



## Romanyk Consulting Corp

Dallas VA Legionella

Contract VA257-15-D-0064,

Task Order VA257-15-J-2681– AE Design Services –

Prevention and Control Legionella

Project Number: 549-15-517

## PROJECT MANUAL

Submittal – 100% Construction Documents

06/15/2016

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services -  
 Prevention and Control Legionella  
 Project Number: 549-15-517  
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06-01-16\*

**DEPARTMENT OF VETERANS AFFAIRS  
 VHA MASTER SPECIFICATIONS**

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\*The specifications in this document are the latest specifications from the [cfm.va.gov/til](http://cfm.va.gov/til) as of 6-13-16.

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

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

**1.1 SAFETY REQUIREMENTS**

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

**1.2 GENERAL INTENTION**

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for the Dallas VA Prevention and Control of Legionella Project Number: 549-15-517 as required by drawings and specifications.

B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer's Representative (COR).

C. Offices of Romanyk Consulting Corp.as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

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

A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, roads, walks, grading, drainage, select demolition, concrete, masonry, metals, insulation, roofing, opening, finishes, plumbing, electrical and select site work and certain other items. necessary for the work identified.

The nature of the project is the collection of individual legionella conditions though out several buildings. Each condition has been

assigned a unique identification number. The scope of each condition is be a turn key effort. Pricing shall be itemized on a per condition basis.

- B. ALTERNATE DEDUCTS: Additional, certain conditions have been identified as an Alternate Deducts.

Bidder shall propose a credit for each Bid Deduct Alternate noted. Owner has the right to select any, all or none of proposed deducts.

Bid Deduct Alternate # 1

Propose a credit for omitting all work associated with Condition # 02SB01, New Water Softener Equipment at Bldg 02

Bid Deduct Alternate # 2

Propose a credit for omitting all work associated with Condition # 2J0B04, New Water Softener Equipment at Bldg 2J

Bid Deduct Alternate # 3

Propose a credit for omitting all work associated with Condition # 600153, New Water Softener Equipment including new enclosure at Bldg 60

Bid Deduct Alternate # 4

Propose a credit for omitting all work associated with Condition # 740B01, New Water Softener Equipment at Bldg 74

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

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

## 1.5 CONSTRUCTION SECURITY REQUIREMENTS

### A. Security Plan:

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

### B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. Before starting work the General Contractor shall give one week's notice to the Contracting Officer so that security arrangements can be made. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer. All photography taken is subject to the VA review and censorship. The contractor is subject to all laws and penalties of HIPAA rules and guidelines.
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.

1.

### E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This

information shall be shared only with those with a specific need to accomplish the project.

3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

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

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The



temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

**(FAR 52.236-10)**

- D. Contractor shall propose working space and space for storing materials for approval by 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 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. Any disruptive activity must first be identified in location and schedule by the Contractor and submitted for to the COR for approval.
1. Do not store materials and equipment in other than assigned areas.
  2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work

days. Provide unobstructed access to Medical Center areas required to remain in operation.

G. Phasing:

The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:

To insure such executions, Contractor shall furnish the COR with a schedule of dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange phasing dates to insure accomplishment of this work in successive phases as noted in the following:

PHASE 1:

Phase 1 is all work associated with Bldg 02.

Once all work for this phase has been completed and accepted by the client, work may begin on the next phase.

PHASE 2:

Phase 2 is all work associated with Bldg 2J.

Once all work for this phase has been completed and accepted by the client, work may begin on the next phase.

PHASE 3:

Phase 3 is all work associated with Bldg 60.

Once all work for this phase has been completed and accepted by the client, work may begin on the next phase.

PHASE 4:

Phase 4 is all work associated with Bldg 74.

Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area as submitted to and approved by the COR. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- J. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:
  1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
  2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs

or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

K. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.
2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 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 operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.

5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned shall be entirely removed. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times with approval.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- N. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

#### **1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Any Existing condition of damage to flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.

4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. 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. Protection: Provide the following protective measures:
  1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
  2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
  3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

**1.8 DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
  - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center
  - 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government.

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

(FAR 52.236-9)

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

#### **1.10 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.

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

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer



is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

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

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- 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 review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

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

- A. For hauling, use only established public roads and roads on Medical Center property.

#### **1.18 TEMPORARY USE OF EXISTING ELEVATORS**

- A\*. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:
  - 1. Contractor may use elevators designated by COR, as the construction elevator. All water shut downs are restricted to start no sooner than 8:00 PM. System must be back in operation no later than 6:00 AM of the following day.
  - 2. Contractor covers and provides maximum protection of following elevator components:
    - a. Entrance jambs, heads soffits and threshold plates.
    - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.

c. Finish flooring.

#### **1.20 TEMPORARY TOILETS**

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

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

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract.
- B. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

#### **1.23 TESTS**

- A. The contractor shall provide a written testing and commissioning plan complete with component level, equipment level, sub-system level and system level breakdowns. The plan will provide a schedule and a written sequence of what will be tested, how and what the expected outcome will be. This document will be submitted for approval prior to commencing work. The contractor shall document the results of the approved plan and submit for approval with the as built documentation.
- B. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- C. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer.

Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

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

#### **1.24 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations

shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR , does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

**1.30 PHOTOGRAPHIC DOCUMENTATION**

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones.
- B. Photographic documentation elements:
  - 1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
  - 2. One picture of each condition before construction
  - 3. One picture of each condition during construction of in-wall or above ceiling work.
  - 4. One picture of each condition at the completion of construction.
  - 5. Label each picture with the condition ID# and date when picture was taken.

**1.32 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.

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

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 CONTRACTOR'S REPRESENTATIVE:**

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

**1.3 CONTRACTOR'S CONSULTANT:**

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

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

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

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

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

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

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

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



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- review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.
- E. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.
- F. The Complete Project Schedule shall contain a minimum of one work activity for each type and phase of trade or discipline.

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

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.

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- D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

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

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
1. Show activities/events as:
    - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
    - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
    - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
    - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
    - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
  2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
  3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.

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4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

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

- A. Monthly, the contractor shall submit an application and certificate for payment using the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment

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requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

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

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

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

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logic agreed upon by the contractor and Contracting Officer's Representative for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the Contracting officer's Representative. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the Contracting Officer's Representative within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**

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

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

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

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

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

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sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

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

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

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

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facts and advise the Contractor in writing of the Contracting Officer's decision.

- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Contracting Officer's Representative (COR) on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

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- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
  - 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
  - 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
- B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center , name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
  2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

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3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
  1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  2. Reproducible shall be full size.
  3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.

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7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.

1-10. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

Attention:

Timm Wikelski, AIA, NCARB  
Romanyk Consulting Corp.  
3308 Preston Rd, Suite 350-164  
Plano, TX 75093  
  
(855) 424-3838, ext. 313 voice

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

1-12. Samples (except laboratory samples for approval shall be sent to Architect-Engineer, in care of COR, VA Medical Center;

Attention:

Fehmi Alturk, COR  
Project Engineer, COR  
VA North Texas Health Care System  
Dallas VA Medical Center  
4500 S. Lancaster Road Bldg 9  
Dallas, Texas 75216  
Desk: 214-857-4491

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**SECTION 01 35 26**  
**SAFETY REQUIREMENTS**

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**SECTION 01 35 26**  
**SAFETY REQUIREMENTS**

**1.1 APPLICABLE PUBLICATIONS:**

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

B. American Society of Safety Engineers (ASSE):

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

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

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

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

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

D. The Facilities Guidelines Institute (FGI):

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

E. National Fire Protection Association (NFPA):

10-2013.....Standard for Portable Fire Extinguishers

30-2012.....Flammable and Combustible Liquids Code

51B-2014.....Standard for Fire Prevention During Welding,  
Cutting and Other Hot Work

70-2014.....National Electrical Code

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70B-2013.....Recommended Practice for Electrical Equipment  
Maintenance

70E-2012 .....Standard for Electrical Safety in the Workplace

99-2012.....Health Care Facilities Code

241-2013.....Standard for Safeguarding Construction,  
Alteration, and Demolition Operations

F. The Joint Commission (TJC)

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

G. U.S. Nuclear Regulatory Commission

10 CFR 20 .....Standards for Protection Against Radiation

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

29 CFR 1904 .....Reporting and Recording Injuries & Illnesses

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

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

CPL 2-0.124.....Multi-Employer Citation Policy

I. VHA Directive 2005-007

**1.2 DEFINITIONS:**

A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to



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solve or resolve problems relating to the subject matter, the work, or the project.

- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - 1. Death, regardless of the time between the injury and death, or the length of the illness;
  - 2. Days away from work (any time lost after day of injury/illness onset);
  - 3. Restricted work;
  - 4. Transfer to another job;
  - 5. Medical treatment beyond first aid;
  - 6. Loss of consciousness; or
  - 7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

### **1.3 REGULATORY REQUIREMENTS:**

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

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requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

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

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
2. Address both the Prime Contractors and the subcontractors work operations.
3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
  - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
    - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

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- 2) Plan approver (company/corporate officers authorized to obligate the company);
- 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

**b. BACKGROUND INFORMATION.** List the following:

- 1) Contractor;
- 2) Contract number;
- 3) Project name;
- 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

**c. STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

**d. RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:

- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
- 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
- 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;

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- 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
- 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
- 6) Lines of authority;
- 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

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

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

**f. TRAINING.**

- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
- 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
- 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

**g. SAFETY AND HEALTH INSPECTIONS.**

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

**h. ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative:

- 1) Exposure data (man-hours worked);
- 2) Accident investigations, reports, and logs.

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

- 1) Emergency response ;
- 2) Contingency for severe weather;
- 3) Fire Prevention ;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);

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- 8) Night operations and lighting ;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work ;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete.

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES [15] calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

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- D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

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

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

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- protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
    - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
    - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
  3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 [\_\_] calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
  4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
  5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime



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contractor for review and approval and then submitted to the  
Contracting Officer Representative.

#### **1.6 PRECONSTRUCTION CONFERENCE:**

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within [14] days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

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

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

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

#### **1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

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- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES [15] calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Contracting Officer Representative that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

#### **1.9 INSPECTIONS:**

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as

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required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

- B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
  2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
  3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
  4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative.

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

- A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer

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Representative determine whether a government investigation will be conducted.

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

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

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
  - 1. Hard Hats - unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.

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2. Safety glasses - unless written authorization is given by the Contracting Officer appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative.
4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### **1.12 INFECTION CONTROL**

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

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determined by the COR at the Kick-off Meeting. The required infection control precautions with each class are as follows:

1. Class I requirements:

a. During Construction Work:

- 1) Notify the Contracting Officer Representative
- 2) Execute work by methods to minimize raising dust from construction operations.
- 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.

b. Upon Completion:

- 1) Clean work area upon completion of task
- 2) Notify the Contracting Officer Representative

2. Class II requirements:

a. During Construction Work:

- 1) Notify the Contracting Officer Representative
- 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
- 3) Water mist work surfaces to control dust while cutting.
- 4) Seal unused doors with duct tape.
- 5) Block off and seal air vents.
- 6) Remove or isolate HVAC system in areas where work is being performed.

b. Upon Completion:

- 1) Wipe work surfaces with cleaner/disinfectant.

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- 2) Contain construction waste before transport in tightly covered containers.
- 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
- 4) Upon completion, restore HVAC system where work was performed
- 5) Notify the Contracting Officer Representative

3. Class III requirements:

a. During Construction Work:

- 1) Obtain permit from the Contracting Officer Representative
- 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Contain construction waste before transport in tightly covered containers.
- 6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:



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- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Vacuum work area with HEPA filtered vacuums.
- 4) Wet mop area with cleaner/disinfectant.
- 5) Upon completion, restore HVAC system where work was performed.
- 6) Return permit to the Contracting Officer Representative

4. Class IV requirements:

a. During Construction Work:

- 1) Obtain permit from the Contracting Officer Representative
- 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
- 5) Seal holes, pipes, conduits, and punctures.
- 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.

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- 7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

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

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

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
  - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the Contracting Officer Representative and Medical Center) - Airtight plastic barrier that extends from

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the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping

- b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
- c. Class III & IV - Seal all penetrations in existing barrier airtight
- d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
- e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
- f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

D. Products and Materials:

- 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
- 2. Barrier Doors: Two-hour solid core wood in steel frame, painted
- 3. Dust proof two-hour
- 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
- 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
- 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches

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7. Disinfectant: Hospital-approved disinfectant or equivalent product
  8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
  3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

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4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
5. The contractor shall not haul debris through patient-care areas without prior approval of the Contracting Officer Representative and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

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

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

#### **1.13 TUBERCULOSIS SCREENING**

- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
  1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
  2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
  3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

#### **1.14 FIRE SAFETY**

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas, the areas that are described in phasing requirements, and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  - 2. Install two-hour construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

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3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

J. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

K. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.



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

#### **1.15 ELECTRICAL**

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified

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persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition ( refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

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- D.** Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
- E.** Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. "Assured Equipment Grounding Conductor Program" only is not allowed.

#### **1.16 FALL PROTECTION**

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

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#### **1.17 SCAFFOLDS AND OTHER WORK PLATFORMS**

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

#### **1.18 EXCAVATION AND TRENCHES**

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P.
- B. All excavations and trenches 5 feet in depth or greater shall require a written trenching and excavation permit (NOTE - some States and other

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local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall be completed and provided to the Contracting Officer Representative prior to commencing work for the day. At the end of the day, the permit shall be closed out and provided to the Contracting Officer Representative. The permit shall be maintained onsite and include the following:

1. Determination of soil classification
  2. Indication that utilities have been located and identified. If utilities could not be located after all reasonable attempt, then excavating operations will proceed cautiously.
  3. Indication of selected excavation protective system.
  4. Indication that the spoil pile will be stored at least 2 feet from the edge of the excavation and safe access provided within 25 feet of the workers.
  5. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere.
- C. If not using an engineered protective system such as a trench box, shielding, shoring, or other Professional Engineer designed system and using a sloping or benching system, soil classification cannot be Solid Rock or Type A. All soil will be classified as Type B or Type C and sloped or benched in accordance with Appendix B of 29 CFR 1926.

#### **1.19 CRANES**

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date of November 10, 2014.
- C. A detailed lift permit shall be submitted 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing. The lift will not be allowed without approval of this document.

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D. Crane operators shall not carry loads

1. over the general public or VAMC personnel
2. over any occupied building unless
  - a. the top two floors are vacated
  - b. or overhead protection with a design live load of 300 psf is provided

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

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

**1.21 CONFINED SPACE ENTRY**

- A. All confined space entry shall comply with 29 CFR 1910.146 except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Contracting Officer Representative.

**1.22 WELDING AND CUTTING**

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

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### **1.23 LADDERS**

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

### **1.24 FLOOR & WALL OPENINGS**

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the

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cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
5. Workers are prohibited from standing/walking on skylights.

- - - E N D - - -



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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

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

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

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

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

DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management  
Facilities Quality Service (00CFM1A)  
425 Eye Street N.W, (sixth floor)  
Washington, DC 20001  
Telephone Numbers: (202) 632-5249 or (202) 632-5178  
Between 9:00 AM - 3:00 PM

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

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

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

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

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

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

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

NBBPVI    National Board of Boiler and Pressure Vessel Inspectors  
<http://www.nationboard.org>

NEC        National Electric Code  
            See - NFPA National Fire Protection Association

NEMA       National Electrical Manufacturers Association  
<http://www.nema.org>

NFPA       National Fire Protection Association  
<http://www.nfpa.org>

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

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

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

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

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

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

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

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

PCA        Portland Cement Association  
<http://www.portcement.org>

PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SCMA	Southern Cypress Manufacturers Association <a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
SOI	Secretary of the Interior <a href="http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm">http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm</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>



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STI        Steel Tank Institute  
<http://www.steeltank.com>

SWI        Steel Window Institute  
<http://www.steelwindows.com>

TCA        Tile Council of America, Inc.  
<http://www.tileusa.com>

TEMA       Tubular Exchange Manufacturers Association  
<http://www.tema.org>

TPI        Truss Plate Institute, Inc.  
583 D'Onofrio Drive; Suite 200  
Madison, WI 53719  
(608) 833-5900

UBC        The Uniform Building Code  
See ICBO

UL         Underwriters' Laboratories Incorporated  
<http://www.ul.com>

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

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

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

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

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**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

7. Sanitary Wastes:

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

**1.2 QUALITY CONTROL**

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

**1.3 REFERENCES**

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

**1.4 SUBMITTALS**

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

proposed operations and the requirements imposed by those laws, regulations, and permits.

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

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

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

cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
  - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
  - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
  - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
  - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 50 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
  - b. Reuse or conserve the collected topsoil sediment as directed by the Contracting Officer Representative
  - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.

5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
  7. Manage and control spoil areas on Government property to limit spoil to areas on the contractor's Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the Contracting Officer Representative.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

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

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

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

**PART 1 GENERAL**

**DESCRIPTION**

This section specifies temporary interior signs.

**PART 2 PRODUCTS**

**2.1 TEMPORARY SIGNS**

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

**PART 3 EXECUTION**

**3.1 INSTALLATION**

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

**3.2 LOCATION**

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

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

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

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- 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.

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

#### **1.5 SUBMITTALS**

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

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B. Prepare and submit to the Contracting Officer Representative a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
  - a. List of each material and quantity to be salvaged, reused, recycled.
  - b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection where applicable.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
  - c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

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

B. U.S. Green Building Council (USGBC):

LEED Green Building Rating System for New Construction

**1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

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

**PART 3 - EXECUTION**

**3.1 COLLECTION**

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

**3.2 DISPOSAL**

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

**3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.



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- 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.

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**SECTION 01 91 00**

**GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 COMMISSIONING DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall

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

1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
  2. Verify and document proper integrated performance of equipment and systems.
  3. Verify that Operations & Maintenance documentation is complete.
  4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
  5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
  6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

## **1.2 CONTRACTUAL RELATIONSHIPS**

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Contracting Officer Representative as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.
- B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Contracting Officer Representative 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 Contracting Officer Representative and Contractor. It is also the practice of the VA that communications between other parties of the

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project (Commissioning Agent and Architect/Engineer) be conducted through the Contracting Officer Representative.

