, FLOOR AND CEILING PLATES**

Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250



mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.

- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.
- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- I. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- J. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.
- K. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- M. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- N. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.
- O. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve in occupied spaces. Request in writing at least one week prior to the planned interruption.

### 3.2 INSPECTION AND TEST

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Technical Representative (COTR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COTR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

### 3.3 INSTRUCTIONS

Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.

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## SECTION 31 08 00

### COMMISSIONING OF SITE UTILITY SYSTEMS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 31.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

##### 1.2 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

##### 1.3 SUMMARY

- A. This Section includes requirements for commissioning the site utility systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

SPEC WRITER NOTE: Paragraph C is for LEED projects. Delete paragraph or subparagraphs as necessary for specific projects.

- ~~C. The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEED™ rating program and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the VA.~~
  - ~~1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" 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. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

##### 1.4 DEFINITIONS

- A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

## 1.5 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in this Division 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.

SPEC WRITER NOTE: Paragraph B should list the specific systems that will be commissioned. Edit the list as necessary for specific projects. The list below should match the list included in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. It is recommended that the list included in Section 01 91 00 be developed first and then copied/pasted into the list below. Both lists should be identical to prevent confusion.

- B. The following Site Utility systems will be commissioned:

- ~~1. Sanitary Sewage Lift Stations (Lift station sump or tank level controls, pump alternator, alarms and alarm panel, pumps and motors).~~
- ~~2. Steam Condensate Pump Stations (Condensate receivers and transfer pumps, motors, controls, pump alternator, alarms and instrumentation, and safeties).~~
- ~~3. Storm Drainage Pump Systems (Sump level controls, pump alternator, alarms and alarm panel, pumps and motors).~~

## 1.6 SUBMITTALS

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the ~~Resident Engineer~~COR prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the

Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

### **3.2 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 31 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the ~~Resident Engineer~~COR. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

### **3.4 TRAINING OF VA PERSONNEL**

- A. Training of the VA operation and maintenance personnel is required in cooperation with the ~~Resident Engineer~~COR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the ~~Resident Engineer~~COR after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 31 Sections for additional Contractor training requirements.

----- END -----

**SECTION 31 20 00  
EARTH MOVING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK:**

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
  2. Excavation.
  3. Underpinning.
  4. Filling and backfilling.
  5. Grading.
  6. Soil Disposal.
  7. Clean Up.

**1.2 DEFINITIONS:**

- A. Unsuitable Materials:
1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D 1557.
  2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
  3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from reference borings and design requirements, excavate to acceptable strata subject to COR's approval.
- B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.
- C. Trench Earthwork: Trenchwork required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through

use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.

- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the COR based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.
- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- R. Contaminated soils: Soil that contains contaminants as defined and determined by the COR or the Government's testing agency.

### **1.3 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. and Section 32 90 00, PLANTING.
- F. Site preparation: Section 02 41 00, DEMOLITION.
- H. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

#### **1.4 CLASSIFICATION OF EXCAVATION:**

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

#### **1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Rock Excavation Report:
  - 1. Certification of rock quantities excavated.
  - 2. Excavation method.
  - 3. Labor.
  - 4. Equipment.
  - 5. Land Surveyor's or Civil Engineer's name and official registration stamp.
  - 6. Plot plan showing elevation.
- C. Furnish to COR:
  - 1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
  - 2. Soil samples.
    - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
    - b. Laboratory compaction curve in accordance with ASTM D 1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
    - c. Test reports for compliance with ASTM D 2940 requirements for subbase material.
    - d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
    - e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.



**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T99-01(2004) .....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
  - T180-01(2004) .....Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
  - D448-03a .....Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  - D698-00ae1 .....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft<sup>3</sup> (600 kN m/m<sup>3</sup>))
  - D1556-00 .....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
  - D1557-02e1 .....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2700 kN m/m<sup>3</sup>))
  - D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
  - D2487-06 .....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
  - D2922-05 .....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  - D2940-03 .....Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D. Society of Automotive Engineers (SAE):
  - J732-92 .....Specification Definitions - Loaders
  - J1179-02 .....Hydraulic Excavator and Backhoe Digging Forces

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

SPEC WRITER NOTE: Make material requirements agree with applicable requirements specified in the referenced Applicable Publications. Update and specify only that which applies to the project.

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.

- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m<sup>3</sup> (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75- $\mu$ m (No. 200) sieve, per ASTM D2940;.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75- $\mu$ m (No. 200) sieve.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- F. Granular Fill:
  - 1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4), per ASTM D 2940.
  - 2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D 2940.

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION:**

SPEC WRITER NOTE: Make the following sections match the areas shown on the drawings. Note any visible areas of trash debris, previously dumped or stored materials to be removed in accordance with these sections on the drawings. NOTE do not estimate quantity or volume of materials to be removed if being handled as part of the lump sum price for the work.

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by COR. Remove materials from Medical Center . Box, and otherwise

protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.

- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by COR. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m<sup>3</sup> (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
  - 1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
  - 2. Locations of existing and proposed elevations indicated on plans are approximate from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Contractor is responsible to notify COR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COR of any differences between existing or constructed grades, as compared to those shown on the plans.
  - 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

4. Finish grading is specified in Section 32 90 00, PLANTING.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

### **3.2 EXCAVATION:**

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the COR, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.
  1. Design of the temporary support of excavation system is the responsibility of the Contractor.
  2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the COR.
  3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
  4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall underpin the existing foundation, per Section 3.3 under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COR.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from COR.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the COR.
- E. Proofrolling:
  1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
  2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proofrolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.

## F. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft materials to a solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.
6. Slope grades to direct water away from excavations and to prevent ponding.

## G. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
  - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
  - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
  - c. Support piping on undisturbed earth unless a mechanical support is shown.
  - d. Length of open trench in advance of piping laying shall not be greater than is authorized by COR.
2. Sanitary and storm sewer trenches:
  - a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
  - b. Bed bottom quadrant of pipe on undisturbed soil or granular fill.
    - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
    - 2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
  - c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
  - d. Use granular fill for bedding where rock or rocky materials are excavated.

SPEC WRITER NOTE: See Landscape Architectural Division for elevation of subgrade.

SPEC WRITER NOTE: Modify the following section to clarify whether the determination of unsuitable material is to be by the COR or the Geotechnical Engineer from the VA Testing Laboratory. Coordinate the determination with the work to be performed by the Testing Laboratory

as specified in Section 01 45 29, TESTING  
LABORATORY SERVICES.

- H. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
  - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
  - 2) Walks: Plus or minus 25 mm (1 inch).
  - 3) Pavements: Plus or minus 13 mm (1 inch).
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

**3.4 FILLING AND BACKFILLING:**

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced,

waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by COR.

- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of COR. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:
  - 1. Fills, Embankments, and Backfill
    - a. Under proposed structures, building slabs, and steps, over excavate and recompact top 900 mm (36 inches) of existing subgrade. Compact each layer of backfill or fill material in accordance with ASTM D698 to 95 percent.
    - b. Curbs, curbs and gutters, and paved areas scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698 to 95 percent/.
    - c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698/ to 95 percent.
    - d. Landscaped areas, top 400 mm (16 inches), ASTM D698 to 85 percent.
    - e. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D698 to 90 percent.
    - a.
    - b.

### **3.5 GRADING:**

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to COR at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

### **3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- C. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- D. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- E. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

### **3.7 CLEAN UP:**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center.

----- E N D -----



**SECTION 32 05 23**  
**CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:
- B. Curb, gutter, and combination curb and gutter.
- C. Pedestrian Pavement: Walks, wheelchair curb ramps and steps.
- E. Equipment Pads: transformers.

**1.2 RELATED WORK**

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 00, EARTH MOVING.
- C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.
- D. Metal Components of Steps (Nosing and Railing): Section 05 50 00, METAL FABRICATIONS.

**1.3 DESIGN REQUIREMENTS**

Design all elements with the latest published version of applicable codes.

**1.4 WEATHER LIMITATIONS**

Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN-PLACE CONCRETE.

**1.6 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
  - 1. Expansion joint filler
  - 2. Hot poured sealing compound
  - 3. Reinforcement
  - 4. Curing materials
- C. Data and Test Reports: Select subbase material.
  - 1. Job-mix formula.

2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

D. Sample Panels

1. Colored concrete with mix design.

## 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. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- M031MM031-07-UL ..... Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement (ASTM A615/A615M-09)
- M147-65-UL ..... Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 2004)
- M148-05-UL ..... Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309)
- M171-05-UL ..... Sheet Materials for Curing Concrete (ASTM C171)
- M182-05-UL ..... Burlap Cloth Made from Jute or Kenaf and Cotton Mats
- M213-01-UL ..... Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)
- T099-09-UL ..... Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
- T180-09-UL ..... Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- C. American Society for Testing and Materials (ASTM):
- C94/C94M-09 ..... Ready-Mixed Concrete
- C143/C143M-09 ..... Slump of Hydraulic Cement Concrete

## PART 2 - PRODUCTS

### 2.1 GENERAL

Concrete shall be Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with the following exceptions:

<u>TYPE</u>	<u>MAXIMUM SLUMP*</u>
Curb & Gutter	75 mm (3")

Pedestrian Pavement	75 mm (3")
Vehicular Pavement	50 mm (2") (Machine Finished) 100 mm (4") (Hand Finished)
Equipment Pad	75 to 100 mm (3" to 4")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

## 2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- C. Dowels shall be plain steel bars conforming to AASHTO M31. Tie bars shall be deformed steel bars conforming to AASHTO M31.

## 2.4 FORMS

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.
- B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

## 2.5 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
  - 1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
  - 2. Impervious Sheeting conforming to AASHTO M171.
  - 3. Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 2 and shall be free of paraffin or petroleum.

## 2.6 EXPANSION JOINT FILLERS

Material shall conform to AASHTO M213.

## 2.7 COLORED CONCRETE

- A. Pedestrian pavement designed to be colored shall have the coloring introduced into the concrete mix at the batch plant. Introduce sufficient quantities of mineral oxide pigment to produce the color specified on the plans. Prior to starting work, submit a sample of the colored concrete with type of coloring additive and the amount of additive per m<sup>3</sup> (cubic yard) of concrete mix to the COR for approval.
- B. Batch plant will make certain that the color and mixtures used do not produce a concrete having less than the desired air content specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

## **PART 3 - EXECUTION**

### **3.1 SUBGRADE PENETRATION**

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

### **3.3 SETTING FORMS**

- A. Base Support:
  - 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
  - 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
  - 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
  - 2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
  - 3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
  - 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
  - 5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.
  - 1. Make necessary corrections to forms immediately before placing concrete.
  - 2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

### **3.4 EQUIPMENT**

- A. The COR shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

### **3.5 PLACING REINFORCEMENT**

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the COR shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

### **3.6 PLACING CONCRETE - GENERAL**

- A. Obtain approval of the COR before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the COR before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

### **3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS**

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

### **3.9 CONCRETE FINISHING - GENERAL**

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
  - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
  - 2. Maintain finishing equipment and tools in a clean and approved condition.

### 3.10 CONCRETE FINISHING CURB AND GUTTER

- A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 6mm (1/4 inch) or as otherwise detailed.
- B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
- C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
- D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.
- E. Except at grade changes or curves, finished surfaces shall not vary more than 3 mm (1/8 inch) for gutter and 6 mm (1/4 inch) for top and face of curb, when tested with a 3000 mm (10 foot) straightedge.
- F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
- G. Correct any depressions which will not drain.
- H. Visible surfaces and edges of finished curb, gutter, and combination curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

### 3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

- A. Walks, Wheelchair Curb Ramps:
  - 1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
  - 2. Brooming shall be transverse to the line of traffic.
  - 3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
  - 4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
  - 5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.
  - 6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
  - 7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
- B. Steps: The method of finishing the steps and the sidewalls is similar to above except as herein noted.
  - 1. Remove the riser forms one at a time, starting with the top riser.

2. After removing the riser form, rub the face of the riser with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Use an outside edger to round the corner of the tread; use an inside edger to finish the corner at the bottom of the riser.
3. Give the risers and sidewall a final brush finish. The treads shall have a final finish with a stiff brush to provide a non-slip surface.
4. The texture of the completed steps shall present a neat and uniform appearance and shall not deviate from a straightedge test more than 5 mm (3/16 inch).

### **3.13 CONCRETE FINISHING EQUIPMENT PADS**

- A. After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.
- B. Carefully finish all slab edges with an edger having a radius as shown in the Drawings.
- C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 3 mm (1/8 inch) when tested with a 3000 mm (10 foot) straightedge.
- D. Correct irregularities exceeding the above.

### **3.14 JOINTS - GENERAL**

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.

### **3.15 CONTRACTION JOINTS**

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.
- B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb and gutter.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

### **3.16 EXPANSION JOINTS**

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.

- E. Form expansion joints as follows:
  1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
  2. Using joint filler of the type, thickness, and width as shown.
  3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

### **3.17 CONSTRUCTION JOINTS**

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.
- B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- C. Use a butt-type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.
- D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

### **3.18 FORM REMOVAL**

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

### **3.20 CURING OF CONCRETE**

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the COR.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.
- D. Liquid Membrane Curing:



1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 m<sup>2</sup>/L (200 square feet per gallon) for both coats.
2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

### **3.21 CLEANING**

#### **A. After completion of the curing period:**

1. Remove the curing material (other than liquid membrane).
2. Sweep the concrete clean.
3. After removal of all foreign matter from the joints, seal joints as herein specified.
4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

### **3.22 PROTECTION**

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the COR, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the COR.

### **3.23 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.

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## **SECTION 32 12 16 ASPHALT PAVING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

#### **1.2 RELATED WORK**

- A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTH MOVING.
- C. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

#### **1.3 INSPECTION OF PLANT AND EQUIPMENT**

The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

#### **1.4 ALIGNMENT AND GRADE CONTROL**

The Contractor's Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
  - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
  - 2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
  - 3. Job-mix formula.
- C. Certifications:
  - 1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
  - 2. Asphalt cement certificate of conformance to State Highway Department requirements.

- 3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.
- D. One copy of State Highway Department Specifications.
- E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA COR or VA Contracting Officer.

### **2.2 AGGREGATES**

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").
- C. Base aggregate maximum size:
  - 1. Base course over 152mm(6") thick: 38mm(1-1/2");
  - 2. Other base courses: 19mm(3/4").
- D. Asphaltic base course:
  - 1. Maximum particle size not to exceed 25.4mm(1").
  - 2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.
- E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

<u>Sieve Sizes</u>	<u>Percentage Passing</u>
19mm(3/4")	100
9.5mm(3/8")	67 to 85
6.4mm(1/4")	50 to 65
2.4mm(No. 8 mesh)	37 to 50
600µm(No. 30 mesh)	15 to 25
75µm(No. 200 mesh)	3 to 8

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

### **2.3 ASPHALTS**

- A. Comply with provisions of Asphalt Institute Specification SS2:

1. Asphalt cement: Penetration grade 50/60
2. Prime coat: Cut-back type, grade MC-250
3. Tack coat: Uniformly emulsified, grade SS-1H

## **2.4 SEALER**

- A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.
- B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

### **3.2 MIXING ASPHALTIC CONCRETE MATERIALS**

- A. Provide hot plant-mixed asphaltic concrete paving materials.
  1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
  2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

### **3.3 SUBGRADE**

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA COR or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

### **3.4 BASE COURSES**

- A. Subbase (when required)
  1. Spread and compact to the thickness shown on the drawings.
  2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
  3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

**B. Base**

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

**3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING**

A. Remove all loose materials from the compacted base.

B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C(280 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
  - a. No depressions which will retain standing water.
  - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

**3.6 APPLICATION OF SEAL COAT**

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

B. Apply one coat of the specified sealer.

- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

### **3.7 PROTECTION**

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

### **3.8 FINAL CLEAN-UP**

Remove all debris, rubbish, and excess material from the work area.