- 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 Contracting Officer Representative. 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 Contracting Officer Representative 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 Contracting Officer Representative to require either an official interpretation of the construction documents or require a modification of the contract documents, Contracting Officer Representative will issue an official directive to this effect.
  4. All parties to the Commissioning Process shall be individually responsible for alerting the Contracting Officer Representative of

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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 Representative, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

### 1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 32.16.15 PROJECT SCHEDULES (SMALL PROJECTS - DESIGN/BID/BUILD)
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

### 1.4 SUMMARY

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

### 1.5 ACRONYMS

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

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

## 1.6 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

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

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

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

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

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

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

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

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

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

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

**Functional Test Procedure (FTP):** A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted

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on components, equipment, assemblies, systems, and interfaces among systems.

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

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

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

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

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

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

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

**Owner's Project Requirements (OPR):** A written document that details the project requirements and the expectations of how the building and its

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systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

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

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

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

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

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

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

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

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

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

**Site Observation Reports (SO):** Reports of site inspections and observations made by the Commissioning Agent. Observation reports are

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intended to provide early indication of an installation issue which will need correction or analysis.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 1.7 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these

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systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

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

Systems To Be Commissioned	
System	Description
<b>Plumbing</b>	
Domestic Water Distribution	Booster pumps, backflow preventers, water softeners, potable water storage tanks
Wastewater Pump Systems	Sump pumps

#### 1.8 COMMISSIONING TEAM

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

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

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

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

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

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  - 1. Participate in commissioning coordination meetings.
  - 2. Conduct operation and maintenance training sessions in accordance with approved training plans.
  - 3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.



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4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

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

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

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- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for

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recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

#### **1.12 COMMISSIONING DOCUMENTATION**

- A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  3. Identification of systems and equipment to be commissioned.
  4. Schedule of Commissioning Coordination meetings.
  5. Identification of items that must be completed before the next operation can proceed.
  6. Description of responsibilities of commissioning team members.
  7. Description of observations to be made.
  8. Description of requirements for operation and maintenance training.
  9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for

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each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested system.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Observations and Issues.
8. Issue number, if any, generated as the result of test.

C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.

D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

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E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

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

1. Creating an Commissioning Issues Log Entry:

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

2. Documenting Issue Resolution:

- a. Log date correction is completed or the issue is resolved.

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- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
  - c. Identify changes to the Contract Documents that may require action.
  - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
  - e. Identify person(s) who corrected or resolved the issue.
  - f. Identify person(s) verifying the issue resolution.
- G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
- 1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
  - 2. Commissioning plan.
  - 3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
  - 4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  - 5. Commissioning Issues Log.
  - 6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems,

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subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
  2. Completed Systems Functional Performance Test Procedures for off season test(s).
  3. Documentation that unresolved system performance issues have been resolved.
  4. Updated Commissioning Issues Log, including status of unresolved issues.
  5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

#### **1.13 SUBMITTALS**

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on

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- 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.



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

#### **1.14 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 15 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The

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Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

- C. Within 15 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.15 QUALITY ASSURANCE**

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

#### **1.16 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address

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scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.

- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall

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have a certified calibration within the past year to an accuracy of  
0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure  
sensors shall have an accuracy of + or - 2.0% of the value range being  
measured (not full range of meter) and have been calibrated within the  
last year. All equipment shall be calibrated according to the  
manufacturer's recommended intervals and following any repairs to the  
equipment. Calibration tags shall be affixed or certificates readily  
available.

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### PART 3 - EXECUTION

#### 3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

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

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

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

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

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

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

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



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

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

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

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Warranty Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		COR = Contracting Officer Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Reports and Logs	Final Commissioning Report Amendment	L	A		R	R	
	Status Reports	L	A		R	R	

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

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

1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
  - a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
  - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
  - a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
  - b. The full startup plan shall at a minimum consist of the following items:
    - 1) The Pre-Functional Checklists.
    - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
    - 3) The manufacturer's normally used field checkout sheets.

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

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

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

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- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.
- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

### **3.4 PHASED COMMISSIONING**

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

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

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

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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.

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- 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



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

### **3.8 DEFERRED TESTING**

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

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

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Contracting Officer Representative, 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.

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

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01

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Section "Quality Requirements," experienced in operation and maintenance procedures and training.

3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. Training Coordination:

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

F. Instruction Program:

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

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- k. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - l. Lighting equipment and controls.
  - m. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - n. 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.

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- 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:

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- 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.

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5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

I. Demonstration and Training Recording:

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

----- END -----



**SECTION 02 21 00**  
**SITE SURVEYS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the gathering of research documents, performance of a property and topographic survey and preparation of a site survey map.

**1.2 DEFINITIONS**

- A. Professional Land Surveyor: One who possesses a valid state license as a "Professional Land Surveyor" from the state in which they practice.
- B. Professional Civil Engineer: One who possesses a valid state license as a "Professional Civil Engineer" from the state in which they practice. For this section, the term "surveyor" shall also include Professional Civil Engineers authorized to practice Land Surveying under the laws of the state in which they practice.

**PART 2 - EXECUTION**

- A. The surveyor shall research available public records for all mapping, monumentation, plats, governmental surveys etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, storm drains, water lines, electrical conduits etc.
- B. The survey shall be performed on the ground in accordance with the current "Accuracy Standards for Land Title Surveys" as adopted, from time to time, by the American Congress on Surveying and Mapping, the National Society of Professional Surveyors, and the American Land Title Association.
- C. The surveyor, when applicable, shall consult with the Contracting Officer to determine scale of plat or map and size of drawings.
- D. The surveyor shall furnish two sets of prints of the plat or map of survey and the electronic CADD file for 3D software. The sheets shall be numbered, the total number of sheets indicated and the match lines shall be shown on each sheet.
- E. On the plat or map, the survey boundary shall be drawn to a scale not larger than 1 inch = 30 feet (25 mm = 9 m), with the scale clearly indicated. A graphic scale, shown in feet or meters or both, shall be included. A north arrow shall be shown and when practicable, the plat or map of survey shall be oriented so that north is at the top of the

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drawing. Symbols or abbreviations used shall be identified on the face of the plat or map by use of a legend or other means. Supplementary or exaggerated diagrams shall be presented accurately on the plat or map where dimensional data is too small to be shown clearly at full scale. The plat or map shall be 30 by 42 inches.

F. The survey shall contain the following applicable information:

1. The name, address, telephone number, and signature of the Professional Land Surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.
2. The survey drawing(s) submitted shall bear the following certification adjacent to the Engineer's official seal:  
"I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to furnish complete and accurate information."
3. Vicinity map showing the property surveyed in reference to nearby highways or major street intersections.
4. Flood zone designation (with proper annotation based on Federal Flood Insurance Rate Maps or the state or local equivalent, by scaled map location and graphic plotting only).
5. Land area as defined by the boundaries of the legal description of the surveyed premises, including legal description of the land.
6. All data necessary to indicate the mathematical dimensions and relationships of the boundary represented by bearings and distances, and the length and radius of each curve, together with elements necessary to mathematically define each curve. The point of beginning of the surveyor's description and the basis of bearings shall also be shown.
7. When record bearings or angles or distances differ from measured bearings, angles or distances, both record and measured bearings, angles, and distances shall be clearly indicated. If the record description fails to form a mathematically closed figure, the surveyor shall so indicate.
8. Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets in urban or suburban areas, together with recovered lot corners and evidence of lot

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- corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of streets and highways abutting the property surveyed and widths of rights of way shall be given. Observable evidence of access (or lack thereof) to such abutting streets or highways shall be indicated. Observable evidence of private roads shall be so indicated. Streets abutting the premises, which have been described in Record Documents, but not physically opened, shall be shown and so noted.
9. The identifying titles of all recorded plats, filed maps, right of way maps, or similar documents which the survey represents, wholly or in part, with their appropriate recording data. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document which has been delivered to the surveyor. Contiguity, gores, and overlaps along the exterior boundaries of the survey premises, where ascertainable from field evidence or Record Documents, or interior to those exterior boundaries, shall be clearly indicated or noted. Where only a part of a recorded lot or parcel is included in the survey, the balance of the lot or parcel shall be indicated.
  10. All evidence of found monuments shall be shown and noted. All evidence of monuments found beyond the surveyed premises on which establishment of the corners of the survey premises are dependent, and their application related to the survey shall be indicated.
  11. The character of any and all evidence of possession shall be stated and the location of such evidence carefully given in relation to both the measured boundary lines and those established by the record. An absence of notation on the survey shall be presumptive of no observable evidence of possession.
  12. The location of all buildings upon the plot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. If there are no buildings, so state. Proper street numbers shall be shown where available.
  13. All easements evidenced by a Record Document which have been delivered to the surveyor shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this

- affect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads, rights-of-ways, water courses, drains, telephone, telegraph, or electric lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.
14. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of all encroaching structural appurtenances and projections, such as fire escapes, bay windows, windows and doors that open out, flue pipes, stoops, eaves, cornices, areaways, stoops, trip, etc., by or on adjoining property or on abutting streets, on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.
  15. Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the surveyor must so indicate on the plat or map with appropriate measurements.
  16. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the points of curvature and tangency by station. Include all curve data as well a location of radius and vertex points. Elevations on 50 foot (15 m) centers on centerline of roads, edges of roads and top and bottom of curbs.
  17. As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.
  18. Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown. When a property surveyed

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- contains a natural water boundary, the surveyor shall measure the location of the boundary according to appropriate surveying methods and note on the plat or map the date of the measurement and the caveat that the boundary is subject to change due to natural causes and that it may or may not represent the actual location of the limit of title. When the surveyor is aware of changes in such boundaries, the extent of those changes shall be identified.
19. Contours at a minimum interval of 1 foot (305 mm). Base vertical control on the permanent (not assumed) National Geodetic Survey (NGS) or VA Medical Center Bench Mark. Note location, description and datum. Surveyor to establish three benchmarks on the property that are based on the NGS. Horizontal and vertical control to be provided on each control point.
  20. Identify and show if possible, setback, height, and floor space area restrictions of record or disclosed by applicable zoning or building codes (in addition to those recorded in subdivision maps). If none, so state.
  21. Exterior dimensions of all buildings at ground level. Show square footage of exterior footprint of all buildings at ground level and gross floor area of all buildings.
  22. Measured height of all buildings above grade at a defined location. If no defined location is provided, the point of measurement shall be shown.
  23. Elevations at each entrance to buildings, service docks, building corners, steps, ramps and grade slabs.
  24. Substantial, visible improvements (in addition to buildings) such as signs, parking areas, swimming pools, etc.
  25. Parking areas and, if striped, the striping and the type (eg. handicapped, motorcycle, regular, etc.) and number of parking spaces.
  26. Indication of access to a public way such as curb cuts and driveways.
  27. Location of utilities existing on or serving the surveyed property as determined by observed evidence together with plans and markings provided by utility companies, and other appropriate sources (with references as to the source of information. Locate and

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- show all fire hydrants located within 500 feet of the subject property.
28. Railroad tracks and sidings.
  29. Manholes, catch basins, valve vaults or other surface indications of subterranean uses together with depths or invert elevations, sizes, and materials of all pipes.
  30. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.
  31. Utility company installations on the surveyed premises.
  32. Names of adjoining owners of platted lands together with zoning classification.
  33. Observable evidence of earth moving work, building construction or building additions within recent months.
  34. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction.  
Observable evidence of recent street or sidewalk construction or repairs.
  35. Observable evidence of site use as a solid waste dump, sump or sanitary landfill.
  36. All trees with a minimum diameter of 6" measured at 48" above the base of the tree. Perimeter outline only of thickly wooded areas with description of predominant vegetation.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition for portions of buildings, utilities and other structures.

**1.2 RELATED WORK:**

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).
- B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
- I. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS,

Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT,  
UTILITIES AND IMPROVEMENTS.

F. In addition to previously listed fire and safety rules to be observed  
in performance of work, include following:

3. Wherever a cutting torch or other equipment that might cause a fire  
is used, provide and maintain fire extinguishers nearby ready for  
immediate use. Instruct all possible users in use of fire  
extinguishers.

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 Contracting Officer  
Representative. The Contractor shall coordinate the work of this  
section with all other work and shall construct and maintain shoring,  
bracing, and supports as required. The Contractor shall ensure that  
structural elements are not overloaded and shall be responsible for  
increasing structural supports or adding new supports as may be  
required as a result of any cutting, removal, or demolition work  
performed under this contract. Do not overload structural elements.  
Provide new supports and reinforcement for existing construction  
weakened by demolition or removal works. Repairs, reinforcement, or  
structural replacement must have Contracting Officer Representative'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.

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

**PART 3 - EXECUTION**

**3.1 DEMOLITION:**

B. Debris, including brick, concrete, stone, metals and similar materials  
shall become property of Contractor and shall be disposed of by him  
daily, off the Medical Center to avoid accumulation at the demolition



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site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer Representative.

- D. Remove and legally dispose of all materials. 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.

**3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Contracting Officer Representative. 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.

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**SECTION 03 30 53**  
**(SHORT-FORM) CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Cast-in-place structural concrete.
2. Slab on grade infill.
3. Suspended slab infill on metal deck.
4. Foundation wall infill.
5. Concrete for metal pan stair fill.
6. Footings.
7. Equipment pads.
8. Preparation of existing surfaces to receive concrete.
9. Preparation of existing surface to received concrete topping.

**1.2 RELATED REQUIREMENTS**

**1.3 APPLICABLE PUBLICATIONS**

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

B. American Concrete Institute (ACI):

1. 117-15 - Tolerances for Concrete Construction, Materials and Commentary.
2. 117M-10(R2015) - Tolerances for Concrete Construction, Materials and Commentary.
3. 211.1-91(R2009) - Proportions for Normal, Heavyweight, and Mass Concrete.
4. 211.2-98(R2004) - Selecting Proportions for Structural Lightweight Concrete.
5. 301/310M-10 - Structural Concrete.
6. 305.1-14 - Hot Weather Concreting.
7. 306.1-90(R2002) - Cold Weather Concreting.
8. 318/318M-14 - Building Code Requirements for Structural Concrete and SP-66-04-ACI Detailing Manual.
9. 347-04 - Guide to Formwork for Concrete.

C. ASTM International (ASTM):

1. A615/A615M-15a1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

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2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
  3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  4. C33/C33M-13 - Concrete Aggregates.
  5. C39/C39M-15a - Compressive Strength of Cylindrical Concrete Specimens.
  6. C94/C94M-15a - Ready-Mixed Concrete.
  7. C143/C143M-15 - Slump of Hydraulic Cement Concrete.
  8. C150/C150M-15 - Portland Cement.
  9. C171-07 - Sheet Material for Curing Concrete.
  10. C192/C192M-15 - Making and Curing Concrete Test Specimens in the Laboratory.
  11. C219-14a - Terminology Relating to Hydraulic Cement.
  12. C260/C260M-10a - Air-Entraining Admixtures for Concrete.
  13. C330/C330M-14 - Lightweight Aggregates for Structural Concrete.
  14. C494/C494M-15 - Chemical Admixtures for Concrete.
  15. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  16. C881/C881M-14 - Epoxy-Resin-Base Bonding Systems for Concrete.
  17. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
  18. C1240-15 - Silica Fume Used in Cementitious Mixtures.
  19. D1751-04(2013el) - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
  20. E1155-14 - Determining FF Floor Flatness and FL Floor Levelness Numbers.
  21. E1745-11 - Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- D. International Concrete Repair Institute:
1. 310.2R-2013 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

#### **1.4 SUBMITTALS**

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

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1. Large scale drawings of reinforcing steel.
- C. Manufacturer's Literature and Data:
  1. Concrete Mix Design.
  2. Air-entraining admixture, chemical admixtures, and curing compounds.
  3. Indicate manufacturer's recommendation for each application.
- D. Sustainable Construction Submittals:
  1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- E. Certificates: Certify products comply with specifications.
  - a. Each ready mix concrete batch delivered to site.

#### **1.5 DELIVERY**

- A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM C94/C94M.

#### **1.6 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Portland Cement: ASTM C150/C150M, Type I or II.
- B. Coarse Aggregate: ASTM C33/C33M.
  1. Size 467 for footings and walls over 300 mm (12 inches) thick.
  2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
  3. Size 67 for other applications.
- C. Fine Aggregate: ASTM C33/C33M.
- D. Lightweight Aggregate for Structural Concrete: ASTM C330/C330M, Table 1.
- E. Mixing Water: Fresh, clean, and potable.
- F. Air-Entraining Admixture: ASTM C260/C260M.
- G. Chemical Admixtures: ASTM C494/C494M.
- H. Vapor Barrier: ASTM E1745, Class A with a minimum puncture resistance of 2200 g (3000 lbs.); minimum 0.38 mm (15 mil) thick.
- I. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, deformed. See Structural Drawings for grade.

J. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer, of grade or type suitable to obtain type of finish specified.

1. Plywood: Exterior grade, free of defects and patches on contact surface.

2. Lumber: Sound, grade-marked, S4S stress graded softwood.

3. Form coating: As recommended by Contractor.

K. Expansion Joint Filler: ASTM D1751.

L. Sheet Materials for Curing Concrete: ASTM C171.

M. Abrasive Aggregates: Aluminum oxide grains or emery grits.

N. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.

O. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

## **2.2 ACCESSORIES**

A. Bonding Agent: ASTM C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

C. Water Stops: Rubber base with self-healing properties. Expanding clay based products not acceptable.

D. Weeps: Geotextile type as recommended by Contractor and approved by Contracting Officer.

## **2.3 CONCRETE MIXES**

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Compressive strength at 28 days: minimum 30 MPa (4,000 psi)

C. Submit mix design and results of compression tests to the Contracting Officer for his evaluation. Identify all materials, including admixtures, making-up the concrete.

D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM C143.

E. Cement and Water Factor (See Table I):

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/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
25 (3000)1,2	300 (500)	*	310 (520)	*
Footnotes: 1. If trial mixes are used, achieve a compressive strength 8.3 MPa (1 200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve a compressive strength 9.7 MPa (1,400 psi) in excess of f'c. 2. Lightweight Structural Concrete: Pump mixes may require higher cement values as specified in ACI 318/318M. 3. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44. * Laboratory Determined according to ACI 211.1 for normal weight concrete or ACI 211.2 for lightweight structural concrete.				