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## **SECTION 32 17 23 PAVEMENT MARKINGS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This work shall consist of furnishing and applying paint on pavement surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings, in accordance with the details as shown or as prescribed by the COR.

Conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, published by the U.S. Department of Transportation, Federal Highway Administration, for details not shown.

#### **1.2 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.
- B. Paint.

#### **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. Federal Specifications (Fed. Spec.):  
TT-P-1952D .....Paint, Traffic Black, and Airfield Marking, Waterborne
- C. Master Painters Institute (MPI):  
Approved Product List - 2010

### **PART 2 - PRODUCTS**

#### **2.1 PAINT**

Paint for marking pavement (parking lot and zone marking) shall conform to MPI No. 97, color as shown. Paint for obliterating existing markings shall conform to Fed. Spec. TT-P-1952D. Paint shall be in containers of at least 18 L (5 gallons). A certificate shall accompany each batch of paint stating compliance with the applicable publication.

#### **2.3 PAINT APPLICATOR**

Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as shown. Provide pneumatic spray guns for hand application of paint in areas where a mobile paint applicator cannot be used. An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.



## 2.4 SANDBLASTING EQUIPMENT

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall furnish not less than 0.08 m<sup>3</sup>/s (150 cfm) of air at a pressure of not less than 625 kPa (90 psi) at each nozzle used.

## PART 3 - EXECUTION

### 3.1 SURFACE PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by the COR. The application of paint conforming to Fed. Spec. TT-P-1952D is an option to removal of existing paint markings on asphalt pavement. Apply the black paint in as many coats as necessary to completely obliterate the existing markings. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint. Pavement marking shall follow as closely as practicable after the surface has been cleaned and dried, but do not begin any marking until the COR has inspected the surface and gives permission to proceed. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals. The Contractor is responsible to preserve and apply marking in conformance with the established control points.

### 3.2 APPLICATION

Apply uniformly painted pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and established control points. The length and width of lines shall conform within a tolerance of plus or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in the case of skip markings. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 10°C (50°F) and less than 35°C (95°F). Apply the paint at a wet film thickness of 0.4 mm (0.015 inch). Apply paint in one coat. At the direction of the COR, markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the marking, discontinue paint operations until

cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, , smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved method to remove marking so that the surface to which the marking was applied will not be damaged.

### **3.3 PROTECTION**

Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Government.

### **3.4 DETAIL PAVEMENT MARKING**

Use Detail Pavement Markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at crosswalks, at parking bays, and at such other locations as shown. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

### **3.5 TEMPORARY PAVEMENT MARKING**

When shown or directed by the COR, apply Temporary Pavement Markings of the color(s), width(s) and length(s) shown or directed. After the temporary marking has served its purpose and when so ordered by the COR, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that the surface to which the marking was applied will not be damaged. As an option, an approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of the required color(s), width(s) and length(s) may be furnished and used in lieu of temporary painted marking. The Contractor shall be fully responsible for the continued durability and effectiveness of such marking during the period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted markings at no additional cost to the Government.

### **3.6 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.

--- E N D ---

## **SECTION 33 10 00 WATER UTILITIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

#### **1.2 RELATED WORK:**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Fire protection system connection and supervisory switch for post indicator valve: Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.
- F. Fire protection system connection, Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS.

#### **1.3 DEFINITIONS:**

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.
- B. Water Service Line: Pipe line connecting building piping to water distribution lines.

#### **1.4 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
  - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.
- C. Comply with all rules and regulations of Federal, State, and Local Health Department having jurisdiction over the design, construction, and operation of potable water systems.
- D. All material surfaces in contact with potable water shall comply with NSF 61.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data (Submit all items as one package):  
(Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to COR for approval.)
  - 1. Piping.
  - 2. Gaskets.
  - 3. Valves.
  - 7. Vaults, frames and covers.
  - 8. Steps.
  - 9. Post indicator.
  - 10. Valve boxes.
  - 13. Joint restraint.
  - 14. Disinfection products.
  - 15. Link/sleeve seals.
- C. Testing Certifications:
  - 1. Certification of Backflow Devices.
  - 2. Hydrostatic Testing.
  - 3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

#### **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 National Standards Institute (ANSI/ASME):
  - B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
  - B16.18.....Cast Bronze Solder Joint Pressure Fittings
  - B16.26-88.....Cast Copper Alloy Fittings for Flared Copper Tubes
  - B40.100-98.....Pressure Gauges and Gauge Attachments
- C. American Society for Testing and Materials (ASTM):
  - A123-97.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A148M-03.....Standard Specifications for Steel Castings
  - A242-00.....Standard Specifications for High Strength Low Alloy Structural Steel AASHTO No. M161
  - A307-02.....Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - A536-04.....Standard Specifications for Ductile Iron Castings
  - B61-02.....Steam or Valve Bronze Castings

B62-02.....	Composition Bronze or Ounce Metal Castings
B88-02.....	Seamless Copper Water Tube
B828.....	Standard Practice: Soldering and Brazing Copper Tube and fittings
C32-04 .....	Sewer and Manhole Brick (Made from Clay or Shale)
C139-03 .....	Concrete Masonry Units for Construction of Catch Basins and Manholes
D1784-03 .....	Standard Specifications for Rigid PVC Compounds and CPVC Compounds
D1869-00 .....	Standard Specifications for Rubber Rings for Asbestos Cement Pipe
D2464-99 .....	Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80
D2467-02 .....	Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D3139-98 .....	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
F477-02e1 .....	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
C32-04 .....	Standard Specifications for Sewer Manhole Brick
D. American Water Works Association (AWWA):	
B300-04.....	Hypochlorites
B301-04.....	Liquid Chlorine
C104-04 .....	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
C105-99 .....	Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids
C110-03 .....	Ductile-Iron and Gray-Iron Fittings, 80 mm (3 Inches) Through 1200 mm (48 Inches) for Water and Other Liquids
C111-01 .....	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C115-99 .....	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
C150-02 .....	American National Standard for Thickness Design of Ductile Iron Pipe
C151-96 .....	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
C153-00 .....	Ductile-Iron Compact Fittings, 80 mm (3 inches) Through 300 mm (12 Inches) for Water and Other Liquids
C500-02 .....	Gate Valves for Water and Sewerage Systems

- C502a-95 ..... Dry-Barrel Fire Hydrants
- C508-01 ..... Swing Check Valves for Waterworks Service, 2 Inches (50 mm)  
Through 24 Inches (600mm) NPS
- C509-01 ..... Resilient Seated Gate Valve for Water and Sewage System
- C510-97 ..... Double Check Valve Back-Flow Prevention Assembly
- C511-97 ..... Reduced Pressure Principle Back-Flow Prevention Assembly
- C550-01 ..... Protective Epoxy Interior Coatings for Valves and Hydrants
- C600-01 ..... Installation for Ductile-Iron Water Mains and Their  
Appurtenances
- C605-94 ..... Underground Installation of Polyvinyl Chloride (PVC) Pressure  
Pipe and Fittings for Water
- C651-92 ..... Disinfecting Water Mains
- C800-01 ..... Underground Service Line Valves and Fittings
- C900-97 ..... Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Thru 12  
Inches, for Water
- C905-97 ..... Polyvinyl Chloride (PVC) Pressure Pipe 14 Inches Thru 36  
Inches
- E. National Fire Protection Association (NFPA):
  - 24-95 ..... Installation of Private Fire Service Mains and Their  
Appurtenances
  - 291-01 ..... Fire Flow Testing and Marking of Hydrants
  - 1141-98 ..... Fire Protection in Planned Building Groups
- F. NSF International:
  - 14-03 ..... Plastics Piping Components and Related Materials
  - 61-02 ..... Drinking Water System Components-Health Effects (Sections 1-  
9)
- G. American Welding Society (AWS):
  - A5.8-04..... Brazing Filler Metal
- H. Foundation for Cross-Connection Control and Hydraulic Research-2005
- I. Copper Development Association's Copper Tube Handbook-2005

## **PART 2 - PRODUCTS**

### **2.1 DUCTILE IRON PIPE AND FITTINGS:**

- A. Ductile iron pipe, direct buried:
  - 1. Provide ductile iron pipe conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 100 mm through 300 mm (4 inches through 12 inches) in diameter and 250, [ ] minimum for pipe larger than 300 mm (12 inches) in diameter, with standard thickness

- cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.
2. Below Grade: Supply pipe in lengths not in excess of a nominal 6 m (20 feet) with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide flange joint pipe where shown on the drawings. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
  3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.
- B. Ductile Iron Pipe Above Grade or in Below Ground Concrete Pits:
1. Flanged ductile iron pipe, AWWA C115, with factory applied screwed long hub flanges except as otherwise specified hereinafter. Face and drill flanges after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and flush with end of pipe, ANSI B16.1, 850 kPa (125 psi) or 1725 kPa (250 psi) standard, for the purpose intended.
  2. Wall Sleeve Castings: Size and types shown on the drawings and be hot dipped galvanized. Seal strips, where required shall be Link Seal as manufactured by Thunderline Corp., Wayne, Michigan or equal.
  3. Pipe Thickness Class: Minimum of Class 53 as defined in AWWA C150 for all sizes of flanged pipe.
  4. Rubber Ring Gaskets: Full face type, AWWA C111, 2 mm (1/16 inch) rubber ring gaskets and of approved composition suitable for the required service.
  5. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop-Coat No. 621 Rust Inhibitive Primer or equal. Paint color shall match the wall color.
  6. Bolts and Nuts on Flanged Fittings: Grade B, ASTM A307. Low alloy, high strength steel in accordance with AWWA C111. Assemble stainless steel bolts and nuts using anti-seize compound to prevent galling.
- C. All Pipe Fittings: Ductile iron with a minimum pressure rating of 2400 kPa (350 psi). Fittings shall meet the requirements of ANSI and AWWA specifications as applicable. Rubber gasket joints shall conform to AWWA C111 for mechanical and push-on type joints. Ball joints shall conform to AWWA C151 with a separately cast ductile iron bell conforming to ASTM A148. Flanged fittings shall conform to AWWA C115 and be furnished flat faced and drilled to 850 kPa (125 psi) or 1725 kPa (250 psi) template in accordance with ANSI B16.1 with full faced gaskets.

- D. Provide cement mortar lining and bituminous seal coat on the inside of the pipe and fittings in accordance with AWWA C104. Provide standard asphaltic coating on the exterior.
- E. Provide a factory hydrostatic test of not less than 3.5 MPa (500 psi) for all pipe in accordance with AWWA C151.
- F. Provide non-detectable adhesive backed identification tape on top and sides of all buried ductile iron pipe, extended from joint to joint along the length of the pipe and have black lettering identifying the pipe service at no more than 300 mm (12 inch) intervals. According to service, the tape background color shall be as follows: sanitary-green; potable water-blue; reclaimed water-lavender.

## **2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS:**

- A. Class-Rated Polyvinyl Chloride (PVC) Pipe:
  - 1. PVC pipe and accessories 100 mm to 356 mm (4 inches–14 inches) in diameter, AWWA C900 “Polyvinyl Chloride (PVC) Pressure Pipe”, Class 200, DR 14, cast iron outside diameters, unless otherwise shown or specified.
  - 2. PVC pipe and accessories 400 mm (16 inches) or larger, AWWA C905, “Polyvinyl Chloride Water Transmission Pipe”, Class 235, DR 18, cast iron outside diameters unless otherwise shown or specified. Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer’s name, AWWA and/or ASTM Specification number, working pressure and production code. Pipe and couplings shall be made in accordance with ASTM D1784.
  - 3. PVC Pipe and Accessories Smaller than 100 mm (4 inches): Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1. All exposed piping shall be CPVC meeting requirements of ASTM F441.
- B. Joints:
  - 1. Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.
  - 2. Pipe Less Than 75 mm (3 inches) in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.
- C. Fittings:
  - 1. Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153.
  - 2. For Schedule 80 Pipe less than 75 mm (3 inches) in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

## **2.3 COPPER PIPE AND TUBING:**



Copper Piping: ASTM B88, Type K, or Type L with flared fittings in accordance with AWWA C800, with sweat cast brass fittings per ANSI B16.18. Use brazing alloy, AWS A5.8, Classification BCuP.

## **2.4 VALVES:**

- A. Asbestos packing is not allowed.
- B. Gate:
  - 1. 75 mm (3 inches) and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter-clockwise to open, 1375 kPa (200 pound) WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.
  - 2. Operator:
    - a. Underground: Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation. Post indicator shall comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.
    - b. Above Ground and in Pits: Hand wheels.
  - 3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.
- C. Check: Swing.
  - 1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 1375 kPa (200 pound) WOG.
  - 2. 100 mm (4 inches) and Larger: Iron body, bronze trim, swing type, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG. Check valves for fire lines shall conform to AWWA C508 and shall be epoxy coated and lined per AWWA C550.
- D. Corporation stops and saddles shall conform to AWWA C800.
- E. Curb Stop: Smaller than 75 mm (3 inches). Waterworks standard for Type "K" copper, single piece cast bronze body with tee top operated plug sealed with O-ring gaskets, 1375 kPa (200 pound) WOG per AWWA C800.

## **2.6 VALVE BOX:**

Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide [ ] "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

## **2.7 POST INDICATOR VALVE:**

- A. Valve: Valve shall conform to the specifications listed in Section 2.4 for gate valves. The Post Indicator shall conform to NFPA 24, and shall be fully compatible with the valve and all the supervisory switches.

**2.8 FIRE HYDRANTS:**

- A. Size of main valve opening of each hydrant shall be 125 mm (5 inches), minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with present local fire department and/or water department standards.
- B. Hydrant shall be type AWWA C502, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with safety flange on barrel and safety couplings on the valve stem with the following features:
  - 1. Interior removable without digging up hydrant; can be packed under pressure; 150 mm (6 inch) bell connection; one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; single rubber or leather-faced valve in base; nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 50 mm (2 inches) above finished grade. All fire hydrants shall have 150 mm (6 inch) bottom connection.
  - 2. Provide fire hydrants with a finish paint identical to the existing fire hydrants.
- C. Provide 2 wrenches with handles not less than 350 mm (14 inches) long.

**2.9 PIPE SLEEVES:**

Ductile iron or zinc coated steel.

**2.10 BACKFLOW PREVENTER:**

- A. Potable Water and Irrigation Water Service: Reduced Pressure Principle Type AWWA C511, except pressure drop at rated flow shall not exceed 100 kPa (15 psi). Gate valves installed on the assembly shall be resilient seated valve conforming to AWWA C509.
- B. Fire Service: Double detector check valve. AWWA C510 and NFPA 14.
- C. In cold climate areas, backflow assemblies and devices shall be protected from freezing by a method acceptable to local jurisdiction.
- D. Backflow preventers shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research per current edition of the Manual of Cross-Connection Control.
- E. Backflow preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
- F. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
- G. Backflow preventer shall be accessed and have clearance for the required testing, maintenance and repair. Access and clearance shall require a minimum of one (1) foot (305 mm) between the lowest portion of the assembly and grade, floor or platform. Installations elevated more than five (5) feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

**2.15 CAST IRON FRAME AND COVER, STEPS, ETC.:**

Cast iron frame and cover, steps, etc. shall comply with State Department of Transportation standard details. Identify cover as "WATER".