F. Air-entrainment as specified, and conform with the following for air content table:

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
10 mm (3/8 inches)	6 Moderate exposure; 7.5 severe exposure
13 mm (1/2 inches)	5.5 Moderate exposure; 7 severe exposure
19 mm (3/4 inches)	5 Moderate exposure; 6 severe exposure
25 mm (1 inches)	4.5 Moderate exposure; 6 severe exposure

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
40 mm (1 1/2 inches)	4.5 Moderate exposure; 5.5 severe exposure

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

- A. Store, batch, and mix materials according to ASTM C94/C94M.
1. Job-Mixed: Batch mix concrete in stationary mixers as specified in ASTM C94/C94M.
  2. Ready-Mixed Concrete: Comply with ASTM C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
  3. Mixing Structural Lightweight Concrete: Charge mixer with 2/3 of total mixing water and total aggregate for each batch. Mix ingredients minimum 30 seconds in stationary mixer or minimum 10 revolutions at mixing speed in truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.
  4. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK**

- A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.
- B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.
- C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.
- D. Treating and Wetting: Treat or wet concrete contact surfaces:
1. Prevent water from accumulating and remaining within forms.

2. Clean and coat removable metal forms with light form oil before reinforcement is placed.
3. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
4. Prevent water from accumulating and remaining within forms.
- E. Inserts, Sleeves, and Similar Items: Install flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.
- F. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.
- G. Adjust or replace completed work exceeding specified tolerances before placing concrete.

### **3.2 REINFORCEMENT**

- A. Install concrete reinforcement according to ACI 318 and ACI SP-66.
- B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.
- C. Drilling for Dowels in Existing Concrete: Use sharp bits, drill hole slightly oversize, fill with epoxy grout, inset the dowel, and remove excess epoxy.

### **3.3 VAPOR BARRIER**

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
- B. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.
- C. Patch punctures and tears.

### **3.4 PLACING CONCRETE**

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.
- B. Install screeds at required elevations for concrete slabs.
- C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.



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1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.
- D. Place structural concrete according to ACI 301 and ACI 318.
- E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.
- F. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.
- G. Concrete Fill in Stair Tread and Landing Pans: Coat steel with bonding agent and fill pans with concrete. Reinforce with 2 inch by 2 inch by 1.6 mm (0.06 inch) welded wire mesh at midpoint.
- H. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.
- I. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.
  1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

### **3.5 TOLERANCES**

- A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.
  1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
  2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

### **3.6 PROTECTION AND CURING**

- A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.
- B. Curing Methods: Cure concrete with curing compound using wet method with sheets.
- C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

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1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

D. Concrete Flatwork Curing:

1. Install sheet materials according to the manufacturer's instructions.
  - a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

**3.7 FORM REMOVAL**

- A. Maintain forms in place until concrete is self-supporting, with construction operation loads.
- B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.
- C. Finish to match adjacent surfaces.

**3.8 FINISHES**

- A. Vertical and Overhead Surface Finishes:
  1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
  2. Surfaces Exposed in Unfinished Areas: As-cast; no additional finishing required.
    - a. Mechanical rooms.
    - b. Electrical rooms.
  3. Surfaces Exposed to View Scheduled for Paint Finish: Remove fins, burrs and similar projections by mechanical means approved by Contracting Officer's Representative flush with adjacent surface. Lightly rub with fine abrasive stone or hone. Use ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
  4. Surfaces Exposed to View in Finished Areas: Grout finish, unless otherwise shown, for uniform color and smooth finish treated.
    - a. Remove laitance, fins and burrs.
    - b. Scrub concrete with wire brushes. Clean stained concrete surfaces with hone or stone.

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- c. Apply grout composed of 1 part Portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until pits and honeycomb are filled.
- d. After grout has hardened, but is still plastic, remove surplus grout with sponge rubber float and by rubbing with clean burlap.
- e. In hot, dry weather fog spray surfaces with water to keep grout wet during setting period. Complete finished areas in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

- 1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.
- 2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.
- 3. Float Finish: Interior and exterior ramps, interior stair treads, and platforms, both equipment pads, and slabs to receive non-cementitious materials, except as specified.
  - a. Screen and float to smooth dense finish.
  - b. After first floating, while surface is still soft, check surfaces for alignment using straightedge or template. Correct high spots by cutting down with trowel or similar tool. Correct low spots by filling in with material same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat slab to uniform sandy texture.
- 4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and other monolithic concrete floor slabs exposed to view without other finish indicated or specified.
  - a. Delay final steel troweling to secure smooth, dense surface, usually when surface can no longer be dented by fingers. During final troweling, tilt steel trowel at slight angle and exert heavy pressure on trowel to compact cement paste and form dense, smooth surface.

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- b. Finished surface: Free from trowel marks. Uniform in texture and appearance.
- 5. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.
- 6. Finished Slab Flatness (FF) and Levelness (FL):
  - a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.
  - b. Test flatness and levelness according to ASTM E1155.

### **3.9 SURFACE TREATMENTS**

- A. Mix and apply the following surface treatments according to manufacturer's instructions.
  - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Liquid Densifier/Sealer: Use for exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- C. Slip Resistant Finish:
  - 1. Except where safety nosing and tread coverings are shown, apply abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms.
    - a. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

### **3.10 APPLIED TOPPING**

- A. Install concrete topping with thickness and strength shown with only enough water to ensure stiff, workable, plastic mix.
- B. Continuously place applied topping until entire area is complete, struck off with straightedge, compact by rolling or tamping, float and steel trowel to hard smooth finish.

### **3.11 RESURFACING FLOORS**

- A. Remove existing flooring by abrasive blasting or grinding, in areas to receive resurfacing, to expose existing structural slab. Achieve a

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surface profile of 2 to 4 according to ICRI 310.2R for the condition found at Site.

- B. Prepare exposed structural slab surface by cleaning, wetting, and applying adhesive according to manufacturer's instructions as specified in the flooring section.

**3.12 FOUNDATION WALL INFILL**

- A. Install air-entrained concrete at foundation wall infill, as indicated.
- B. Install expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves, as indicated.
- C. Finish exposed surfaces to match adjacent concrete surfaces, new or existing.
- D. Place porous backfill, as indicated on Drawings.

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Concrete and masonry sections.

**1.2 RELATED REQUIREMENTS**

A. Mortar used in Section:

1. Section 04 20 00, UNIT MASONRY.

**1.3 APPLICABLE PUBLICATIONS**

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

B. ASTM International (ASTM):

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

**1.4 SUBMITTALS**

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

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.
3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.

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6. Color admixture.

D. Qualifications: Substantiate qualifications comply with specifications.

1. Testing laboratory.

### **1.5 QUALITY ASSURANCE**

A. Preconstruction Testing:

1. Engage independent testing laboratory to tests and submit reports.

a. Deliver samples to laboratory in number and quantity required for testing.

2. Test mortar and materials specified.

3. Mortar:

a. Test for compressive strength and water retention according to ASTM C270/C270M.

b. Minimum Mortar compressive strengths 28 days:

1) Type M: 17.2 MPa (2,500 psi).

2) Type S: 12.4 MPa (1,800 psi).

3) Type N: 5.1 MPa (750 psi).

4. Non Staining Cement: Test for water soluble alkali.

a. Water Soluble Alkali: Maximum 0.03 percent.

5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

### **1.6 DELIVERY**

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

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

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

### **1.7 STORAGE AND HANDLING**

A. Store masonry materials under waterproof covers on planking clear of ground.

1. Protect loose, bulk materials from contamination.

B. Protect products from damage during handling and construction operations.

### **1.8 WARRANTY**

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Hydrated Lime: ASTM C207/C207M, Type S.
- B. Aggregate for Masonry Mortar: ASTM C144/C144M 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 except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
  - 3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.
- C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.
- D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.
  - 1. Use white masonry cement whenever white mortar is specified.
- E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.
- F. Portland Cement: ASTM C150/C150M, Type I.
  - 1. Use white Portland cement wherever white mortar is specified.
- G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.
- H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

### **2.2 MIXES**

- A. Pointing Mortar for New Work:
  - 1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
  - 2. Pointing Mortar for Glazed Structural Facing Tile:
    - a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.
- B. Masonry Mortar: ASTM C270/C270M.
  - 1. Admixtures:
    - a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
    - b. Do not use antifreeze compounds.
- C. Colored Mortar:



1. Maintain uniform mortar color for exposed work, throughout.
  2. Match mortar color in approved sample
  3. Alteration Work Mortar Color: Match existing mortar.
- D. Color Admixtures:
1. Proportion as specified by manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

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

#### **3.2 MIXING**

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

#### **3.3 MORTARING**

- A. Type M Mortar: Use for precast concrete panels,
- B. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered)
- C. Brick Veneer Over Frame Back Up Walls: Use Type S Portland cement-lime mortar.
- D. Type N Mortar: Use for other masonry work.
- E. Type N Mortar: Use for pointing items and tuck pointing specified.

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services -  
Prevention and Control Legionella  
Project Number: 549-15-517  
Submittal - 100% Construction Documents 06/15/2016

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### **3.4 FIELD QUALITY CONTROL**

- A. Field Tests: Performed by testing laboratory.
  - 1. Take and test samples during progress of work according to  
ASTM C780/C780M.
  - 2. Testing is contractor provided.

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

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

**1.2 RELATED REQUIREMENTS**

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

**1.3 APPLICABLE PUBLICATIONS**

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

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

#### **1.4 SUBMITTALS**

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

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#### **1.5 QUALITY ASSURANCE**

- A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.
  - 1. Not required

#### **1.6 DELIVERY**

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

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

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

#### **1.8 FIELD CONDITIONS**

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

#### **1.9 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM PERFORMANCE**

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

#### **2.2 PRODUCTS - GENERAL**

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run
- C. Sustainable Construction Requirements:
  - 1.

#### **2.3 UNIT MASONRY PRODUCTS**

- A. Brick:
  - 1. Face Brick:
    - a. ASTM C216, Grade SW, Type FBS.

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b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.

c. Size:

1) Modular.

**B. Concrete Masonry Units (CMU):**

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

**C. Concrete Brick: ASTM C55.**

**2.4 ANCHORS, TIES, AND REINFORCEMENT**

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

**B. Joint Reinforcement:**

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

## **2.5 ACCESSORIES**

- A. Weeps:
  - 1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
  - 2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.
  - 3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.
- B. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.
- C. Preformed Compressible Joint Filler:
  - 1. Thickness and depth to fill joint.
  - 2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
  - 3. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.
- D. Masonry Cleaner:
  - 1. Detergent type cleaner selected for each type masonry.
  - 2. Acid cleaners are not acceptable.
  - 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- E. 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.
- F. Welding Materials: AWS D1.4/D1.4M, type to suit application.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings.
  - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Keep finish work free from mortar smears or spatters, and leave neat and clean.

C. Wall Openings:

1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:

1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:

1. Extend partitions minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
  - a. Full height partitions, and fire partitions and smoke partitions indicated on drawings.
  - b. Both walls at expansion joints.
  - c. Corridor walls.
  - d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
  - e. Walls at refrigerator space.
  - f. Reinforced masonry partitions.
3. Extend finished masonry partitions minimum 100 mm (4 inches) above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:

1. Lintels are not required for openings less than 1000 mm (40 inches) wide that have hollow metal frames.
2. Openings 1025 mm (41 inches) wide to 1600 mm (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam filled with grout and reinforced with



- one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
3. Use steel lintels, for openings greater than 1600 mm (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
  4. box.
  5. Lintel Bearing Length: Minimum 100 mm (4 inches) at both ends.
- G. Wall, Furring, and Partition Units:
1. Lay out field units to provide one-half running bond, unless indicated otherwise.
  2. Align head joints of alternate vertical courses.
  3. At sides of openings, balance head joints in each course on vertical center lines of openings.
  4. Minimum Masonry Unit Length: 100 mm (4 inches).
  5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
  6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.
  7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.
- H. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.
- I. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- J. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- 1.
- 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 indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

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

N. Minimum Curing Times Before Removing Shores and Forms:

1. Girders and Beams: 10 days.
2. Slabs: 7 days.
3. Reinforced Masonry Soffits: 7 days.

### **3.2 INSTALLATION - ANCHORAGE**

A. Masonry Facing to Backup and Cavity Wall Ties:

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

### **3.3 INSTALLATION - REINFORCEMENT**

A. Joint Reinforcement:

1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.

4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.
5. Wherever brick masonry is backed up with stacked bond masonry, install multiple wythe joint reinforcement in every two courses of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:

1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
2. Bond Beams:
  - a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
  - b. Brake bond beams only at expansion joints and at control joints, if shown.
3. Grout openings:
  - a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
  - b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
  - c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

**3.4 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS**

- A. Provide brick expansion joint (EJ) and CMU control joints (CJ) where indicated on drawings.
- B. Keep joint free of mortar and other debris.
- C. Joints Occur In Masonry Walls:
  1. Install preformed compressible joint filler in brick wythe.
  2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.
- 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. Alter Structural clay tile units to accommodate shear key flanges.

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

### **3.5 INSTALLATION - BRICKWORK**

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

1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Solid Exterior Walls:

1. Build with 100 mm (4 inches) of nominal thick facing brick.
2. Construct solid brick jambs minimum 20 mm (0.81 inches) wide at exterior wall openings and at recesses, except where exposed concrete unit backup is shown.
3. Do not install full bonding headers.
4. Coordinate with building insulation for thickness of insulation and allowance of air space behind exterior wythe.

F. Cavity Walls:

1. Keep air space clean of mortar accumulations and debris.
2. Lay the interior wythe of the masonry wall full height where air barrier is required on cavity face. Coordinate to install air barrier before laying outer wythe.

### **3.6 INSTALLATION - CONCRETE MASONRY UNITS**

A. Types and Uses:

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

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.

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19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

### **3.7 POINTING**

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

### **3.8 GROUTING**

- A. Preparation:
  1. Clean grout space of mortar droppings before placing grout.
  2. Close cleanouts.
  3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
  4. Verify reinforcing bars are installed as indicated on drawings.
- B. Placing:
  1. Place grout in grout space in lifts as specified.
  2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
  3. Do not slush with mortar or use mortar with grout.
  4. Interruptions:
    - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
    - b. Grout from dam to dam on high lift method.
    - c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
- C. Low Lift Method:
  1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.

2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

D. High Lift Method:

1. Do not pour grout until masonry wall has cured minimum of 4 hours.
2. Place grout in 1.5 m (5 feet) maximum lifts.
3. Exception:
  - a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
  - b. Masonry has cured minimum of 4 hours.
  - c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
  - d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

**3.9 PLACING REINFORCEMENT**

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.
- C. For columns, piers and pilasters, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.
- D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.



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- E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.
- F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.
- G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- H. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.
- J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.
- K.

1.

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

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
  - 1. 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.

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2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontally reinforced beams (bond beams) are indicated on drawings, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:

1. Use CMU units of size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

F. Grouting:

1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At Contractor's option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.

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

H. High-Lift Grouting:

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

11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
17. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

### **3.11 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:
- B. Maximum variation from plumb:
  - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
  - 2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
  - 3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
  - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  - 2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
  - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
  - 2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
  - 1. Minus 6 mm (1/4 inch).
  - 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
  - 1. Accurate to minus 0 mm (0 inch).
  - 2. Plus 6 mm (1/4 inch).

### **3.12 CLEANING AND REPAIR**

- A. General:
  - 1. Clean exposed masonry surfaces on completion.
  - 2. Protect adjoining construction materials and landscaping during cleaning operations.
  - 3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
  - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- B. Brickwork:
  - 1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
  - 2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
  - 3. Remove traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:

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

**3.13 FIELD QUALITY CONTROL**

A. Water Penetration Testing:

1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.
2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.
4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.
5. Make water test at following locations:
  - a. Eight places

- - E N D - -

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Structural steel shapes, plates, and bars.
2. Structural pipe.
3. Bolts, nuts, and washers.

**1.2 RELATED REQUIREMENTS**

- A. Painting: Section 09 91 00, PAINTING.

**1.3 APPLICABLE PUBLICATIONS**

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

B. American Institute of Steel Construction (AISC):

1. AISC Manual - Steel Construction Manual, 14th Ed.
2. 303-10 - Code of Structural Steel Buildings and Bridges.
3. 360-10: Specification for Structural Steel Buildings.

C. The American Society of Mechanical Engineers (ASME):

1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):

1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):

1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
2. A36/A36M-14 - Carbon Structural Steel.
3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

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8. A325-14 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  9. A490-14a - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
  10. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
  11. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
  12. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
  13. A992/A992M-15 - Structural Shapes.
  14. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
- F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.
- G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.
- H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
  2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.
- I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM A325 or A490 Bolts.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.
- C. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- D. Test Reports: Certify products comply with specifications.
1. Welders' qualifying tests.
- E. Certificates: Certify each product complies with specifications.



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1. Structural steel.
  2. Steel connections.
  3. Welding materials.
  4. Shop coat primer paint.
- F. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator
  2. Installer
  3. Welders and welding procedures.

#### **1.5 QUALITY ASSURANCE**

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

#### **1.6 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM PERFORMANCE**

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.
- B. Design structural steel framing connections complying with specified performance:
1. Load Capacity: Account for connection and member loads and eccentricities.

2. Configuration: 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 details shown on drawings, supplementing where necessary. The details shown on 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 Contracting Officer Representative 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 Contracting Officer's Representative. 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.

## **2.2 MATERIALS**

### **A. W-Shapes:**

1. ASTM A992/A992M.
2. ASTM A572/A572M; Grade 50
3. ASTM A529; Grade /50

### **B. S -Shapes:**

1. ASTM A36/A36M.
2. ASTM A572/A572M; Grade 50
3. ASTM A529; Grade 50

### **C. Channel and Angles:**

1. ASTM A36/A36M.
2. ASTM A572/A572M; Grade 50
3. ASTM A529; Grade 50

### **D. Plates and Bars:**

1. ASTM A36/A36M.
2. ASTM A572/A572M; Grade 50
3. ASTM A529; Grade 50

### **E. Hollow Structural Sections:**

1. ASTM A500/A500M.
2. ASTM A501/A501M.

- F. Structural Pipe: ASTM A53/A53M, Grade B.
- G. Bolts, Nuts and Washers plain finish
  - 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: ASME B18.22.1.
- H. Welding Materials: AWS D1.1, type to suit application.

## **2.3 PRODUCTS - GENERAL**

- 1.

## **2.4 FABRICATION**

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

## **2.5 FINISHES**

- A. Shop Priming:
  - 1. Prime paint structural steel according to AISC 303, Section 6.
    - a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.
- B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.
- C. Do not paint:
  - 1. Surfaces within 50 mm (2 inches) of field welded joints.
  - 2. Surfaces indicated to be encased in concrete.
  - 3. Surfaces receiving sprayed on fireproofing.
  - 4. Beam top flanges receiving shear connector studs applied.