#### **2.16 FLEXIBLE EXPANSION JOINTS: (PROVIDE FOR DOMESTIC AND FIRE SERVICE)**

Ductile iron with ball joints rated for 1725 kPa (250 PSI) working pressure conforming to ANSI/AWWA A21.53/C153, capable of deflecting a minimum of 30 degrees and expanding simultaneously to the amount shown on the drawings. Flexible expansion joint shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 375 µm (15 mils) of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts high strength steel with synthetic gaskets that comply with AWWA C110.

#### **2.17 POTABLE WATER:**

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

#### **2.18 DISINFECTION CHLORINE:**

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

#### **2.19 WARNING TAPE**

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

### **PART 3 - EXECUTION**

#### **3.1 BUILDING SERVICE LINES:**

Install water service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps.

#### **3.2 REGRADING:**

Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

#### **3.3 PIPE LAYING, GENERAL:**

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying,

and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the COR.

- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.7 "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- M. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

### **3.4 DUCTILE IRON PIPE:**

- A. Installing Pipe: Lay pipe in accordance with AWWA C600 with polyethylene encasement if required in accordance with AWWA C105. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:

1. Push-on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home with approved means.
2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque.
3. Ball Joints: Install in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.
4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

### **3.5 PVC PIPE:**

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.
- C. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe locating. Generally, install markers on 6 m (20 foot) centers. If pipe is in a congested piping area, install on 3 m (10 foot) centers. Prepare as-built drawing indicating exact location of magnetic markers.

### **3.6 COPPER PIPE:**

Copper piping shall be installed in accordance with the Copper Development Association's Copper Tube Handbook and manufacturer's recommendations. Copper piping shall be bedded in 150 mm (6 inches) of sand and then back filled as specified in Section 31 20 00, EARTH MOVING.

### **3.7 PIPE SUPPORTS:**

- A. Supports:

1. All piping shall be properly and adequately supported. Hangers, supports, base elbows and tees, and concrete piers and pads shall be provided as indicated on the drawings. If the method of support is not indicated on the drawings, exposed piping shall be supported by hangers wherever the structure is suitable and adequate to carry the superimposed load. Supports shall be placed approximately 2.4 m (8 feet) on centers and at each fitting.
2. Hangers shall be heavy malleable iron of the adjustable swivel type, split ring type, or the adjustable-swivel, pipe-roll type for horizontal piping and adjustable, wrought iron, clamp type for vertical piping. Flat steel strap or chain hangers are not acceptable unless indicated on the drawings.
3. Hangers shall be attached to the structure, where possible, by beam clamps and approved concrete inserts set in the forms before concrete is poured. Where this method is impractical, anchor bolts with expanding lead shields, rawl drives, or malleable iron expansion shields will be permitted.
4. Where hangers cannot be used, the Contractor shall provide pipe saddle supports with pipe column and floor flange.

### **3.8 RESTRAINED JOINTS:**

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.
- C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be "Flex-Ring", "Lok-Ring", or mechanical joint coupled as manufactured by American Cast Iron Pipe Company, "Mega-Lug" or approved equal.
- D. Ductile iron pipe bell and spigot joints shall be restrained with EBBA Iron Sales, Inc. Series 800 Coverall or approved equal.
- E. Ductile iron mechanical joint fittings shall be restrained with EBBA Iron Sales, Inc. Series 1200 Restrainer. The restraining device shall be designed to fit standard mechanical joint bells with standard T head bolts conforming to AWWA C111 and AWWA C153. Glands shall be manufactured of ductile iron conforming to ASTM A536. Set screws shall be hardened ductile iron and require the same torque in all sizes. Steel set screws not permitted. These devices shall have the stated pressure rating with a minimum safety factor of 2:1. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.
- F. Thrust blocks shall not be permitted.

- G. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.
- H. PVC pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1350 Restrainer or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.
- I. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1300 Restrainer, EBBA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

### **3.9 PIPE SEPARATION:**

- A. Horizontal Separation-Water Mains and Sewers:
  - 1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
  - 2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
    - a. Local conditions prevent a lateral separation of 3 m (10 feet); and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
    - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
  - 3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.
- B. Vertical Separation-Water Mains and Sewers:
  - 1. A water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
  - 2. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
    - a. It is impossible to obtain the proper vertical separations described in (1) above; or
    - b. The water main passes under a sewer or drain.

3. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

### 3.10 SETTING OF VALVES AND BOXES:

- A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box when valve is not located below pavement.
- B. Clean valve and curb stops interior before installation.
- C. Set valve and curb stop box cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

### 3.12 PIPE SLEEVES:

Install where water lines pass through retaining walls, building foundations and floors. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

### 3.13 FLUSHING AND DISINFECTING:

- A. Flush and disinfect new water lines in accordance with AWWA C651.
- B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1(25)	1 ½(38)	2(51)	2 1/2-in (64 mm)
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

The backflow preventers shall not be in place during the flushing.

- C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all



required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.

- D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Health Department of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.
- G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

### **3.14 HYDROSTATIC TESTING:**

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1375 kPa (200 psi). Leakage shall not exceed the following requirements.
  - 1. Copper Tubing: No leaks.
  - 2. Ductile Iron Pipe: AWWA C600. Provide to COR office.
  - 3. Polyvinyl Chloride (PVC) AWWA C605. Provide to COR office.

### **3.15 BACKFLOW PREVENTOR TESTING:**

- A. All backflow preventers shall be tested and certified for proper operation prior to being placed in operation.
- B. Original copies of the certification shall be submitted to the COR.

--- E N D ---

**SECTION 33 30 00  
SANITARY SEWERAGE UTILITIES**

**ART 1 - GENERAL**

**1.1 DESCRIPTION:**

Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

**1.2 RELATED WORK:**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete Work Reinforcing, Placement and Finishing; Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.
5. Steps and Ladders.

#### **1.5 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A48/A48M-03 ..... Gray Iron Castings
  - A536-84(2004) ..... Ductile Iron Castings
  - A615/A615M-06 ..... Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - A625/A625M-03 ..... Tin Mill Products, Black Plate, Single Reduced
  - A746-03..... Ductile Iron Gravity Sewer Pipe
  - C12-06 ..... Installing Vitrified Clay Pipe Lines
  - C76-05b/C76M-05b ..... Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
  - C139-05 ..... Concrete Masonry Units for Construction of Catch Basins and Manholes
  - C150-05 ..... Portland Cement
  - C425-04 ..... Compression Joints for Vitrified Clay Pipe and Fittings
  - C478-06a/C478M-06a ..... Precast Reinforced Concrete Manhole Sections
  - C700-05 ..... Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
  - C828-03 ..... Low-Pressure Air Test of Vitrified Clay Pipe Lines

C857-95(2001) .....	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
D698-00ae1 .....	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
D2321-05 .....	Underground Installation of Thermoplastic Pipes for Sewers and Other Gravity-Flow Applications
D2412-02 .....	Determination of External Loading Characteristics of Plastic Pipe by Parallel- Plate Loading
D2992-01 .....	Practice for Obtaining Hydrostatic or Pressure Design Basis for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
D3034-04a .....	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3212-96a (2003) e1 .....	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
D3261-03 .....	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
D3350-05 .....	Polyethylene Plastics Pipe and Fittings Materials
D4101-05a. ....	Polypropylene Injection and Extrusion Materials
F477-02e1 .....	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F679-06 .....	Poly (vinyl chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
F714-05 .....	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
F794-03 .....	Poly (Vinyl Chloride)(PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
F894-05 .....	Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
F949-03 .....	Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