## **2.6 ACCESSORIES**

- A. General: Shop paint steel according to AISC 303, Section 6.
- B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.

## **PART 3 - EXECUTION**

### **3.1 ERECTION**

- A. Erect structural steel according to AISC 303 and AISC 360.
- B. Set structural steel accurately at locations and elevations indicated on drawings.
- C. Maintain erection tolerances of structural steel within AISC 303 requirements.
  - 1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.
- D. Weld and bolt connections as specified for shop connections.

### **3.2 FIELD PAINTING**

- A. After welding, clean and prime weld areas to match adjacent finish.
- B. Touch-up primer damaged by construction operations.
- C. Finish Painting: As specified in Section 09 91 00, PAINTING.

### **3.3 FIELD QUALITY CONTROL**

- A. Record Survey:
  - 1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.
  - 2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
  - 3. Identify deviations from allowable tolerances specified in AISC Manual.

- - 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.

2. Frames:
3. Guards
4. Covers and Frames for Pits and Trenches.
5. Gratings
6. Loose Lintels
7. Shelf Angles
8. Gas Racks
9. Plate Door Sill
10. Safety Nosings
11. Ladders
12. Railings:
13. Catwalks and Platforms
14. Trap Doors with Ceiling Hatch
15. Sidewalk Access Doors
16. Screened Access Doors
17. Steel Counter or Bench Top Frame and Leg

**1.2 RELATED WORK**

C. Prime and finish painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

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

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.

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

#### **1.4 QUALITY ASSURANCE**

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

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):  
B18.6.1-97.....Wood Screws  
B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):  
A36/A36M-12.....Structural Steel  
A47-99(R2009).....Malleable Iron Castings  
A48-03(R2012).....Gray Iron Castings  
A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless  
A123-12.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services -  
Prevention and Control Legionella  
Project Number: 549-15-517  
Submittal - 100% Construction Documents 06/15/2016

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- A240/A240M-14.....Standard Specification for Chromium and  
Chromium-Nickel Stainless Steel Plate, Sheet  
and Strip for Pressure Vessels and for General  
Applications.
- A269-10.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
- A307-12.....Carbon Steel Bolts and Studs, 60,000 PSI  
Tensile Strength
- A391/A391M-07(R2012)....Grade 80 Alloy Steel Chain
- A786/A786M-09.....Rolled Steel Floor Plate
- B221-13.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B456-11.....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-13.....Packaged Dry, Hydraulic-Cement Grout  
(Nonshrink)
- D3656-13.....Insect Screening and Louver Cloth Woven from  
Vinyl-Coated Glass Yarns
- F436-11.....Hardened Steel Washers
- F468-06(R2012).....Nonferrous Bolts, Hex Cap Screws, Socket Head  
Cap Screws and Studs for General Use
- F593-13.....Stainless Steel Bolts, Hex Cap Screws, and  
Studs
- F1667-11.....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

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SP 2-04.....No. 2, Hand Tool Cleaning

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

G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

**PART 2 - PRODUCTS**

**2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
- D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m<sup>2</sup> (100 pounds per square foot).

**2.2 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Floor Plate:
  - 1. Steel ASTM A786.
  - 2. Aluminum: ASTM B632.
- 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



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- 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.

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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

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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.

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- 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 AMP 500 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.

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- 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.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

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.

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4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

## **2.6 FRAMES**

### **C. Frames for Breech Opening:**

1. Fabricate from steel channels, or combination of steel plates and angles to size and contour shown.
2. Weld strap anchors on back of frame at not over 600 mm (2 feet) on centers for concrete or masonry openings.

## **2.7 GUARDS**

### **A**

### **D. Edge Guard Angles for Openings in slabs.**

1. Fabricate from steel angles of sizes and with anchorage shown.
2. Where size of angle is not shown, provide 50 x 50 x 6 mm (2 x 2 x 1/4 inch) steel angle with 32 x 5 mm (1-1/4 x 3/16 inch) strap anchors, welded to back.
3. Miter or butt angles at corners and weld.
4. Use one anchor near end and three feet on centers between end anchors.

## **2.8 COVERS AND FRAMES FOR PITS AND TRENCHES**

### **A. Fabricate covers to support live loads specified.**

### **B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.**

### **C. Steel Covers:**

1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
2. Provide clearance at all sides to permit easy removal of covers.
3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
4. Drill covers for flat head countersunk screws.

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5. Make cover sections not to exceed 2.3 m<sup>2</sup> (25 square feet) in area and 90 kg (200 pounds) in weight.
6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet) or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.

E. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
5. Drill and tap frames for screw anchors where plate covers occur.

**2.9 GRATINGS**

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.
- C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
- D. Fabricate in sections not to exceed 2.3 m<sup>2</sup> (25 square feet) in area and 90 kg (200 pounds) in weight.
- E. Fabricate sections of grating with end-banding bars.
- F. Fabricate angle frames and supports, including anchorage as shown.
  1. Fabricate intermediate supporting members from "T's" or angles.
  2. Locate intermediate supports to support grating section edges.

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3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

G.

## **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.

## **2.11 SHELF ANGLES**

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.



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- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

## **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. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
  - 2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.

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3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

C. Ladder Rungs:

1. Fabricate from 25 mm (one inch) diameter steel bars.
2. Fabricate so that rungs will extend at least 100 mm (4 inches) into wall with ends turned 50 mm (2 inches), project out from wall 175 mm (7 inches), be 400 mm (16 inches) wide and be designed so that foot cannot slide off end.
3. Galvanized after fabrication, ASTM A123, G-90 rungs for exterior use and for access to pits.

**2.16 CATWALKS**

- A. Fabricate catwalks including platforms, railings, ladders, supports and hangers, and arrangement of members as shown on drawings.
- C. Fabricate steel ladders as specified under paragraph LADDERS unless shown otherwise.
- D. Fabricate steel pipe railings as specified under paragraph RAILINGS.
- E. Catwalk and platforms floor surfaces as shown.
  1. Steel gratings as specified under paragraph gratings, either bar or plank type.
  2. Steel floor plate.
  3. Aluminum floor plate.
- F. 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.

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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. Well Lining:

1. Fabricate well linings, for access through concrete floor slabs and suspended ceilings, from hatch to ceiling hatch or ceiling openings.
2. Use steel sheet and shapes of size and thickness as shown. If not shown use 1.5 mm (0.0598 inch) thick steel sheet.
3. If not shown use 50 x 50 x 6 mm (2 x 2 x 1/4 inch) angle braces from ceiling level on each side angled at 45 degrees to structure above.
4. Use 25 x 25 x 3 mm (1 x 1 x 1/8 inch) angle bottom flange trim welded to well lining where no ceiling hatch occurs.

E. 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.

F. Finish with baked on 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.

**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.

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C. Supports for Wall Mounted items:

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

**3.3 COVERS AND FRAMES FOR PITS AND TRENCHES**

- A. Set frame and cover flush with finish floor.
- B. Secure plates to frame with flat head countersunk screws.
- C. Set gratings loose in drainage trenches or over pits unless shown anchored.

**3.6 OTHER FRAMES**

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

**3.7 GUARDS**

- A. Steel Angle Corner Guards:
  1. Build into masonry as the work progress.
  2. Set into formwork before concrete is placed.
  3. Set angles flush with edge of opening and finish floor or wall or as shown.
  4. At existing construction fasten angle and filler piece to adjoining construction with 16 mm (5/8 inch) diameter by 75 mm (3 inch) long expansion bolts 450 mm (18 inches) on center.
  5. Install Guard Angles at Edges of Trench, Stairwell, Openings in Slab, Dock Leveler, and Overhead Doors where shown.
- B. Channel Guard at Top Edge of Concrete Platforms:
  1. Install in formwork before concrete is placed.
  2. Set channel flush with top of the platform.
- C. Wheel Guards:
  1. Set flanges of wheel guard at least 50 mm (2 inches) into pavement.
  2. Anchor to walls as shown, expansion bolt if not shown.

### **3.8 GRATINGS**

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.
- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

### **3.9 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.

### **3.10 SHELF ANGLES**

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

### **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.

### **3.12 SAFETY NOSINGS**

- A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
  - 1. Exterior concrete steps.
  - 2. Door sills of areaway entrances curbs.
  - 3. Exposed edges of curbs of door sills at transformer and service rooms.
  - 4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.
- B. Install flush with horizontal and vertical surfaces.
- C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

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- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

### **3.13 LADDERS**

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
  - 1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
  - 2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.
- C. Ladder Rungs:
  - 1. Set ladder rungs into formwork before concrete is placed. Build ladder rungs into masonry as the work progresses.
  - 2. Set step portion of rung 150 mm (6 inches) from wall.
  - 3. Space rungs approximately 300 mm (12 inches) on centers.
  - 4. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

### **3.15 CATWALK AND PLATFORMS**

- A. Expansion bolt members to concrete unless shown otherwise.
- B. Bolt or weld structural components together including ladders and stairs to support system.
- C. Weld railings to structural framing.
- D. Bolt or 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.

### **3.19 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.

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services -  
Prevention and Control Legionella  
Project Number: 549-15-517  
Submittal - 100% Construction Documents 06/15/2016

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- C. 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.
- C. Shop Drawings showing framing connection details, fasteners, connections and dimensions.
- D. Manufacturer's Literature and Data:
  - 1. Submit data for lumber, panels, hardware and adhesives.
  - 2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.
- E. Manufacturer's certificate for unmarked lumber.

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

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having

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firmly constructed over hanging roof with sufficient end wall to  
protect lumber from driving rain.

**1.5 QUALITY ASSURANCE:**

- A. Installer: A firm with a minimum of three (3) years' experience in the  
type of work required by this section.

**1.6 GRADING AND MARKINGS:**

- A. Any unmarked lumber or plywood panel for its grade and species will not  
be allowed on VA Construction sites for lumber and material not  
normally grade marked, provide manufacturer's certificates (approved by  
an American Lumber Standards approved agency) attesting that lumber and  
material meet the specified the specified requirements.

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent  
referenced. Publications are referenced in the text by basic  
designation only.
- B. American Forest and Paper Association (AFPA):  
NDS-15.....National Design Specification for Wood  
Construction  
WCD1-01.....Details for 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):  
B18.2.1-12(R2013).....Square and Hex Bolts and Screws  
B18.2.2-10.....Square and Hex Nuts  
B18.6.1-81(R2008).....Wood Screws
- E. American Plywood Association (APA):  
E30-11.....Engineered Wood Construction Guide
- F. ASTM International (ASTM):  
A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) by the Hot Dip  
Process  
C954-11.....Steel Drill Screws for the Application of  
Gypsum Board or Metal Plaster Bases to Steel  
Studs from 0.033 inch (2.24 mm) to 0.112-inch  
(2.84 mm) in thickness

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- C1002-14.....Steel Self-Piercing Tapping Screws for the  
Application of Gypsum Panel Products or Metal  
Plaster Bases to Wood Studs or Metal Studs
- D198-14.....Test Methods of Static Tests of Lumber in  
Structural Sizes
- D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer  
Matrix Composite Materials and Their Laminates
- D2559-12a.....Adhesives for Structural Laminated Wood  
Products for Use Under Exterior (Wet Use)  
Exposure Conditions
- D3498-03(R2011).....Adhesives for Field-Gluing Plywood to Lumber  
Framing for Floor Systems
- D6108-13.....Test Method for Compressive Properties of  
Plastic Lumber and Shapes
- D6109-13.....Test Methods for Flexural Properties of  
Unreinforced and Reinforced Plastic Lumber and  
Related Products
- D6111-13a.....Test Method for Bulk Density and Specific  
Gravity of Plastic Lumber and Shapes by  
Displacement
- D6112-13.....Test Methods for Compressive and Flexural Creep  
and Creep-Rupture of Plastic Lumber and Shapes
- F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for  
General Use
- F1667-13.....Nails, Spikes, and Staples
- G. American Wood Protection Association (AWPA):  
AWPA Book of Standards
- H. Commercial Item Description (CID):  
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self  
Threading Anchors)
- I. Forest Stewardship Council (FSC):  
FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest  
Stewardship
- J. Military Specification (Mil. Spec.):  
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):

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40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

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

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

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems  
(Guards and Handrails)

**PART 2 - PRODUCTS**

**2.1 LUMBER:**

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

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

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

B. Structural Members: Species and grade as listed in the AFPA NDS 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 7584 kPa (1100 PSI).

3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

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D. Sizes:

1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
  - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
  - b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

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 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

**2.3 PLYWOOD:**

- A. Comply with 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:

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1. APA rated Exposure 1 or Exterior; panel grade CD or better.
2. Wall sheathing:
  - a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 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 406 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 610 mm (24 inches) on center.

#### **2.4 STRUCTURAL-USE PANELS:**

- A. Comply with APA E30.
- 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 406 mm (16 inches) on center and 24/0 or greater for supports 610 mm (24 inches) on center.

#### **2.5 ROUGH HARDWARE AND ADHESIVES:**

- A. Anchor Bolts:
  1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
  2. Extend at least 203 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. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers

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

D. Screws:

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

F. Framing and Timber Connectors:

1. Fabricate of ASTM A653/A653M, 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 (3) 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.

**PART 3 - EXECUTION**

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

- A. Conform to applicable requirements of the following:

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3. AFPA WCD1 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 WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
- b. Use special nails with framing connectors.
- c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
- d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
- e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
- f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
- g. Nailing Schedule; Using Common Nails:
  - 1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
  - 2) Bridging to joist, toe nail each end two (2) 8d nails.
  - 3) Ledger strip to beam or girder three (3) 16d nails under each joint.
  - 4) Subflooring or Sheathing:
    - a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
    - b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.
    - c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.



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2. Bolts:
  - a. Fit bolt heads and nuts bearing on wood with washers.
  - b. Countersink bolt heads flush with the surface of nailers.
  - c. Embed in concrete and solid masonry or provide expansion bolts.  
Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
  - d. Provide toggle bolts to hollow masonry or sheet metal.
  - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
  - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
- D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
  1. Install furring, blocking, nailers, and grounds where shown.
  2. Provide longest lengths practicable.
  3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
  4. Layers of Blocking or Plates:
    - a. Stagger end joints between upper and lower pieces.
    - b. Nail at ends and not over 610 mm (24 inches) between ends.
    - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

F.

N. Sheathing:

1. Provide 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 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.

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**SECTION 07 21 13**  
**THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Thermal insulation.
  - a. Board or block insulation at foundation perimeter.
  - b. Batt or blanket insulation at exterior framed and furred walls.
  - c. Board or block insulation at floor assemblies above unconditioned spaces.
  - d. Board or block insulation at masonry cavity walls.
  - e. Loose fill insulation at exterior hollow masonry walls.
2. Acoustical insulation.
  - a. Semi-rigid insulation at interior framed partitions.
  - b. Batt and blanket insulation at interior framed partitions and ceilings .
  - c. Board insulation at interior concrete and masonry partitions.

**1.2 RELATED REQUIREMENTS**

- A. Safing Insulation: Section 07 84 00, FIRESTOPPING.

**1.3 APPLICABLE PUBLICATIONS**

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
1. C516-08(2013)e1 - Vermiculite Loose Fill Thermal Insulation.
  2. C549-06(2012) - Perlite Loose Fill Insulation.
  3. C552-15 - Cellular Glass Thermal Insulation.
  4. C553-13 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  5. C578-15 - Rigid, Cellular Polystyrene Thermal Insulation.
  6. C591-15 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  7. C612-14 - Mineral Fiber Block and Board Thermal Insulation.

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8. C665-12 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
9. C728-15 - Perlite Thermal Insulation Board.
10. C954-15 - 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.
11. C1002-14 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
12. D312/D312M-15 - Asphalt Used in Roofing.
13. E84-15a - Surface Burning Characteristics of Building Materials.
14. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

#### **1.4 SUBMITTALS**

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
  1. Show insulation type, thickness, and R-value for each location.
- C. Manufacturer's Literature and Data:
  1. Description of each product.
  2. Adhesive indicating manufacturer recommendation for each application.
- D. Sustainable Construction Submittals:
  1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
  2. Low Pollutant-Emitting Materials:
    - a. Show volatile organic compound types and quantities.

#### **1.5 DELIVERY**

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

#### **1.6 STORAGE AND HANDLING**

- A. Store products indoors in dry, weathertight facility.

- B. Protect products from damage during handling and construction operations.

#### **1.7 WARRANTY**

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

### **PART 2 - PRODUCTS**

#### **2.1 INSULATION - GENERAL**

- A. Insulation Thickness:
  - 1. Provide thickness required by R-value shown on drawings.
  - 2. Provide thickness indicated when R-value is not shown on drawings.
- B. Insulation Types:
  - 1. Provide one insulation type for each application.

#### **2.2 THERMAL INSULATION**

- A. Exterior Framing or Furring Insulation:
  - 1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
  - 2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

#### **2.3 ACOUSTICAL INSULATION**

- A. Semi Rigid, Batts and Blankets:
  - 1. Widths and lengths to fit tight against framing.
  - 2. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semi rigid unfaced .
    - a. Density: nominal 4.5 pound.
  - 3. Mineral Fiber Batt or Blankets: ASTM C665 unfaced .
  - 4. Maximum Surface Burning Characteristics: ASTM E84.
    - a. Flame Spread Rating: 25.
    - b. Smoke Developed Rating: 450.
- B. Sound Deadening Board:
  - 1. Mineral Fiber Board: ASTM C612, Type IB.
    - a. Thickness: 13 mm (1/2 inch).
  - 2. Perlite Board: ASTM C728.
    - a. Thickness: 13 mm (1/2 inch).

#### **2.4 ACCESSORIES**

- A. Fasteners:

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1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
  - a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
  - b. Adhesive: Type recommended by manufacturer to suit application.
- B. Insulation Adhesive:
  1. Nonflammable type recommended by insulation manufacturer to suit application.
- C. Tape:
  1. Pressure sensitive adhesive on one face.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

#### **3.2 INSTALLATION - GENERAL**

- A. Install products according to manufacturer's instructions and approved submittal drawings.
  1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.
- C. Installboard insulation with joints close and flush, in regular courses, and with end joints staggered.
- D. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.
- E. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

### **3.3 THERMAL INSULATION**

#### **A. Exterior Framing or Furring Insulation:**

1. General:
  - a. Open voids are not acceptable.
  - b. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
  - c. Pack behind outlets, around pipes, ducts, and services encased in walls.
  - d. Hold insulation in place with pressure sensitive tape.
  - e. Lap facing flanges together over framing for continuous surface. Seal penetrations through insulation and facings.
2. Metal Studs:
  - a. Fasten insulation between metal studs, framing, and furring with pressure sensitive tape continuous along flanged edges.
3. Roof Rafters and Floor Joists:
  - a. Friction fit insulation between framing to provide minimum 50 mm (2 inch) air space between insulation and roof sheathing and subfloor.
4. Ceilings and Soffits:
  - a. Metal Framing:
    - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
    - 2) At metal framing and ceilings suspension systems, install insulation above suspended ceilings and metal framing at right angles to main runners and framing.
    - 3) Tape insulation tightly together without gaps. Cover metal framing members with insulation.
  - b. Ceiling Transitions:
    - 1) In areas where suspended ceilings transition to structural ceiling, install blanket or batt insulation.
    - 2) Extend insulation from suspended ceiling to underside of structure above.
    - 3) Secure blanket and batt with continuous cleats to structure above.

### **3.4 ACOUSTICAL INSULATION**

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

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1. Install insulation without voids.
2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
3. Pack behind outlets, around pipes, ducts, and services encased in walls.
4. Hold insulation in place with pressure sensitive tape.
5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
6. Do not compress insulation below required thickness except where embedded items prevent required thickness.

B. Semi Rigid, Batts and Blankets:

1. Semi Rigid Batts and Blankets:
  - a. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedments.
  - b. Metal Framing:
    - 1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
    - 2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.
    - 3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

C. Sound Deadening Board:

1. Secure with screws to metal. Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

**3.5 CLEANING**

- A. Remove excess adhesive before adhesive sets.

**3.6 PROTECTION**

- A. Protect insulation from construction operations.
- B. Repair damage.

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**SECTION 07 61 16**  
**BATTEN SEAM METAL ROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

A. This section specifies the installation of batten seam metal roofing.

**1.2 RELATED WORK:**

B. Sealant: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS:**

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

C. Fabricator's qualifications.

D. Installer qualifications.

E. Manufacturers literature, data, for metal panel, underlayment, sealant and accessories.

F. Submit shop and erection drawings containing data necessary to clearly describe design, materials, sizes, layouts, seam configuration, construction details, provisions for thermal movement, line of panels, fastener sizes and spacings, sealants and installation procedures. Show waterproof connections to adjoining work; show obstruction and penetration details.

G. Samples consisting of 152 mm (6 inch) or 305 mm (12 inch) square specimens of specified metal roofing material.

**1.4 WIND UPLIFT LOADS:**

A. Provide roof assemblies meeting uplift pressures using a basic wind speed of the prevailing regional speeds.

**1.5 QUALITY ASSURANCE:**

A. Fabricator's Qualifications: Company specializing in standing seam metal roofing work with three (3) years' experience in similar size and type of installations. Submit qualifications.

B. Installer: A firm with three (3) years of successful experience with installation of standing seam metal roofing of type and scope equivalent to Work of this Section. Submit qualifications.

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**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. ASTM International (ASTM):
  - B32-08(R2014).....Solder Metal
  - D1970/D1970M-14.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
  - D226/D226M-09.....Asphalt-Saturated Organic Felt Used In Roofing and Waterproofing
  - D227-03.....Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
  - D2822/D2822M-05(R2011)..Asphalt Roofing Cement
  - F1667-13.....Driven Fasteners: Nails, Spikes and Staples
  - E1980-11 .....Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (Seventh Edition - 2012)

**PART 2 - PRODUCTS**

**2.1 STANDING SEAM METAL:**

- B. Finish matching adjacent CLC roofing.

**2.2 BATTENS:**

- A. Metal Batten Caps: 4.9 kg per square meter (16 oz. per square foot).
- B. Wood Batten Strips: Fabricated to size indicated from lumber complying with requirements of 06 10 00, ROUGH CARPENTRY and preservative treated by pressure process using a chemical solution that is non-hygroscopic and non-corrosive to type of standing seam metal roofing.

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**2.3 FLASHING CEMENT:**

- A. ASTM D2822/D2822M, Type I.

**2.4 SOLDER:**

- A. Solder conforming to ASTM B32. Provide muriatic acid flux neutralized with zinc or approved brand of soldering flux as required for use with metals to be soldered.

**2.5 BITUMINOUS COATING:**

- A. Provide cold-applied inert-type noncorrosive compound bituminous coating, nominally free of sulfur components and other deleterious impurities.

**2.6 SEALANT:**

- A. Provide sealant in accordance with CDA A4050 and manufacturer's recommendations. Submit descriptive information.

**2.7 NAILS:**

- A. ASTM F1667, slating nails with large flat heads and needle points.
- B. Nails of sufficient length to penetrate nailer at least 22 mm (7/8-inch).

**2.9 UNDERLAYMENTS:**

- A. Felt Underlayment: No. 30 felt in compliance with ASTM D226/D226M, Type II.
- D. Slip Sheet: Slip sheet to be 0.24 kg per square meter (5 pounds per 100 square foot) rosin sized unsaturated building paper.

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details, dimensions, profiles shown and with applicable requirements and recommendations of the CDA, the SMACNA Manual, and other recognized industry practices. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrate. Comply with material manufacturer's instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roofing surface:

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1. Clean, dry, and debris free before application.
2. Remove protrusions from the deck area.
3. Verify substrate has no voids, damaged, or unsupported areas.
4. Repair voids or unacceptable area before installing membrane.

C. Roofing Felt Underlayment:

1. Install underlayment over solid substrates with horizontal overlaps and endlaps staggered.
2. Lay parallel to ridgeline with 63 mm (2-1/2 inch) sidelaps and 152 mm (6 inch) endlaps.
3. Start application at low point, working up deck laying plies in shingle fashion.
4. Fasten underlayment with roofing nails spaced on 305 mm (12 inch) centers maximum.

E. Slip Sheet:

1. Apply specified slip sheet at time of roof panel installation when underlayment is used that may be in direct contact with and adhere to or adversely impact the underside of roof panels, and as otherwise recommended by the roof panel manufacturer.
2. Paper slip sheets must be installed over the underlayment. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under roofing.
3. Lap joints 50 mm (2 inch) minimum.

F. Form tapered wood batten 76 mm (3 inches) wide at top, 57 mm (2-1/4 inches) wide at bottom and 38 mm (1-1/2 inches) high unless otherwise indicated in construction documents. Secure battens to roof deck construction with lag bolts or wood screws having the heads recessed below the top of the batten. Space battens to suit width of pans.

G. Fabricate:

1. Fabricate pans to create center to center standing and batten seam spacing as indicated on construction documents.
2. Lay sheets of metal formed into pans with sides turned up to top of batten and out 13 mm (1/2-inch) for locking to cover.
3. Form cross seams by forming folds on upper and lower ends.

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4. Stagger cross seams. Slit cross seam at each corner to form a tab.
- G. Form cleats of 50 mm (2-inch) wide 450 g (16 ounce) copper. Place cleats at center of each cross seam and along battens at 305 mm (12 inches) on center.
- H. Eaves and Rakes:
  1. At eaves and rakes which do not abut vertical surfaces, turn roofing sheets over edge of roof sheathing and hook 19 mm (3/4-inch) over a 560 g (20 ounce) cold rolled metal edge strip.
  2. Form edge strip from 2438 to 3048 mm (8 to 10 foot) long pieces with ends butted together.
  3. Secure edge strip to roof deck with nails 101 mm (4 inches) on center.
  4. Do not face nail roofing.
- I. Cover batten with metal. Lock edges together with flanges of pans and mallet down against side of battens.
- J. Ridges and Hips: Provide metal covered battens similar to roof battens.
- K. Cover exposed ends of battens with metal caps locked in place.

### **3.2 JOINING:**

- A. Solder seams where required to produce water tight joints. Remove flux after soldering is completed.
- B. Tin edges of metal required to be soldered with solder for a width of 38 mm (1-1/2 inches).
- D. Make joints for metal over 560 g (20 ounces) weight by lapping, riveting, and soldering. Space rivets 76 mm (3 inches) on center in two (2) rows in a staggered position.

### **3.3 SEALING:**

- A. Where dowels, fastening devices and similar items penetrate roofing, make penetrations watertight by means of sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

**1.2 RELATED WORK:**

- D. Sealants and application: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Installer qualifications.
- D. Inspector qualifications.
- E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- F. List of FM, UL, or WH classification number of systems installed.
- G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

**1.4 DELIVERY AND STORAGE:**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

**1.5 QUALITY ASSURANCE:**

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.
- B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply

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with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

- C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
- E84-14.....Surface Burning Characteristics of Building Materials
  - E699-09.....Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
  - E814-13a.....Fire Tests of Through-Penetration Fire Stops
  - E2174-14.....Standard Practice for On-Site Inspection of Installed Firestops
  - E2393-10a.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- C. FM Global (FM):
- Annual Issue Approval Guide Building Materials
  - 4991-13.....Approval of Firestop Contractors
- D. Underwriters Laboratories, Inc. (UL):
- Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 723-10(2008).....Standard for Test for Surface Burning Characteristics of Building Materials
  - 1479-04(R2014).....Fire Tests of Through-Penetration Firestops
- E. Intertek Testing Services - Warnock Hersey (ITS-WH):
- Annual Issue Certification Listings

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F. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

**PART 2 - PRODUCTS**

**2.1 FIRESTOP SYSTEMS:**

- A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) in overall cross sectional area.
- C. Firestop sealants used for firestopping or smoke sealing to have the following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Release no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
  - 5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
    - a. Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
- D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
  - 1. Classified for use with the particular type of penetrating material used.



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2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
- E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.
- F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
- H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  2. For floor penetrations with annular spaces exceeding 101 mm (4 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
  3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

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

- A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Provide mineral fiber filler and bond breaker behind sealant.
- C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
- B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

**3.2 PREPARATION:**

- A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
- C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

**3.3 INSTALLATION:**

- A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

**3.4 CLEAN-UP:**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Clean up spills of liquid type materials.
- C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

**3.5 INSPECTIONS AND ACCEPTANCE OF WORK:**

- A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).
- B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):**

- A. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.
- B. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.
- E. Mechanical Work: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING

**1.3 QUALITY ASSURANCE:**

- A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
- B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:

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1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

#### **1.4 CERTIFICATION:**

- A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.
- F. Cured samples of exposed sealants for each color.
- G. Manufacturer's Literature and Data:
  1. Primers
  2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- H. Manufacturer warranty.

#### **1.6 PROJECT CONDITIONS:**

- A. Environmental Limitations:
  1. Do not proceed with installation of joint sealants under following conditions:

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- a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
  - b. When joint substrates are wet.
- B. Joint-Width Conditions:
1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

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

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

**1.8 DEFINITIONS:**

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

**1.9 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

**1.10 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):  
C509-06.....Elastomeric Cellular Preformed Gasket and  
Sealing Material

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- C612-14.....Mineral Fiber Block and Board Thermal  
Insulation
- C717-14a.....Standard Terminology of Building Seals and  
Sealants
- C734-06(R2012).....Test Method for Low-Temperature Flexibility of  
Latex Sealants after Artificial Weathering
- C794-10.....Test Method for Adhesion-in-Peel of Elastomeric  
Joint Sealants
- C919-12.....Use of Sealants in Acoustical Applications.
- C920-14a.....Elastomeric Joint Sealants.
- C1021-08(R2014).....Laboratories Engaged in Testing of Building  
Sealants
- C1193-13.....Standard Guide for Use of Joint Sealants.
- C1248-08(R2012).....Test Method for Staining of Porous Substrate by  
Joint Sealants
- C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold  
Liquid Applied Sealants
- C1521-13.....Standard Practice for Evaluating Adhesion of  
Installed Weatherproofing Sealant Joints
- D217-10.....Test Methods for Cone Penetration of  
Lubricating Grease
- D412-06a(R2013).....Test Methods for Vulcanized Rubber and  
Thermoplastic Elastomers-Tension
- D1056-14.....Specification for Flexible Cellular Materials-  
Sponge or Expanded Rubber
- E84-09.....Surface Burning Characteristics of Building  
Materials
- C. Sealant, Waterproofing and Restoration Institute (SWRI).  
The Professionals' Guide
- D. Environmental Protection Agency (EPA):  
40 CFR 59(2014).....National Volatile Organic Compound Emission  
Standards for Consumer and Commercial Products

## **PART 2 - PRODUCTS**

### **2.1 SEALANTS:**

- A. Exterior Sealants:

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1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25
  2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
  3. Provide location(s) of exterior sealant as follows:
    - a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
    - b. Metal to metal.
    - c. Masonry to masonry or stone.
    - d. Stone to stone.
    - e. Cast stone to cast stone.
    - f. Masonry expansion and control joints.
    - g. Wood to masonry.
    - h. Masonry joints where shelf angles occur.
    - i. Voids where items penetrate exterior walls.
    - j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.
- B. Floor Joint Sealant:
1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
  2. Provide location(s) of floor joint sealant as follows.
    - a. Seats of metal thresholds exterior doors.
    - b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.
- C. Interior Sealants:
1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
    - a. Architectural Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
  2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25
  3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.



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4. Provide location(s) of interior sealant as follows:

- a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
- b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
- c. Interior surfaces of exterior wall penetrations.
- d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
- e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
- f. Exposed isolation joints at top of full height walls.
- g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
- h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
- i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:

1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
  - a. Exposed acoustical joint at sound rated partitions.
  - b. Concealed acoustic joints at sound rated partitions.
  - c. Joints where item pass-through sound rated partitions.

**2.2 COLOR:**

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent concrete.
- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

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### **2.3 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

### **2.4 WEEPS:**

- A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.
  - 1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

### **2.5 FILLER:**

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

### **2.6 PRIMER:**

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

### **2.7 CLEANERS-NON POROUS SURFACES:**

- A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or

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harming joint substrates and adjacent non-porous surfaces and  
formulated to promote adhesion of sealant and substrates.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION:**

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

#### **3.2 PREPARATIONS:**

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

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- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
  - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
  - 2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

### **3.3 BACKING INSTALLATION:**

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

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

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

### **3.5 INSTALLATION:**

- A. General:
  - 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).

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2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
  3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
  4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  5. Avoid dropping or smearing compound on adjacent surfaces.
  6. Fill joints solidly with compound and finish compound smooth.
  7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
  8. Finish paving or floor joints flush unless joint is otherwise detailed.
  9. Apply compounds with nozzle size to fit joint width.
  10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
  11. Replace sealant which is damaged during construction process.
- B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
1. Use round plastic tubing to form weep holes.
  2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
  3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.
- C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

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1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL:**

- 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.
- 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.

### **3.7 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
- B. Leave adjacent surfaces in a clean and unstained condition.

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.
- F. Door Hardware: Section 08 71 00, DOOR HARDWARE.

**1.3 TESTING**

An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.
  - 2. Sound rated doors, including test report from Testing Laboratory.

**1.5 SHIPMENT**

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

**1.6 STORAGE AND HANDLING**

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

**1.7 APPLICABLE PUBLICATIONS**

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

- B. Federal Specifications (Fed. Spec.):
  - L-S-125B.....Screening, Insect, Nonmetallic
- C. Door and Hardware Institute (DHI):
  - A115 Series.....Steel Door and Frame Preparation for Hardware,  
Series A115.1 through A115.17 (Dates Vary)
- D. Steel Door Institute (SDI):
  - 113-01 (R2006).....Thermal Transmittance of Steel Door and Frame  
Assemblies
  - 128-09.....Acoustical Performance for Steel Door and Frame  
Assemblies
- E. American National Standard Institute:
  - A250.8-2003 (R2008).....Specifications for Standard Steel Doors and  
Frames
- F. American Society for Testing and Materials (ASTM):
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet, and Strip
  - A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-  
alloy, Hot-Rolled and Cold-Rolled
  - A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low Alloy and High Strength Low  
Alloy with Improved Formability
  - B209/209M-10.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221/221M-12.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles and Tubes
  - D1621-10.....Compressive Properties of Rigid Cellular  
Plastics
  - D3656-07.....Insect Screening and Louver Cloth Woven from  
Vinyl Coated Glass Yarns
  - E90-09.....Laboratory Measurement of Airborne Sound  
Transmission Loss of Building Partitions
- G. The National Association Architectural Metal Manufacturers (NAAMM):
  - Metal Finishes Manual (AMP 500-06)
- H. National Fire Protection Association (NFPA):
  - 80-13.....Fire Doors and Fire Windows
- I. Underwriters Laboratories, Inc. (UL):
  - Fire Resistance Directory
- J. Intertek Testing Services (ITS):



Certifications Listings...Latest Edition

K. Factory Mutual System (FM):

Approval Guide

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- E. Aluminum Sheet: ASTM B209/209M.
- F. Aluminum, Extruded: ASTM B221/221M.
- G. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

### **2.2 FABRICATION GENERAL**

- A. GENERAL:
  - 1. Follow ANSI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
  - 2. Close top edge of exterior doors flush and seal to prevent water intrusion.
  - 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- C. Heavy Duty Doors: ANSI A250.8, Level 2, Full flush seamless design of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

Core Construction Type	Door Core Description
e	Mineral fiberboard

## **2.3 METAL FRAMES**

### **A. General:**

1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
7. Knocked-down frames are not acceptable.

### **B. Reinforcement and Covers:**

1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

### **C. Terminated Stops: ANSI A250.8.**

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### **F. Frame Anchors:**

#### **1. Floor anchors:**

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

#### **2. Jamb anchors:**

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.

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- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use the following type:
  - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.

## **2.6 SHOP PAINTING**

ANSI A250.8.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  - 3. Protect frame from accidental abuse.
  - 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
  - 5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
  - 1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
  - 2. Power actuated drive pins may be used to secure frame anchors to concrete floors.
- C. Jamb Anchors:
  - 1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
  - 2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
  - 3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.

4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

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

E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

F. Overhead Bracing (Lead Lined Frames): Where jamb extensions extend to structure above, anchor clip angles with not less than two, 9 mm (3/8 inch) expansion bolts or power actuated drive pins to concrete slab. Weld to steel overhead members.

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

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

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
- F. Electrical: Division 26, ELECTRICAL.

**1.3 GENERAL**

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

#### 1.4 WARRANTY

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
1. Locks, latchsets, and panic hardware: 5 years.
  2. Door closers and continuous hinges: 10 years.