## C. American Water Works Association (AWWA):

C105/A21.5-05 .....	Polyethylene Encasement for Ductile Iron Pipe Systems
C110/A21.10-03 .....	Ductile-Iron and Gray-Iron Fittings for Water
C111/A21.11-00 .....	Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C115-99 .....	Flanged Ductile-Iron Pipe with Threaded Flanges
C116-03 .....	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron Pipe and Gray Iron Fittings for Water Supply Service
C151-/A21.51-02	Ductile-Iron Pipe, Centrifugally Cast for Water
C153-00	Ductile-Iron Compact Fittings for Water Services
C508-01 .....	Swing Check Valves for Waterworks, 2 inches (50 mm) Through 24 inches (600 mm) NPS
C509-01 .....	Resilient Seated Gate Valves for Water-Supply Service
C515-01 .....	Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service
C512-04 .....	Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
C550-05 .....	Protective Epoxy Interior Coatings for Valves and Hydrants
C600-05 .....	Installation for Ductile-Iron Water Mains and Their Appurtenances
C605-94 .....	Underground Installation of Polyvinyl (PVC) Pressure Pipe and Fittings for Water
C900-97 .....	Polyvinyl Chloride (PVC) Pressure Pipe, 100 mm (4 inches) Through 300 mm (12 inches) for Water Distribution
C905-97 .....	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm through 1,200 mm (14 Inches through 48 Inches), for Water Transmission and Distribution

C906-99 ..... Polyethylene (PE) Pressure Pipes and Fittings, 100 mm through 1575 mm (4 Inches through 63 Inches), for Water Distribution

D. American Association of State Highway and Transportation Officials (AASHTO):

M198-05 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants

E. Uni-Bell PVC Pipe Association:

Uni-B-6-98 ..... Recommended Practice Low Pressure Air Testing of Installed Sewer Pipe

## PART 2 - PRODUCTS

SPEC WRITER NOTE: Update material requirements to agree with applicable requirements (types, grades, classes, and other related items) specified in the referenced Applicable Publications. Where installation requires extra strength on higher class pipe, adjust the following:

### 2.1 PIPING:

A. Gravity Flow Lines (Pipe and Fittings):

1. Vitrified Clay: Pipe and fittings shall conform to ASTM C700, extra strength, with gasketed bell and spigot end joints. Joints on the pipe and fitting shall conform to ASTM C425.
2. Polyvinyl Chloride (PVC):
  - a. Pipe and Fittings, 100 to 375 mm (4 to 15 inches) in diameter, shall conform to ASTM D3034, Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints shall not be permitted.
  - b. Pipe and fittings, 450 to 900 mm (18 to 36 inches) in diameter, shall be solid wall or have a corrugated or ribbed exterior profile and a smooth interior. Pipe shall conform to the following:
    - 1) Pipe and fittings shall conform to ASTM F949 corrugated sewer pipe with a smooth interior. The corrugated outer wall shall be fused to the smooth interwall at the corrugation valley. Pipe and fitting shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 350 kPa (50

psi) at 5 percent deflection, when tested in accordance with ASTM D2412.

Corrugation shall be perpendicular to the axis of the pipe to allow gaskets to be installed on field cut sections of pipe without the requirement for special fittings.

- 2) Ribbed wall PVC pipe and fittings shall conform to ASTM F794 ribbed sewer pipe with smooth interior pipe and fittings shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 320 kPa (46 psi) when tested in accordance with ASTM D 2412, at 5 percent vertical deflection. Joints shall not leak at 7.6 m (25 feet) of head under 5 percent deflection.
- 3) Solid wall pipe and fittings shall conform to ASTM F679, SDR 35 pipe and fittings shall gaskets conforming to ASTM F477, and shall be able to withstand a hydrostatic pressure of 345 kPa (50 psi).

**B. Gravity flow lines with secondary containment (pipe and fittings):**

1. Piping systems conveying hazardous materials shall be constructed with a watertight primary (carrier) pipe completely enclosed within a watertight secondary (containment) pipe.
2. Fiberglass Piping and Fittings: Shall be manufactured in accordance with ASTM D2992 using a filament-winding process. Joints shall be adhesive bonded straight or tapered spigot and bells. Taper angles shall not be greater than 0.5 degrees. The pipe and fittings shall have an integral epoxy resin-rich reinforced liner not less than 0.50 mm (0.020 inch) for carrier pipes, and not less than 0.25 mm (0.010 inch) for containment pipe.
3. The carrier pipe shall be installed with manufactured spacers to maintain a minimum interstitial space of 19 mm (0.75 inch) between the carrier pipe and the containment pipe.
4. The piping shall be equipped with adequate monitoring ports to detect the presence of fluids within the containment pipe and for the extraction of fluids from the containment pipe.

**2.2 JOINTING MATERIAL:**

**A. Gravity Flow Lines:**

1. Vitrified Clay Pipe: Rubber gasket, ASTM C425.
3. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.

- B. Gravity Flow with Secondary Containment: Tapered or straight bell and spigot with adhesive bond. Completed joint shall be equal or greater than the pressure rating of the pipe.

## **2.3 MANHOLES:**

- A. Manholes shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The manholes shall be in accordance with State Department of Transportation standard details, and the following:
1. Precast Concrete Segmental Blocks: Blocks shall conform to ASTM C139 and shall not be less than 150 mm (6 inches) thick for manholes to a depth of 3.6m (12 feet); not less than 200 mm (8 inches) thick for manholes deeper than 3.6m (12 feet) deep. Blocks shall be not less than 200 mm (8 inches) in length. Blocks shall be shaped so that joints seal and bond effectively with cement mortar. Parge structure interior and exterior with 15 mm (1/2 inch) of cement mortar applied with a trowel and finished to an even glazed surface.
  2. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1200 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top section shall be eccentric cone type. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  3. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  4. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.
  6. Mortar:
    - a. Precast Concrete Segmental Block Structures: By volume, 1 part of Portland cement, 1/4 part lime hydrate, and 3 parts sand.
    - b. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 21 L (5-1/2 gallons) per sack of cement.
  7. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M198.



8. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20-44 loading, have a studded pattern on the cover, and the words "sanitary sewer". The studs and the lettering shall be raised 8 mm (5/16 inch). The cover shall be a minimum of 600 mm (24 inches) in diameter and shall have four 19 mm (3/4 inch) vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
9. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 406 mm (16 inches) wide and project a minimum of 178 mm (7 inches) away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 300 mm (12 inch) centers.
10. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 10 mm (3/8 inch) by 63 mm (2-1/2 inches) spaced a minimum of 400 mm (16 inches) apart. Rungs shall be 35 mm (1-3/8 inches) in diameter and have a non-slip surface. Standoffs shall offset the ladder 180 mm (7 inches) from the wall. The ladder assembly shall be rated for a minimum of 2200 N (500 pounds).

## **2.4 CONCRETE:**

Concrete shall have a minimum compressive strength of 20 MPa (3000 psi) at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform with the provisions of Division 03 of these specifications.

## **2.5 REINFORCING STEEL:**

Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

## **2.15 CLEANOUT FRAMES AND COVERS:**

Frames and covers shall be gray iron casting conforming to ASTM C48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

**2.16 WARNING TAPE:**

Standard, .1mm (4Mil) polyethylene 76 mm (3 inch) wide tape detectable non-detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

**PART 3 - EXECUTION****3.1 BUILDING SERVICE LINES:**

- A. Install sanitary sewer service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.
- B. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the COR. The Contractor shall install all temporary caps or plugs required for testing.
- C. When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

**3.2 ABANDONED MANHOLES STRUCTURES AND PIPING:**

- C. Piping under and within 1500 mm (5 feet) of building areas shall be completely removed.
- D. Piping outside of building areas shall have all ends of the piping at the limit of the abandonment plugged with concrete and abandoned in-place.
- E. The Contractor shall comply with all OSHA confined space requirements while working within existing manholes and structures.
- F. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

**3.3 REGRADING:**

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

### **3.4 CONNECTIONS TO EXISTING VA OWNED MANHOLES:**

- A. During construction of new connections to existing manholes, it shall be the sole responsibility of the Contractor to maintain continued sanitary sewer service to all buildings and users upstream. The contractor shall provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All temporary measures required to meet this requirement shall be subject to the review of the COR.
- B. Core existing structure, install pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.
- C. The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all pipes connected to the manhole.
- D. Connections and alterations to existing manholes shall be constructed so that finished work conforms as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting and shaping.