#### 1.5 MAINTENANCE MANUALS

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

#### 1.6 SUBMITTALS

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

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

C. Samples and Manufacturers' Literature:

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

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

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

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

#### **1.8 PREINSTALLATION MEETING**

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

#### **1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware

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requirements for each door are indicated on drawings by symbols.

Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

- B. Keying: Coordinate with COR regarding locks and keying.
- C. Keying: A new Great Grandmaster key shall be established for this project. The key system shall be small format (Best size and profile) removable core type as previously described. The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.
1. Keying information will be furnished to the Contractor by the Contracting Officer Representative.
  2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify Contracting Officer Representative immediately when and to whom keys or keying information is supplied. Return all such keys to the Contracting Officer Representative.

#### **1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):  
F883-04.....Padlocks



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E2180-07.....Standard Test Method for Determining the  
Activity of Incorporated Antimicrobial Agent(s)  
In Polymeric or Hydrophobic Materials

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

A156.1-06.....Butts and Hinges  
A156.2-03.....Bored and Pre-assembled Locks and Latches  
A156.3-08.....Exit Devices, Coordinators, and Auto Flush  
Bolts  
A156.4-08.....Door Controls (Closers)  
A156.5-14.....Cylinders and Input Devices for Locks.  
A156.6-05.....Architectural Door Trim  
A156.8-05.....Door Controls-Overhead Stops and Holders  
A156.11-14.....Cabinet Locks  
A156.12-05 .....Interconnected Locks and Latches  
A156.13-05.....Mortise Locks and Latches Series 1000  
A156.14-07 .....Sliding and Folding Door Hardware  
A156.15-06.....Release Devices-Closer Holder, Electromagnetic  
and Electromechanical  
A156.16-08.....Auxiliary Hardware  
A156.17-04 .....Self-Closing Hinges and Pivots  
A156.18-06.....Materials and Finishes  
A156.20-06 .....Strap and Tee Hinges, and Hasps  
A156.21-09.....Thresholds  
A156.22-05.....Door Gasketing and Edge Seal Systems  
A156.23-04.....Electromagnetic Locks  
A156.24-03.....Delayed Egress Locking Systems  
A156.25-07 .....Electrified Locking Devices  
A156.26-06.....Continuous Hinges  
A156.28-07 .....Master Keying Systems  
A156.29-07 .....Exit Locks and Alarms  
A156.30-03 .....High Security Cylinders  
A156.31-07 .....Electric Strikes and Frame Mounted Actuators  
A156.36-10.....Auxiliary Locks  
A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Other Opening Protectives

101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

## **PART 2 - PRODUCTS**

### **2.1 BUTT HINGES**

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:

1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide.

Hinges for exterior outswing doors shall have non-removable pins.

Hinges for exterior fire-rated doors shall be of stainless steel material.

2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide.

Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

B. Provide quantity and size of hinges per door leaf as follows:

1. Doors up to 1210 mm (4 feet) high: 2 hinges.

2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.

3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.

4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.

5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).

6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).

7. Provide heavy-weight hinges where specified.

8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.

- C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

## **2.2 CONTINUOUS HINGES**

- A. ANSI/BHMA A156.26, Grade 1-600.
1. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete
- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
1. Base Metal for Exterior Hinges: Stainless steel.
  2. Base Metal for Interior Hinges: Stainless steel and Steel.
  3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel and Steel.
  4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
  5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
  6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
  7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
  8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

## **2.3 DOOR CLOSING DEVICES**

- A. Closing devices shall be products of one manufacturer.

## **2.4 OVERHEAD CLOSERS**

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:

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1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
2. Where specified, closer shall have hold-open feature.
3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
4. Material of closer body shall be forged or cast.
5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

## **2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS**

- A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements for concealed type floor closers for classes of fire doors indicated on drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single acting floor closers shall also have built in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer case, provide closer without floor plate and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.
- B. Where floor closer appears in hardware set provide the following as applicable.
1. Double Acting Floor Closers: Type C06012.
  2. Single Acting Floor Closer: Type C06021 (center pivoted).  
(Intermediate pivot is not required).
  3. Single Acting Floor Closers: Type C06041 (offset pivoted).
  4. Single Acting Floor Closer for Labeled Fire Doors: Type C06051  
(offset pivoted).
  5. Single Acting Floor Closers For Lead Lined Doors: Type C06071  
(offset pivoted).

## 2.6 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
- H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
- L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

## **2.7 OVERHEAD DOOR STOPS AND HOLDERS**

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

## **2.8 FLOOR DOOR HOLDERS**

- A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

## **2.9 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall be per facility standard. Cylinders for all locksets shall be removable core type. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

- B. In addition to above requirements, locks and latches shall comply with following requirements:

- 1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead

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- lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
  3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.
  4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
  5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

#### **2.10 PUSH-BUTTON COMBINATION LOCKS**

- A. ANSI/BHMA A156.5, Grade 1. Battery operated pushbutton entry.
- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.



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- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.

## 2.13 KEYS

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

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

- B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

## 2.15 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates and door edging as specified below:
- Kick plates, mop plates and armor plates of metal, Type J100 series.
  - Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
  - Kick plates and/or mop plates are not required on following door sides:
    - Armor plate side of doors;

- b. Exterior side of exterior doors;
  - c. Closet side of closet doors;
  - d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets".  
Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

## **2.16 EXIT DEVICES**

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

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- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.
- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

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

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

#### **2.18 FLUSH BOLTS (AUTOMATIC)**

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).
- B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

## **2.19 DOOR PULLS WITH PLATES**

- A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

## **2.20 PUSH PLATES**

- A. Conform to ANSI A156.6. Metal, Type J302, 203 mm (8 inches) wide by 406.4 mm (16 inches) high. Provide metal Type J302 plates 102 mm (4 inches) wide by 406.4 mm (16 inches) high where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

## **2.21 COMBINATION PUSH AND PULL PLATES**

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

## **2.22 COORDINATORS**

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

## **2.23 THRESHOLDS**

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors

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coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.

- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

#### **2.24 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS**

- A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

#### **2.25 WEATHERSTRIPS (FOR EXTERIOR DOORS)**

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length ( $0.000774\text{m}^3/\text{s/m}$ ).

#### **2.26 MISCELLANEOUS HARDWARE**

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E07213, conforming to ANSI A156.11. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.
- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:
  - 1. Folding doors and partitions.
  - 2. Wicket door (in roll-up door assemblies).
  - 3. Slide-up doors.
  - 4. Swing-up doors.
  - 5. Fire-rated access doors-Engineer's key set.
  - 6. Doors from corridor to electromagnetic shielded room.
  - 7. Day gate on vault door.
- C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof

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and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

## **2.27 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES**

- A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.
- B. Key padlocks as follows:
  - 1. Constant Temperature Rooms in Research Departments: Research Laboratory Set.
  - 2. Cold Room in Morgue Department: Autopsy Set.
  - 3. Refrigerators in Canteen Department: Canteen Storage Set.
  - 4. All Refrigerator Rooms in Main Kitchen Department: Kitchen Storage Set.
  - 5. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
  - 6. Chain Link Fence Gates for Oxygen Storage Buildings: Maintenance supply set.
  - 7. Roof Access and Scuttles: Engineer's set.
  - 8. Hinged Wicket in Post Office Partitions: Post Office set.
- C. Omit padlocks on communicating refrigerator doors.

## **2.28 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS**

- A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.36. Key locks in Key Sets approved by Contracting Officer. See mechanical drawings and specifications for location of cabinets.
- B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

## **2.29 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS**

- A. Butt hinges, type A8133 (special swaging) 100 mm by 90 mm (4 inches by 3-1/2 inches), Finish US2C.
  - 1. 3 hinges for guards over 1060 mm (3-1/2 feet) high.
  - 2. 2 hinges for guards less than 1060 mm (3-1/2 feet) high.

B. Conform to ANSI A156.36. Lock Type E06081 for guards and Type E06061 for partitions.

1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.
2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed drawings for number of locks and butt hinges required for each guard).

## **2.30 FINISHES**

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes."
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
  2. Hinges --interior doors: 652 or 630.
  3. Pivots: Match door trim.
  4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
  5. Thresholds: Mill finish aluminum.
  6. Cover plates for floor hinges and pivots: 630.
  7. Other primed steel hardware: 600.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces
- E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.
- F. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

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### 2.31 BASE METALS

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

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

## PART 3 - EXECUTION

### 3.1 HARDWARE HEIGHTS

- A. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  3. Deadlocks centerline of strike 1219 mm (48 inches).
  4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
  5. Centerline of door pulls to be 1016 mm (40 inches).
  6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
  8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

### 3.2 INSTALLATION

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



B. Hinge Size Requirements:

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

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by Contracting Officer Representative. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

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

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

G. After locks have been installed; show in presence of Contracting Officer Representative that keys operate their respective locks in

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accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Contracting Officer Representative for his records.)

Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

### **3.3 FINAL INSPECTION**

A. Installer to provide letter to COR that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

### **3.4 DEMONSTRATION**

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of COR and VA Locksmith.

### **3.5 HARDWARE SETS**

- A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.
- B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

#### **ELECTRIC HARDWARE ABBREVIATIONS LEGEND:**

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

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**PAIRS OF DOORS**

**EXTERIOR PAIRS OF DOORS**

HW-E8

Each Pair to Have:

NON-RATED

Butt Hinges

- |   |   |  |
|---|---|--|
| 1 | Set Auto Flush Bolts                            | TYPE 25  |
| 1 | Dust Proof Strike                               | L04021   |
| 1 | Storeroom Lock                                  | F13-MOD x RIGID OUTSIDE LEVER x KEY<br>RETRACTS DEADBOLT AND LATCHBOLT |
| 1 | Overlapping Astragal with<br>Self-Adhesive Seal | R0Y634 x R0Y154 x THRU-BOLTS   |
| 1 | Coordinator                                     | TYPE 21A   |
| 2 | Closer  | C02011/C02021  |
| 2 | Armor Plate                                     | J101 x 3.125 MM (0.125 INCH) THICKNESS                                 |
| 2 | Floor Stop                                      | L02121 x 3 FASTNERS  |
| 1 | Threshold (inswing door)                        | ALUMINUM, Width to cover wall thickness                                |
| 2 | Door Sweep                                      | R0Y416   |
| 1 | Set Frame Seals                                 | R0Y164   |
| 1 | Drip  | R0Y976   |

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**SECTION 08 90 00**  
**LOUVERS AND VENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

**1.2 RELATED WORK:**

- A. 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:
  - 1. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
  - 1. Each type of louver and vent.
- D. Color samples.

**1.4 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):  
Approved Product List - Updated Monthly
- C. ASTM International (ASTM):
  - A240/A240M-14.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
  - A1008/A1008M-13.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
  - B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate

- B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate  
(Metric)
- B221-14.....Aluminum and Aluminum Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B221M-13.....Aluminum and Aluminum Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes (Metric)
- D1187/D1187M-97(R2011)..Asphalt-Base Emulsions for Use as Protective  
Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Metal Finishes Manual
- E. National Fire Protection Association (NFPA):  
90A-15.....Installation of Air Conditioning and  
Ventilating Systems
- G. American Architectural Manufacturers Association (AAMA):  
2605-13.....High Performance Organic Coatings on  
Architectural Extrusions and Panels
- H. Air Movement and Control Association, Inc. (AMCA):  
500-L-07.....Testing Louvers

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

- A. Aluminum, Extruded: ASTM B221M (B221).
- B. Stainless Steel: ASTM A240/A240M, Type 302B.
- C. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.
- D. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).
- E. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with  
temper as required for forming.
- F. Fasteners: Fasteners for securing louvers and wall vents to adjoining  
construction, except as otherwise specified or indicated in  
construction documents, to be toggle or expansion bolts of size and  
type as required for each specific type of installation and service  
condition.
1. Where type, size, or spacing of fasteners is not shown or specified,  
submit shop drawings showing proposed fasteners, and method of  
installation.

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2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

G. Inorganic Zinc Primer: MPI No. 19.

H. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

## **2.2 EXTERIOR WALL LOUVERS:**

### **A. General:**

1. Provide fixed type louvers of size and design shown.
2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
3. Furnish louvers with sill extension or separate sill as shown.
4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

### **B. Performance Characteristics:**

1. Weather louvers are to have a maximum free area.
2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.

### **C. Aluminum Louvers:**

1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or -T52 aluminum. Blades to be drainable type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.
3. Louvers are to withstand the effects of gravity loads and the following wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.

### **2.3 CLOSURE ANGLES AND CLOSURE PLATES:**

- A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.
- B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
- C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

### **2.4 WIRE GUARDS:**

- A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.
- B. Fabricate frames from 2 mm (0.078-inch) thick extruded or sheet aluminum designed to retain wire mesh.
- C. Wire mesh to be woven from not less than 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 not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 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 of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

### **2.11 FINISH:**

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers
  - 1. Anodized finish
    - c. AA-M10C22A42, Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick. Color to match standing seam metal roofing.

### **2.12 PROTECTION:**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.



- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on colored anodized finish is not approved.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

- A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Set wall louvers in masonry walls during progress of the work. If wall louvers are not delivered to job in time for installation in prepared openings, make provision for later installation. 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 are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration

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are unsuccessful, as determined by Contracting Officer  
Representative (COR) damaged units and replace with new units.

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**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies steel studs wall systems, shaft wall systems, 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**

- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- D. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

**1.3 TERMINOLOGY**

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. 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.

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2. Typical metal stud and furring construction system including details around openings and corner details.

3. Typical shaft wall assembly

4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

#### **1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C754.

#### **1.6 APPLICABLE PUBLICATIONS**

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

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-07.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-08.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-09.....Non-Structural Steel Framing Members

C754-11.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2008).....Installation of Interior Lathing and Furring

C954-10.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

E580-11.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

## **PART 2 - PRODUCTS**

### **2.1 PROTECTIVE COATING**

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 A653/A653M 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.

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- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

#### **2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
  - 1. ASTM A641, soft temper, Class 1 coating.
  - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
  - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
  - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

#### **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**

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### **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.
- G. Openings:
  - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- H. Fastening Studs:
  - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
  - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- I. Chase Wall Partitions:

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1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

J. Form 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.

K. 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.



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- D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

### **3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

### **3.5 INSTALLING SHAFT WALL SYSTEM**

- A. Conform to UL Design No. U438 for two-hour fire rating.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
1. Provide necessary liner fillers and shims to conform to label frame requirements.
  2. Frame openings cut within a liner panel with E studs around perimeter.
  3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.
- F. Elevator Shafts:
1. Frame elevator door frames with 0.87 mm (0.0341-inch) thick J strut or J stud jambs having 75 mm (three-inch) long legs on the shaft side.

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2. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
3. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

### **3.6 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. New exposed concrete slabs:
  1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
  2. Furnish for installation under Division 3, CONCRETE.
  3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.
- C. Concrete slabs on steel decking composite construction:
  1. Use pull down tabs when available.
  2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- D. 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.
- E. Existing concrete construction exposed or concrete on steel decking:
  1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
  2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- F. 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.

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G. Installing suspended ceiling system for gypsum board (ASTM C635  
Option):

1. Install only for ceilings to receive screw attached gypsum board.
2. Install in accordance with ASTM C636.
  - a. Install main runners spaced 1200 mm (48 inches) on center.
  - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
  - c. Install wall track channel at perimeter.

H. Installing Ceiling Bracing System:

1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.

**3.7 TOLERANCES**

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

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**SECTION 09 29 00**  
**GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 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.
- .
- F. 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.
  - 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.

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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. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

**1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

In accordance with the requirements of ASTM C840.

**1.6 ENVIRONMENTAL CONDITIONS**

In accordance with the requirements of ASTM C840.

**1.7 APPLICABLE PUBLICATIONS**

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

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

- C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems
- C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board
- C840-08.....Application and Finishing of Gypsum Board
- C919-08.....Sealants in Acoustical Applications
- C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
- C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
- C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing

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 maximum percentage of post industrial recycled gypsum content available in the area (a minimum of 95 percent post industrial recycled gypsum content). Paper facings shall contain 100 percent post-consumer recycled paper content.

### **2.2 GYPSUM SHEATHING BOARD**

- A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.
- B. ASTM C1177, Type X.

### **2.3 ACCESSORIES**

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

### **2.4 FASTENERS**

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

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- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

## **2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE**

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.

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- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
  - 1. For single-ply construction, use perpendicular application.
  - 2. For two-ply assemblies:
    - a. Use perpendicular application.
    - b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
- G. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.
  - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints 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,



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- 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.

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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. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating.
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
  - 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
  - 2. Stagger joints top and bottom in adjacent panels.

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3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

D. Gypsum Board:

1. Two hour wall:

- a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
- b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
- c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

2. 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.

3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

F. Elevator Shafts:

1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

**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.

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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 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 nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

### **3.7 UNACCESSIBLE CEILINGS**

At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

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**SECTION 09 30 13**  
**CERAMIC/PORCELAIN TILING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies interior ceramic, porcelain and quarry tile, marble thresholds and window stools, terrazzo divider strips, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

**1.2 RELATED WORK:**

- C. Sealing of Joints: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Samples:
1. Base tile, each type, each color, each size.
  2. Mosaic floor tile panels, 228 by 228 mm (9 by 9 inches), each type, color, size and pattern.
  3. Paver tile, each size, type, color and pattern.
  4. Quarry tile, each type, color, and size.
  5. Porcelain tile, each type, color, patterns and size.
  6. Wall (or wainscot) tile, each color, size and pattern.
  7. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
  8. Therapeutic pool tile, panels 305 mm (12 inches) square, each type, size, color, typical lettering and special shapes.
- D. Product Data:
1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
  2. Chemical resistant mortar and grout (epoxy and furan).
  3. Cementitious backer unit.
  4. Dry-set portland cement mortar and grout.
  5. Divider strip.

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6. Elastomeric membrane and bond coat.
7. Reinforcing tape.
8. Leveling compound.
9. Latex-portland cement mortar and grout.
10. Commercial portland cement grout.
11. Organic adhesive.
12. Slip resistant tile.
13. Waterproofing isolation membrane.
14. Fasteners.