### **3.6 PIPE SEPARATION:**

- A. Horizontal Separation - Water Mains and Sewers:
  - 1. Existing and proposed water mains shall be at least 3 meters (10 feet) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
  - 2. Gravity flow mains and pressure (force) mains may be located closer than 3 meters (10 feet) but not closer than 1.8 m (6 feet) to a water main when:
    - a. Local conditions prevent a lateral separation of ten feet; and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer or 600 mm (24 inches) above the crown of the pressure (force) main; and

- c. The water main is in a separate trench separated by undisturbed earth.
  - 3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall comply with Section 33 10 00, WATER UTILITIES. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.
- B. Vertical Separation - Water Mains and Sewers at Crossings:
- 1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 600 mm (24 inches) above the crown of gravity flow sewer or 1200 mm (48 inches) above the crown of pressure (force) mains. The vertical separation shall be maintained within 3 meters (10 feet) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
  - 2. In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.
  - 3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 450 mm (18 inches) above or 300 mm (12 inches) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 600 mm (24 inches) below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 10 00, WATER UTILITIES.
  - 4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 3 meters (10 feet).

### **3.7 GENERAL PIPING INSTALLATION:**

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 600 mm (2 feet) below water lines.
- H. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 300 mm (12 inches) over the crown of the pipe.
- I. Warning tape shall be continuously placed 300 mm (12 inches) above sewer pipe
- J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
  - 2. Vitrified Clay Piping: ASTM C12.
  - 3. Polyvinyl Chloride (PVC) Piping: ASTM D2321.
- K. Gravity Flow Lines with Secondary Containment:
  - 1. Install per manufacturer's recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.

### **3.8 MANHOLES AND VAULTS:**

- A. General:
  - 1. Circular Structures:
    - a. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 15 mm (1/2 inch) or cement mortar applied with a trowel and finished to an even glazed surface.

- b. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
  - c. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
- 3. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
- 4. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
  - a. Forming directly in concrete base of structure.
  - b. Building up with brick and mortar.
- 5. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (1-inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.
- 6. The wall that support access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.
- 7. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
- 8. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

### **3.9 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES:**

Reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

**3.15 CLEANOUTS:**

- A. 150 millimeters (6 inches) in diameter and consisting of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 300 by 300 by 150 mm (12 by 12 by 6 inches) thick concrete slab set flush with adjacent finished grade. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 50 mm (2 inches) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 600 mm (24 inches) in diameter.
- B. The top of the cleanout assembly shall be 50 mm (2 inches) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

**3.19 INSPECTION OF SEWERS:**

Inspect and obtain the COR's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints on the inside of gravity sewer lines are not acceptable.

**3.20 TESTING OF SANITARY SEWERS:**

- A. Gravity Sewers and Manholes (Select one of the following):
  - 1. Air Test: Vitrified Clay Pipe ASTM C828. PVC Pipe, Uni-Bell Uni-B-6. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 28 kPa (4 psi) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 24 kPa (3.5 psi) greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell Uni-B-6.
  - 2. Exfiltration Test:
    - a. Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11 L (3.0 gallons) per hour per 30 m (100 feet).
    - b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

3. Infiltration Test: If ground water level is greater than 900 mm (3 feet) above invert of the upper manhole, infiltration tests are acceptable. Allowable leakage for this test will be the same as for the exfiltration test.

- - - E N D - - -



## **SECTION 33 40 00**

### **STORM SEWER UTILITIES**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

##### **1.2 RELATED WORK**

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.
- E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

##### **1.3 ABBREVIATIONS**

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes and stormwater inlets according to manufacturer's written rigging instructions.

##### **1.5 COORDINATION**

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

##### **1.6 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be

either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

### 1.7 SUBMITTALS

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

### 1.8 APPLICABLE PUBLICATIONS

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

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

A185/A185M-07 .....	Steel Welded Wire Reinforcement, Plain, for Concrete
A615/A615M-09b .....	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
C33/C33M-08 .....	Concrete Aggregates
C76-11 .....	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C150/C150M-11 .....	Portland Cement
C443-10 .....	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C478-09 .....	Precast Reinforced Concrete Manhole Sections
C506-10b .....	Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
C507-10b .....	Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
C655-09 .....	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C857-07 .....	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
C891-09 .....	Installation of Underground Precast Concrete Utility Structures
C913-08 .....	Precast Concrete Water and Wastewater Structures
C923-08 .....	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
C924-02(2009) .....	Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
C990-09 .....	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C1103-03(2009)	Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
C1173-08	Flexible Transition Couplings for Underground Piping Systems
C1433-10	Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
C1479-10	Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
D448-08	Sizes of Aggregate for Road and Bridge Construction
D698-07e1	Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
D1056-07	Flexible Cellular Materials—Sponge or Expanded Rubber
D1785-06	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D2321-11	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2774-08	Underground Installation of Thermoplastic Pressure Piping
D3034-08	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3350-10	Polyethylene Plastics Pipe and Fittings Materials
D3753-05e1	Glass-Fiber-Reinforced Polyester Manholes and Wetwells
D4101-11	Polypropylene Injection and Extrusion Materials
D5926-09	Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
F477-10	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F679-08	Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
F714-10	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
F794-03(2009)	Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
F891-10	Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F894-07 ..... Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11 ..... Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08 ..... Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials (AASHTO):

M198-10 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

M252-09 ..... Corrugated Polyethylene Drainage Pipe

M294-10 ..... Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C900-07 ..... Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

M23-2nd ed ..... PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001 ..... Floor and Trench Drains

F. American Concrete Institute (ACI):

318-05 ..... Structural Commentary and Commentary

350/350M-06 ..... Environmental Engineering Concrete Structures and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

## 1.9 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of ~~one year~~ ~~two years~~ from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

## PART 2 - PRODUCTS

### 2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

### 2.2 PE PIPE AND FITTINGS

- ~~A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.~~

~~SPEC WRITER NOTE: Select Paragraph 1 or 2 below. If both types of couplings are required indicate on Drawings location for different couplings.~~

- ~~1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.~~
- ~~2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.~~

- ~~B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); // AASHTO M294, Type S // ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) // with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.~~

~~SPEC WRITER NOTE: Select Paragraph 1, 2 or 3 below. If both types of couplings are required indicate on Drawings location for different couplings.~~

- ~~1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.~~
- ~~2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.~~
- ~~3. Water-tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil-tight joints shall conform to requirements in AASHTO HB-17, Division II, for soil tightness and shall be as recommended by the manufacturer.~~

- ~~C. Profile Wall PE Pipe: Pipe shall comply with ASTM F894, Class 160.~~

- ~~1. Profile Wall PE Plastic Pipe Joints: Joints shall be as per ASTM F894, // gasket // or // thermal // weld type with integral bell.~~

#### ~~D.A.~~ PVC Pipe And Fittings

1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, //SDR 35 // ~~Insert SDR~~ //, PVC socket-type fittings.