E. Certification:

1. Master grade certificate, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
  - a. Chemical resistant mortar and grout (epoxy and furan).
  - b. Modified epoxy emulsion.
  - c. Commercial portland cement grout.
  - d. Cementitious backer unit.
  - e. Dry-set portland cement mortar and grout.
  - f. Elastomeric membrane and bond coat.
  - g. Reinforcing tape.
  - h. Latex-portland cement mortar and grout.
  - i. Leveling compound.
  - j. Organic adhesive.
  - k. Waterproof isolation membrane.
  - l. Factory back mounted tile documentation for suitability for application in wet area.

F. Installer Qualifications:

1. Submit letter stating installer's experience.

**1.4 DELIVERY AND STORAGE:**

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

**1.5 QUALITY ASSURANCE:**

- A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.

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- B. Each type and color of tile to be provided from a single source.
- C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

**1.6 WARRANTY:**

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

**1.7 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  - A10.20-06(R2011).....Safe Operating Practices for Tile, Terrazzo and Marble WorkA108/A118/A136-14 Installation of Ceramic Tile
  - A108.01-13.....Subsurfaces and Preparations by Other Trades
  - A108.02-13.....Materials, Environmental, and Workmanship
  - A108.1A-14.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
  - A108.1B-10.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
  - A108.1C-10.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
  - A108.4-09.....Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive
  - A108.6-10.....Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
  - A108.8-10.....Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout
  - A108.10-10.....Grout in Tilework
  - A108.13-10.....Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
  - A118.1-12.....Dry-Set Portland Cement Mortar

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- A118.3-13.....Chemical Resistant, Water Cleanable Tile-  
Setting and -Grouting Epoxy and Water Cleanable  
Tile-Setting Epoxy Adhesive
- A118.4-12.....Latex-Portland Cement Mortar
- A118.5-10.....Chemical Resistant Furan Mortars and Grouts
- A118.6-10.....Cement Grouts for Tile Installation
- A118.7-10.....High Performance Cement Grouts for Tile  
Installation
- A118.9-10.....Cementitious Backer Units
- A118.10-14.....Load Bearing, Bonded, Waterproof Membranes for  
Thin-Set Ceramic Tile and Dimension Stone  
Installation
- A136.1-13.....Organic Adhesives for Installation of Ceramic  
Tile
- A137.1-12.....American National Standard Specifications for  
Ceramic Tile
- C. ASTM International (ASTM):
- A666-10.....Annealed or Cold-Worked Austenitic Stainless  
Steel Sheet, Strip, Plate and Flat Bar
- A1064/A1064M-14.....Carbon-Steel Wire and Welded Wire  
Reinforcement, Plain and Deformed, for Concrete
- C109/C109M-13.....Standard Test Method for Compressive Strength  
of Hydraulic Cement Mortars (Using 2 inch. or  
[50-mm] Cube Specimens)
- C241/C241M-13.....Abrasion Resistance of Stone Subjected to Foot  
Traffic
- C348-14.....Standard Test Method for Flexural Strength of  
Hydraulic-Cement Mortars
- C627-10.....Evaluating Ceramic Floor Tile Installation  
Systems Using the Robinson-Type Floor Tester
- C954-11.....Steel Drill Screws for the Application of  
Gypsum Board on Metal Plaster Base to Steel  
Studs from 0.033 in (0.84 mm) to 0.112 in (2.84  
mm) in thickness
- C979/C979M-10.....Pigments for Integrally Colored Concrete



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- C1002-14.....Steel Self-Piercing Tapping Screws for the  
Application of Panel Products
- C1027-09.....Test Method for Determining Visible Abrasion  
Resistance of Glazed Ceramic Tile
- C1127-01(R2009).....Standard Guide for Use of High Solids Content,  
Cold Liquid-Applied Elastomeric Waterproofing  
Membrane with an Integral Wearing Surface
- C1178/C1178M-13.....Standard Specification for Coated Glass Mat  
Water-Resistant Gypsum Backing Panel
- C1325-14.....Non-Asbestos Fiber-Mat Reinforced Cementitious  
Backer Units
- C1353/C1353M-09(R2013)..Abrasion Resistance of Dimension Stone  
Subjected to Foot Traffic Using a Rotary  
Platform, Double-Head Abraser
- D1204-14.....Test Method for Linear Dimensional Changes of  
Nonrigid Thermoplastic Sheeting or Film at  
Elevated Temperature
- D2240-05(R2010).....Test Method for Rubber Property - Durometer  
Hardness
- D2497-07(R2012).....Tolerances for Manufactured Organic-Base  
Filament Single Yarns
- D3045-92(R2010).....Heat Aging of Plastics Without Load
- D4397-10.....Standard Specification for Polyethylene  
Sheeting for Construction, Industrial and  
Agricultural Applications
- D5109-12.....Standard Test Methods for Copper-Clad  
Thermosetting Laminates for Printed Wiring  
Boards
- D. Code of Federal Regulation (CFR):
- 40 CFR 59.....Determination of Volatile Matter Content, Water  
Content, Density Volume Solids, and Weight  
Solids of Surface Coating
- E. Marble Institute of America (MIA): Design Manual III-2007
- F. Tile Council of North America, Inc. (TCNA):  
Handbook for Ceramic Tile Installation (2014)
- DCOF AcuTest-2012.....Dynamic Coefficient of Friction Test

## **PART 2 - PRODUCTS**

### **2.1 TILE:**

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
  - 1. Inspection procedures listed under the Appendix of ANSI A137.1.
  - 2. Abrasion Resistance Classification:
    - a. Tested in accordance with values listed in Table 1, ASTM C1027.
    - b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
    - c. Class IV, 6000 revolutions for remaining areas.
  - 3. Slip Resistant Tile for Floors:
    - a. Coefficient of friction, when tested in accordance with ANSI A137.1 and measured per the TCNA DCOF AcuTest.
      - 1) Equal to or greater than .42 for level interior tile floors that will be walked on when wet.
    - b. Tile Having Abrasive Grains:
      - 1) Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
      - 2) Quarry Tile: Abrasive grains uniformly embedded in face at rate of approximately 7.5 percent of surface area.
    - c. Porcelain Paver Tile: Matte surface finish .
  - 4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
  - 5. Back mounted tiles in showers. Provide certification that the factory mounted tile has been used successfully in service at three (3) projects and is suitable for wet locations.
  - 6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one (1) package show the same range in colors as those taken from other packages and match approved samples.
  - 7. Factory-Applied Temporary Protective Coating:
    - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.

- b. Do not coat unexposed tile surfaces.
- B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.
- C. Unglazed Quarry Tile: Nominal 13 mm (1/2 inch) thick, square edges.
- D. Glazed Wall Tile: Cushion edges, glazing.
- E. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method are to be made of approximately 50% feldspar; the remaining 50% is to be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 176 to 181 kg (390 to 400 lbs.).
- F. Trim Shapes:
  - 1. Conform to applicable requirements of adjoining floor and wall tile.
  - 2. Use slip resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and seats.
  - 3. Use trim shapes sizes conforming to size of adjoining field wall tile including existing spaces unless detailed on construction documents or specified otherwise.
  - 4. Internal and External Corners:
    - a. Square internal and external corner joints are not acceptable.
    - b. External corners including edges: Use bullnose shapes.
    - c. Internal corners: Use cove shapes.
    - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
    - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
    - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
    - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
    - h. For unglazed ceramic mosaic and glazed wall tile installed in portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.

- i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set portland cement mortar, latex-portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
- j. For quarry tile work, use cove and bullnose shapes as applicable.
- k. Provide cove and bullnose shapes required to complete tile work.

## **2.2 BACKER UNITS:**

- A. Cementitious Backer Units:
  - 1. Use in showers or wet areas.
  - 2. Conform to ASTM C1325; Type A.
  - 3. Use in maximum lengths available to minimize end to end butt joints.

## **2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS:**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.
- C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

## **2.4 FASTENERS:**

- A. Screws for Cementitious Backer Units.
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
  - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

## **2.5 SETTING MATERIALS OR BOND COATS:**

- A. Conform to TCNA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.02.
- C. Latex-Portland Cement Mortar: ANSI A118.4.
  - 1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
  - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and

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other ingredients to which only water needs to be added at Project site.

- D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.1.
- E. Organic Adhesives: ANSI A136.1, Type 1.
- F. Chemical-Resistant Bond Coat:
1. Epoxy Resin Type: ANSI A118.3.
  2. Furan Resin Type: ANSI A118.5.
- G. Elastomeric Waterproofing Membrane and Bond Coat:
1. TCNA F122-14 (on ground concrete) and TCNA F112A-14 (above ground concrete).
  2. ANSI A118.10.
  3. One component polyurethane, liquid applied material having the following additional physical properties:
    - a. Hardness: Shore "A" between 40-60.
    - b. Elongation: Between 300-600 percent.
    - c. Tensile strength: Between .27 - .41 Newton per square millimeter (40-60 pounds per square inch gauge).
    - d. No volatile compounds (VOC).
  4. Coal tar modified urethanes are not acceptable.
- H. Waterproofing Isolation Membrane:
1. Sheet System TCNA F122-14 (on-ground concrete) and TCNA F122A-14 (above-ground concrete).
  2. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
  3. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.
  4. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second

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			Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature -37 degrees C (-35 degrees F)	ASTM D2497 13 mm (1/2-inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

5. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
6. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

## 2.6 GROUTING MATERIALS:

### A. Coloring Pigments:

1. Pure mineral pigments, lime proof and nonfading, complying with ASTM C979/C979M.
2. Coloring pigments may only be added to grout by the manufacturer.
3. Job colored grout is not acceptable.
4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

### B. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated. Zero VOC content.

### C. Standard Cement Grout: ANSI A118.6.

### D. High Performance Tile Grout: ANSI A118.7 with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24) .

1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

### E. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24)

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 60 and 100 degrees C (140 and

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212 degrees F), respectively, and certified by manufacturer for intended use.

**2.7 PATCHING AND LEVELING COMPOUND:**

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Provide a patching and leveling compound with the following minimum physical properties:
  - 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
  - 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
  - 3. Tensile strength - 4.1 MPa (600 psi) per ANSI 118.7.
  - 4. Density - 1.9.
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

**2.10 WATER:**

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

**2.11 CLEANING COMPOUNDS:**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic Material are not acceptable.

**2.12 FLOOR MORTAR BED REINFORCING:**

- A. ASTM A1064/A1064M welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

**2.13 POLYETHYLENE SHEET:**

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: 0.15 mm (6 mils).

### **PART 3 - EXECUTION**

#### **3.1 ENVIRONMENTAL REQUIREMENTS:**

- A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

#### **3.2 ALLOWABLE TOLERANCE:**

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
  - 1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
  - 2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where dry-set portland cement, and latex-portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
  - 1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
  - 2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

#### **3.3 SURFACE PREPARATION:**

- A. Cleaning New Concrete or Masonry:
  - 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical



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- method, or by using products specifically designed for cleaning concrete and masonry.
2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
  3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.
- B. Patching and Leveling:
1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
  2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
    - a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
    - b. Float finish except finish smooth for elastomeric waterproofing.
    - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
  3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
  4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown on construction documents.
  2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
  3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
  4. Screed for slope to drain and float finish.
  5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
  6. Perform flood test to verify mortar bed slopes to drain before installing tile. Contracting Officer Representative (COR) to be present during flood test.

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D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin is to be in accordance with the manufacturer's printed instructions.

E. Cleavage Membrane:

1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
2. Turn up at edge of depressed floor slab to top of floor.

F. Walls:

1. In showers or other wet areas cover studs with polyethylene sheet.
2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
4. Apply metal lath to framing in accordance with ANSI A108.1:
  - a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
  - b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1C.
  - c. Total thickness of scratch and leveling coats:
    - 1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
    - 2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
    - 3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
  - d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two (2) coats.

G. Existing Floors and Walls:

1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.

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2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles, cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

### **3.4 CEMENTITIOUS BACKER UNITS:**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A118.9 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a "V" joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.
- G. Joint Treatment:
  1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
  2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

### **3.8 CERAMIC TILE - GENERAL:**

- A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.

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B. Installing Mortar Beds for Floors:

1. Install mortar bed in a manner that does not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
2. Install floor mortar bed reinforcing centered in mortar fill.
3. Screed finish to level plane or slope to drains shown on construction documents, float finish.
4. For thin set systems cure mortar bed not less than seven (7) days. Do not use curing compounds or coatings.
5. For tile set with portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

C. Setting Beds or Bond Coats:

1. Where recessed or depressed floor slabs are filled with portland cement mortar bed, set ceramic mosaic floor tile in either portland cement paste over plastic mortar bed or latex-portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCNA System F121-14 or F111-14.
2. Use quarry tile in chemical-resistant bond coat, except in floor of walk-in refrigerator rooms use: TCNA System R612-11.
  - a. Portland cement paste over plastic mortar bed. ANSI A108.1A.
  - b. Dry-set portland cement mortar over cured mortar bed.  
ANSI A108.1B.
3. Pools Holding Water: ANSI A108.1C. Do not use latex portland cement mortar.
4. Set floor tile in elastomeric bond coat over elastomeric membrane per ANSI 108.13, TCNA System F122-14 where indicated on construction documents.
5. Set wall tile installed over concrete or masonry in dry-set portland cement mortar, or latex-portland cement mortar, ANSI 108.1B and TCNA System W211-14, W221-14 or W222-14.
6. Set wall tile installed over concrete backer board in latex-portland cement mortar, ANSI A108.1B.
7. Set wall tile installed over portland cement mortar bed on metal lath base in portland cement paste over plastic mortar bed, or dry-set portland cement mortar or latex-portland cement mortar over a cured mortar bed, ANSI A108.1C, TCNA System W231-14, W241-14.

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8. Set tile over concrete in therapeutic pools in portland cement paste or dry set portland cement mortar, ANSI A108.1C, TCNA System P601MB-14.
9. Set tile installed over gypsum board and gypsum plaster in organic adhesive, ANSI A108.1, TCNA System W242-14.
10. Set trim shapes in same material specified for setting adjoining tile.

D. Workmanship:

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
  - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
  - b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
  - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
  - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
  - c. In areas where floor drains occur, slope tile to drains.
  - d. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.

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9. Walls:

- a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
- b. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
- d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.

10. Joints:

- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
- b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
- c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
- d. Make joints in paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:

- a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
- b. Tile installed with chemical-resistant mortars and grouts.
- c. Tile wall installations composed of tiles 203 by 203 mm (8 by 8 inches) or larger.
- d. Exterior tile wall installations.

**3.9 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR:**

- A. Mortar Mixes for Floor, Wall and Base Tile (including Showers: ANSI A108.1A. except specified otherwise.
- B. Installing Wall and Base Tile: ANSI A108.1A, except specified otherwise.

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- C. Installing Floor Tile: ANSI A108.1A, except as specified otherwise.  
Slope mortar beds to floor drains at a minimum of 3 mm in 305 mm  
(1/8 inch per foot).

**3.10 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR:**

- A. Due to the denseness of porcelain tile use latex portland cement bonding mortar that meets the requirements of ANSI A108.01. Mix bonding mortars in accordance with manufacturer's instructions. Provide liquid ratios and comply with dwell times during the placement of bonding mortar and tile.

**3.11 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR:**

- A. Installation of Tile: ANSI A108.1B, except as specified otherwise.  
B. Slope tile work to drains at not less than 3 mm in 305 mm (1/8 inch per foot).

**3.12 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH ORGANIC ADHESIVE**

- A. Installation of Tile: ANSI A108.4.

**3.13 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH CHEMICAL-RESISTANT BOND COAT:**

- A. Epoxy Resin Type: Install tile in accordance with Installation of Tile with Epoxy Mortar; ANSI A108.6.  
B. Furan Resin Type: Proportion, mix and place in accordance with the manufacturer's printed instructions. Set tile in accordance with ANSI A108.8.

**3.14 CERAMIC AND PORCELAIN TILE INSTALLED WITH ELASTOMERIC BOND COAT:**

- A. Surface Preparation: Prepare surfaces as specified.  
B. Installation of Elastomeric Membrane: ANSI A108.10 and TCNA F122-14 (on ground concrete) and F122A-14 (above-ground concrete).  
1. Prime surfaces, where required, in accordance with manufacturer's instructions.  
2. Install first coat of membrane material in accordance with manufacturer's instructions, in thickness of 0.76 to 1.3 mm (30 to 50 mils).  
3. Extend material over flashing rings of drains and turn up vertical surfaces not less than 101 mm (4 inches) above finish floor surface.

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4. When material has set, recoat areas with a second coat of elastomeric membrane material for a total thickness of 1.3 to 1.9 mm (50 to 75 mils).
5. After curing test for leaks with 25 mm (1 inch) of water for 24 hours.

C. Installation of Tile in Elastomeric Membrane:

1. Spread no more material than can be covered with tile before material starts to set.
2. Apply tile in second coat of elastomeric membrane material in accordance with the coating manufacturer's instructions in lieu at aggregate surfacing specified in ASTM C1127. Do not install top coat over tile.

**3.15 GROUTING:**

A. Grout Type and Location:

1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile except for therapeutic pool /portland cement grout, latex-portland cement grout, dry-set grout, or commercial portland cement grout.
2. Grout for quarry tile floor and base:
  - a. Grout for floors of walk-in refrigerated rooms: Epoxy grout.
  - b. Therapeutic pool areas: Portland cement grout.
3. Grout for tile of therapeutic pools: Portland cement grout.

B. Workmanship:

1. Install and cure grout in accordance with the applicable standard.
2. Sand Portland Cement Grout: ANSI A108.10.
3. Standard Cement Grout: ANSI A118.6.
4. High Performance Grout: ANSI A118.7.
5. Epoxy Grout: ANSI A108.6.
6. Water-Cleanable Epoxy Grout: ANSI A118.3.
7. Furan and Commercial Portland Cement Grout: ANSI A118.5 and in accordance with the manufacturer's printed instructions.

**3.16 MOVEMENT JOINTS:**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCNA details EJ 171-14.



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- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, tub, service sink, at toe of base, and where indicated in construction documents not less than 6 mm (1/4 inch) deep.

**3.17 CLEANING:**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

**3.18 PROTECTION:**

- A. Keep traffic off tile floor, until grout and setting material is fully set and cured.
- B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

**3.19 TESTING FINISH FLOOR:**

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**PART 1- GENERAL**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.
- C. Adhesive application.