#### ~~E.B.~~ PVC Corrugated Sewer Piping

1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

#### F.C. PVC Profile Sewer Piping

1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

#### G.D. PVC Type PSM Sewer Piping

1. Pipe: ASTM D3034, ~~//SDR 35 // Insert SDR //~~, PVC Type PSM sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

#### H.E. PVC Gravity Sewer Piping

1. Pipe and fittings shall be ASTM F679, ~~//T-1 //T-2//~~ wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

#### ~~I. PVC Pressure Piping~~

- ~~1. Pipe: AWWA C900, // Class 100 // Class 150 // and // Class 200 // PVC pipe with bell-and-spigot ends for gasketed joints.~~
- ~~2. Fittings: AWWA C900, // Class 100 // Class 150 // and // Class 200 // PVC pipe with bell ends~~
- ~~3. Gaskets: ASTM F477, elastomeric seals.~~

## 2.3 CONCRETE PIPE AND FITTINGS

~~A. Non-Reinforced Concrete sewer pipe and fittings shall be ASTM C14, // Class 1 // Class 2 // Class 3 //, with // bell-and-spigot // or // tongue-and-groove // ends and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.~~

B.A. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. ~~// Bell-and-spigot // or // tongue-and-groove //~~ ends and ~~// gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.~~

SPEC WRITER NOTE: Retain one of subparagraphs below for NPS 12 to NPS 144 (DN 300 to DN 3600).

~~2. Class I: // Wall A // Wall B //~~

~~3. Class II, Wall B~~

~~4.2. Class III: // Wall A // Wall B // Wall C~~

~~5. Class IV: // Wall A // Wall B // Wall C //~~

~~6. Class V: // Wall B // Wall C //~~

~~C. Reinforced arch culvert and storm drain pipe and fittings shall be ASTM C506, Class // A-III // A-IV // and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.~~

~~D. Reinforced Concrete elliptical culvert and storm drain pipe and fittings shall be ASTM C507, Class // HE III // HE IV // VE III // VE IV // VE V // VE VI // and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl rubber sealant //~~

## 2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials
  - 1. For concrete pipes: ASTM C443, rubber.
  - 2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  - 3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with ~~// stainless-steel shear ring and //~~ corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
- F. for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

## 2.5 DRAINS

- A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round ~~// secured //~~ grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
  - 1. Top-Loading Classification(s): ~~// Medium Duty // Medium and Heavy Duty // Heavy Duty //~~
- ~~B. Cast-Iron Trench Drains: ASME A112.6.3, 6 inch (150 mm) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular // secured // grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.~~
  - ~~1. Top-Loading Classification(s): // Medium Duty // Heavy Duty // Extra-Heavy Duty // Medium and Heavy Duty // Medium and Extra-Heavy Duty // Heavy and Extra-Heavy Duty // Medium, Heavy, and Extra-Heavy Duty //~~
- C. Steel Trench Drains: ASTM A242, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate.
  - 1. Plate Thicknesses: ~~// 1/8 inch (3.2 mm) // and // 1/4 inch (6.4 mm) //~~
  - 2. Overall Widths: ~~// 7-1/2 inches (190 mm) // and // 12-1/3 inches (313 mm) //~~
- ~~D-B.~~ Grate openings shall be ~~// 1/4 inch (6.4 mm) circular // 3/8 inch (9.5 mm) circular // or // 3/8 by 3 inch (9.5 by 76 mm) slots //~~.

## 2.6 MANHOLES AND CATCH BASINS

~~SPEC WRITER NOTE: Retain one or more paragraphs below. If more than one paragraph is selected, show location of each on Drawings.~~

### A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). ~~// Individual FRP steps or FRP ladder // Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP // ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP //~~, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

### B. Manhole Frames and Covers:

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ~~// ASTM A536, Grade 60-40-18 ductile // ASTM A48/A48M, Class 35 gray //~~ iron unless otherwise indicated.

## ~~2.7 CONCRETE FOR MANHOLES AND CATCH BASINS~~

### ~~A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:~~

- ~~1. Cement: ASTM C150, Type II.~~
- ~~2. Fine Aggregate: ASTM C33, sand.~~



~~3. Coarse Aggregate: ASTM C33, crushed gravel.~~

~~4. Water: Potable.~~

~~B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.~~

~~1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.~~

~~2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.~~

~~C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.~~

~~1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope:~~

~~Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel.~~

~~Minimum of 6 inch slope from main line pipe to wall sides.~~

## **2.92.7 PIPE OUTLETS**

A. Head walls: Cast in-place reinforced concrete, with apron and tapered sides.

B. Riprap basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

~~SPEC WRITER NOTE: Retain one of three subparagraphs below or insert another grade.~~

~~1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).~~

~~2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).~~

~~3.1. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).~~

~~4. Average Size: // Insert size //~~

~~SPEC WRITER NOTE: Retain both paragraphs below to require specific stone sizes.~~

~~C. Filter Stone: NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average size graded stone.~~

~~D-C.~~ Energy Dissipaters: To be as per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

## **2.92.8 HEADWALLS**

A. Headwalls: Cast in-place concrete with a minimum compressive strength of 3000 psi (20 MPa) at 28 days.

## **2.102.9 FLARED END SECTIONS**

A. Flared End Sections: Sections shall be of standard design fabricated from zinc-coated steel sheets conforming to requirements of ASTM A929.

## **2.112.10 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS**

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

**2-122.11 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

**PART 3 - EXECUTION****3.1 PIPE BEDDING**

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

**3.2 PIPING INSTALLATION**

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with ~~//36 inch (915 mm)~~ ~~// 48 inch (1220 mm)~~ ~~// 60 inch (1520 mm)~~ ~~// 72 inch (1830 mm)~~ ~~// Insert dimension //~~ minimum cover as shown on the Drawings.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
  2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
  3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
  4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.

5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
  6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
  7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process ~~or~~ microtunneling.
- G. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
  2. Install piping ~~# NPS 6 (DN 150) --Insert value--~~ and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
  - ~~3. Install PE corrugated sewer piping according to ASTM D2321 with --gasketed joints-- gaskets with fused joints --.~~
  - ~~4.~~3. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
  - ~~5.~~4. Install reinforced concrete sewer piping according to ASTM C1479.

### 3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

### 3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

### 3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification cleanouts in ~~// earth or unpaved foot-traffic // Insert other //~~ areas.
2. ~~Use Medium-Duty, top-loading classification cleanouts in // paved foot-traffic // Insert other //~~ areas.
3. ~~2. Use Heavy-Duty, top-loading classification cleanouts in // vehicle traffic service // Insert other //~~ areas.
4. ~~3. Use Extra-Heavy-Duty, top-loading classification cleanouts in // roads // Insert area //~~

B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints and embed trench sections in ~~// 4 inch (102 mm) //~~ ~~Insert dimension //~~ minimum concrete around bottom and sides.

### 3.6 MANHOLE INSTALLATION

A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.

B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops ~~// 3 inches (76 mm) // Insert dimension //~~ above finished surface elsewhere unless otherwise indicated.

C. Circular Structures:

1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.

3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
  - a. Forming directly in concrete base of structure.
  - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

### **3.7 CATCH BASIN INSTALLATION**

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### **3.8 STORMWATER INLET # AND OUTLET # INSTALLATION**

- A. Construct inlet head walls, aprons, and sides of reinforced concrete.
- B. Construct riprap of broken stone.
- C. Install outlets that spill onto grade, anchored with concrete.
- D. Install outlets that spill onto grade, with flared end sections that match pipe.
- E. Construct energy dissipaters at outlets.

### **3.9 CONNECTIONS**

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.
- B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
- C. Make connections to existing piping and underground manholes.
  1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
  2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.

3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    - a. ~~Unshielded~~ ~~Shielded~~ flexible couplings for same or minor difference OD pipes.
    - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
  2. Use pressure-type pipe couplings for force-main joints.

### 3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8 inch (203 mm) thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Division 31 Section EARTH MOVING.

### 3.11 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edge of underground structures.

### 3.12 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.

- b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
  - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
  - d. Infiltration: Water leakage into piping.
  - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.

### 3.13 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
  4. Submit separate report for each test.
  5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
  - ~~6. Test force main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1 1/2 times the maximum system operating pressure, but not less than // 150 psi (1035 kPa) // Insert value //.~~
    - ~~a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.~~
    - ~~b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.~~
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.14 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. ~~// Flush with potable water. //~~ Flush with water ~~//~~.

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