**1.2 RELATED WORK**

**1.3 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation
  - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**1.4 DEFINITIONS**

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-09.....Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/A653M-11.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process

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C423-09.....	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
C634-11.....	Standard Terminology Relating to Environmental Acoustics
C635-13.....	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-13.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-13.....	Surface Burning Characteristics of Building Materials
E119-12.....	Fire Tests of Building Construction and Materials
E413-10.....	Classification for Rating Sound Insulation.
E580-11.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-08e1.....	Classification for Acoustical Ceiling Products
C. International Organization for Standardization (ISO)	
ISO 14644-1.....	Classification of Air Cleanliness

## **PART 2- PRODUCTS**

### **2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
    - c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
  - 3. Use aluminum suspension in kitchens and aluminum or fire resistant plastic in toilets adjacent to shower areas, hydrotherapy, and swimming pools.

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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..

**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.

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- 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.

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6. Manufacturers standard finish, minimum Light Reflectance (LR)  
 coefficient of 0.75 on the exposed surfaces.

7. Lay-in panels: Match existing in immediate adjacency while  
 conforming to the requirements noted.

2.8 Acoustical Ceiling Products shall comply with following standards for  
 biobased materials:

Material Type	Percent by Weight
Acoustical Ceiling	37 percent biobased material

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

## 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:

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1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

E. Existing ceiling:

1. Where extension of existing ceilings occur, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

### **3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

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B. Anchorage to Structure:

1. Concrete:

- a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
- b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

2. Steel:

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
  - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
  - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
- b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
- c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

B. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.



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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.

### **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.

### **3.5 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.

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B. Leave finished work free from defects.

- - - E N D - - -

**SECTION 09 91 00**  
**PAINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Prime coats which may be applied in shop under other sections.
2. Prime painting unprimed surfaces to be painted under this Section.
3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
4. Painting ferrous metal (except stainless steel) exposed to view.
5. Painting galvanized ferrous metals exposed to view.
6. Painting interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

**1.2 RELATED WORK:**

- E. Shop prime painting of steel and ferrous metals: Division 05 - METALS,  
Division 08 - OPENINGS;

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA,  
AND SAMPLES.
- C. Painter qualifications.
- D. Manufacturer's Literature and Data:
  - 1. Before work is started, or sample panels are prepared, submit  
manufacturer's literature and technical data, 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 (1) 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.
- E. 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 x 250 mm (4 x 10 inch).
  - 3. Panel to Show Transparent Finishes: Wood of same species and grain  
pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face)  
minimum, and where both flat and edge grain will be exposed, 250 mm  
(10 inches) long by sufficient size, 50 x 50 mm (2 x 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.

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- F. Sample of identity markers if used.
- G. 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. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, 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 7 and 30 degrees C (45 and 85 degrees F).

**1.5 QUALITY ASSURANCE:**

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other

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subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

#### **1.7 REGULATORY REQUIREMENTS:**

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
  - 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. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
    - d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
  - 3. Asbestos: Provide materials that do not contain asbestos.
  - 4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 5. Human Carcinogens: Provide materials that do 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.

#### **1.8 SAFETY AND HEALTH**

- A. Apply paint materials using safety methods and equipment in accordance with the following:
  - 1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS.

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The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
  - 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
  - 2. 29 CFR 1910.1000.
  - 3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

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

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
  - ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
  - ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. ASME International (ASME):
  - A13.1-07(R2013).....Scheme for the Identification of Piping Systems
- D. Code of Federal Regulation (CFR):
  - 40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- E. Commercial Item Description (CID):
  - A-A-1272A.....Plaster Gypsum (Spackling Compound)
- F. Federal Specifications (Fed Spec):
  - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
  - 1.....Aluminum Paint
  - 4.....Interior/ Exterior Latex Block Filler
  - 5.....Exterior Alkyd Wood Primer
  - 7.....Exterior Oil Wood Primer

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- 8.....Exterior Alkyd, Flat MPI Gloss Level 1
- 9.....Exterior Alkyd Enamel MPI Gloss Level 6
- 10.....Exterior Latex, Flat
- 11.....Exterior Latex, Semi-Gloss
- 18.....Organic Zinc Rich Primer
- 22.....Aluminum Paint, High Heat (up to 590° - 1100F)
- 27.....Exterior / Interior Alkyd Floor Enamel, Gloss
- 31.....Polyurethane, Moisture Cured, Clear Gloss
- 36.....Knot Sealer
- 43.....Interior Satin Latex, MPI Gloss Level 4
- 44.....Interior Low Sheen Latex, MPI Gloss Level 2
- 45.....Interior Primer Sealer
- 46.....Interior Enamel Undercoat
- 47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
- 48.....Interior Alkyd, Gloss, MPI Gloss Level 6
- 50.....Interior Latex Primer Sealer
- 51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- 52.....Interior Latex, MPI Gloss Level 3
- 53.....Interior Latex, Flat, MPI Gloss Level 1
- 54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
- 59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low  
Gloss
- 60.....Interior/Exterior Latex Porch & Floor Paint, Low  
Gloss
- 66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC  
Approved)
- 67.....Interior Latex Fire Retardant, Top-Coat (ULC  
Approved)
- 68.....Interior/ Exterior Latex Porch & Floor Paint,  
Gloss
- 71.....Polyurethane, Moisture Cured, Clear, Flat
- 77.....Epoxy Cold Cured, Gloss
- 79.....Marine Alkyd Metal Primer
- 90.....Interior Wood Stain, Semi-Transparent
- 91.....Wood Filler Paste
- 94.....Exterior Alkyd, Semi-Gloss
- 95.....Fast Drying Metal Primer



- 98.....High Build Epoxy Coating
- 101.....Epoxy Anti-Corrosive Metal Primer
- 108.....High Build Epoxy Coating, Low Gloss
- 114.....Interior Latex, Gloss
- 119.....Exterior Latex, High Gloss (acrylic)
- 134.....Galvanized Water Based Primer
- 135.....Non-Cementitious Galvanized Primer
- 138.....Interior High Performance Latex, MPI Gloss Level 2
- 139.....Interior High Performance Latex, MPI Gloss Level 3
- 140.....Interior High Performance Latex, MPI Gloss Level 4
- 141.....Interior High Performance Latex (SG) MPI Gloss  
Level 5
- 163.....Exterior Water Based Semi-Gloss Light Industrial  
Coating, MPI Gloss Level 5

G. Society for Protective Coatings (SSPC):

- SSPC SP 1-82(R2004).....Solvent Cleaning
- SSPC SP 2-82(R2004).....Hand Tool Cleaning
- SSPC SP 3-28(R2004).....Power Tool Cleaning
- SSPC SP 10/NACE No.2.....Near-White Blast Cleaning
- SSPC PA Guide 10.....Guide to Safety and Health Requirements

H. Maple Flooring Manufacturer's Association (MFMA):

I. U.S. National Archives and Records Administration (NARA):

- 29 CFR 1910.1000.....Air Contaminants

J. Underwriter's Laboratory (UL)

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Conform to the coating specifications and standards referenced in PART 3.  
Submit manufacturer's technical data sheets for specified coatings and solvents.

**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.

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- C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.
- D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Non-flat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
  - 5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  - 7. Pretreatment Wash Primers: 420 g/L.
  - 8. Shellacs, Clear: 730 g/L.
  - 9. Shellacs, Pigmented: 550 g/L.
- E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

#### Biobased Content

- A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Interior Paint	20 percent biobased material
Interior Paint- Oil Based and Solvent Alkyd	67 percent biobased material
Exterior Paint	20 percent biobased material
Wood & Concrete Stain	39 percent biobased content
Polyurethane Coatings	25 percent biobased content
Water Tank Coatings	59 percent biobased content
Wood & Concrete Sealer-Membrane Concrete Sealers	11 percent biobased content
Wood & Concrete Sealer-Penetrating Liquid	79 percent biobased content

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

### 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.
- Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
- Do not apply coating when air or substrate conditions are:
    - Less than 3 degrees C (5 degrees F) above dew point.
    - Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
    - When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
  - Maintain interior temperatures until paint dries hard.
  - Do no exterior painting when it is windy and dusty.

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4. Do not paint in direct sunlight or on surfaces that the sun will 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 only when allowed by manufacturer's printed instructions.
  - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days 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 INSPECTION:**

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

### **3.3 GENERAL WORKMANSHIP REQUIREMENTS:**

- A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
- B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

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- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
- I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.
- J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

### **3.4 SURFACE PREPARATION:**

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

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments 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. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

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- a. Concrete: 12 percent.
  - b. Fiber-Cement Board: 12 percent.
  - c. Masonry (Clay and CMU's): 12 percent.
  - d. Wood: 15 percent.
  - e. Gypsum Board: 12 percent.
  - f. Plaster: 12 percent.
- B. 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.
- C. Ferrous Metals:
- 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
  - 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). 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

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- 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. Fill 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. 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 (3) 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 Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.
- F. 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 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.

**3.5 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 (2) component and two (2) 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.

**3.6 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 (3) coats; prime, body, and finish. When two (2) 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 COR.
- E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In new construction and in existing occupied spaces, 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 "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.



- F. 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.

### **3.7 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 rabbets for stop and face glazing of wood, and for face glazing of steel.
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) finish is specified.
- G. Gypsum Board and Hardboard:
  - 1. Surfaces scheduled to have MPI 11 (Exterior Latex, Semi-Gloss) MPI 54 (Interior Latex, Semi-Gloss,)
  - 2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.
  - 3. Surfaces scheduled to receive vinyl coated fabric wall covering:  
Use MPI 45 (Interior Primer Sealer)
- I. Concrete Masonry Units except glazed or integrally colored and decorative units:
  - 1. MPI 4 (Block Filler) on interior surfaces.
  - 2. Prime exterior surface as specified for exterior finishes.
- K. Concrete Floors: MPI 99 (Water-based Acrylic Curing and Sealing Compound).

### **3.9 INTERIOR FINISHES:**

- A. Apply following finish coats over prime coats in spaces or on surfaces specified
- 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.

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3. Ferrous Metal

- a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.

C. Gypsum Board:

- 3. One (1) coat of MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5)

E. Masonry and Concrete Walls:

- 1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
- 2. Two (2) coats of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5)

H. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

I. Miscellaneous:

- 2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.
- 3. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:
  - a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.

**3.10 REFINISHING EXISTING PAINTED SURFACES:**

- A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.
- B. Remove and reinstall items as specified under "General Workmanship Requirements".
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).

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- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

**3.11 PAINT COLOR:**

- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
  - 1. Color of priming coat: Lighter than body coat.
  - 2. Color of body coat: Lighter than finish coat.
  - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  - 1. Paint to match color of casework where casework has a paint finish.
  - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

**3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe

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tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".

H. Color:

- a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
  - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
  - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.
3. Other exposed locations:
- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).
  - b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer)

### **3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:**

A. Painting and finishing of interior and exterior work except as specified here-in-after.

1.

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2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
5. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:

- a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
- b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.

2. Finished surfaces:

- a. Hardware except ferrous metal.
- b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
- c. Signs, fixtures, and other similar items integrally finished.

3. Concealed surfaces:

- a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
- b. Inside walls or other spaces behind access doors or panels.
- c. Surfaces concealed behind permanently installed casework and equipment.

4. Moving and operating parts:

- a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
- b. Tracks for overhead or coiling doors, shutters, and grilles.

5. Labels:

- a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
- b. Identification plates, instruction plates, performance rating, and nomenclature.

6. Galvanized metal:

- a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.

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- b. Gas Storage Racks.
- c. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.
- 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
- 10. Face brick.
- 11. Structural steel encased in concrete, masonry, or other enclosure.
- 12. Structural steel to receive sprayed-on fire proofing.
- 13. Ceilings, walls, columns in interstitial spaces.
- 14. Ceilings, walls, and columns in pipe basements.
- 15. Wood Shingles.

### **3.14 IDENTITY PAINTING SCHEDULE:**

- A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
  - 1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
  - 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
  - 3. Locate Legends clearly visible from operating position.
  - 4. Use arrow to indicate direction of flow using black stencil paint.
  - 5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
    - a. High Pressure - 414 kPa (60 psig) and above.
    - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
    - c. Low Pressure - 103 kPa (14 psig) and below.
    - d. Add Fuel oil grade numbers.
  - 6. Legend name in full or in abbreviated form as follows:

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PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Green	White	Blow-off
Boiler Feedwater		Green	White	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Blue	White	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret _____*
Medium Pressure Steam		Green	White	M. P. Stm _____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
Boiler Water Sampling		Green	White	Sample
Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent
Alkali		Orange	Black	Alk
Bleach		Orange	Black	Bleach

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services -  
 Prevention and Control Legionella  
 Project Number: 549-15-517  
 Submittal - 100% Construction Documents 06/15/2016

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Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Orange	Black	Acid Waste
Vent		Orange	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain
Hot Water Supply Dom./				
Solar Water		Green	White	H.W. Sup Dom/SW
Hot Water Return Dom./				
Solar Water		Green	White	H.W. Ret Dom/SW

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class,



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8. See Sections for methods of identification, legends, and abbreviations of the following:
  - a. Regular compressed air lines: Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS.
  - b. Dental compressed air lines: Section 22 61 13.74, DENTAL COMPRESSED-AIR PIPING / Section 22 61 19.74, DENTAL COMPRESSED-AIR EQUIPMENT.
  - c. Laboratory gas and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
  - d. Oral evacuation lines: Section 22 62 19.74, DENTAL VACUUM AND EVACUATION EQUIPMENT.
  - e. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
  - f. Conduits containing high voltage feeders over 600 volts:  
Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS /  
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS /  
Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY.
- B. Fire and Smoke Partitions:
  1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
  2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
  3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
  4. Use semi-gloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
  1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
  2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
  3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
  4. Color:
    - a. Use black on concrete columns.
    - b. Use white or contrasting color on steel columns.

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**3.15 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 26 00**  
**WALL AND DOOR PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies wall guards, handrail/wall guard combinations, corner guards and door/door frame protectors and high impact wall covering.

**1.2 RELATED WORK:**

- C. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

**1.3 QUALITY ASSURANCE:**

- A. Manufacturer's Qualifications: Manufacturer with a minimum of three (3) years' experience in providing items of type specified.
  - 1. Obtain wall and door protection from single manufacturer.
- B. Installer's Qualifications: Installers are to have a minimum of three (3) years' experience in the installation of units required for this project.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Shop Drawings: Show design and installation details.
- D. Manufacturer's Literature and Data:
  - 5. High Impact Wall covering.
- E. Test Report: Showing that resilient material complies with specified fire and safety code requirements.
- F. Manufacturer's qualifications.
- G. Installer's qualifications.
- H. Manufacturer's warranty.

**1.5 DELIVERY AND STORAGE:**

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21 degrees C (70 degrees F) for at least 48 hours prior to installation.

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**1.6 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their wall and door protection for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

**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. ASTM International (ASTM):
  - A240/A240M-14.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications
  - B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
  - D256-10.....Impact Resistance of Plastics
  - D635-10.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
  - E84-14.....Surface Burning Characteristics of Building Materials
- C. Aluminum Association (AA):
  - DAF 45-09.....Designation System for Aluminum Finishes
- D. American Architectural Manufacturers Association (AAMA):
  - 611-14.....Anodized Architectural Aluminum
- E. Code of Federal Regulation (CFR):
  - 40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- F. The National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500-06.....Metal Finishes Manual
- G. National Fire Protection Association (NFPA):
  - 80-13.....Standard for Fire Doors and Windows
- H. SAE International (SAE):

J 1545-05(R2014).....Instrumental Color Difference Measurement for  
Exterior Finishes.

I. Underwriters Laboratories Inc. (UL):

Annual Issue.....Building Materials Directory

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

A. Stainless Steel: A240/A240M, Type 304.

B. Aluminum Extruded: ASTM B221M (B221), Alloy 6063, Temper T5 or T6.

C. Resilient Material:

1. Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:
  - a. Minimum impact resistance of 960.8 N-m/m (18 ft.-lbs./sq. inch) when tested in accordance with ASTM D256 (Izod impact, ft.-lbs. per inch notched).
  - 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. Provide material labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
  - e. Provide resilient material for protection on fire rated doors and frames assemblies that is listed by the testing laboratory performing the tests.
  - f. Provide resilient material installed on fire rated wood/steel door and frame assemblies that have been tested on similar type assemblies. Test results of material tested on any other combination of door and frame assembly are not acceptable.
  - g. Provide integral color with colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.

### **2.5 HIGH IMPACT WALL COVERING:**

- A. Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material.

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- B. Panel sizes to be (4 x 8 ft.)
- C. Submit fire rating and extinguishing test results for resilient material.
- D. Submit statements attesting that the items comply with specified fire and safety code requirements.
- E. Rigid Vinyl Acrylic Wall Covering: Wall covering thickness to be 0.56 mm (0.022 inch).
- F. High Impact Wall Panels: Wall panel face and edge thickness to be 0.56 mm (0.022 inch) . Panel face to be factory banded to a 9.53 mm (0.375 inch) thick fiberboard core. The backside of the panel is to be laminated with a moisture resistant vapor barrier.
- G. Provide adhesive as recommended by the wall covering manufacturer.

## **2.6 FASTENERS AND ANCHORS:**

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified in construction documents, submit shop drawings showing proposed installation details.

## **2.7 FINISH:**

- D. Resilient Material: Embossed textures and color in accordance with SAE J1545.

## **PART 3 - INSTALLATION**

### **3.6 HIGH IMPACT WALL COVERING**

- A. Surfaces to receive protection to be clean, smooth and free of obstructions.
- C. Apply with adhesive in controlled environment according to manufacturer's recommendations.

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**SECTION 22 05 11**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.
- C. Abbreviations/Acronyms:
  - 1. ABS: Acrylonitrile Butadiene Styrene
  - 2. AC: Alternating Current
  - 3. ACR: Air Conditioning and Refrigeration
  - 4. AI: Analog Input
  - 5. AISI: American Iron and Steel Institute
  - 6. AO: Analog Output
  - 7. AWG: American Wire Gauge
  - 8. BACnet: Building Automation and Control Network
  - 9. BAg: Silver-Copper-Zinc Brazing Alloy
  - 10. BAS: Building Automation System
  - 11. BCuP: Silver-Copper-Phosphorus Brazing Alloy
  - 12. BSG: Borosilicate Glass Pipe
  - 13. CDA: Copper Development Association
  - 14. C: Celsius
  - 15. CLR: Color
  - 16. CO: Carbon Monoxide
  - 17. COR: Contracting Officer's Representative
  - 18. CPVC: Chlorinated Polyvinyl Chloride
  - 19. CR: Chloroprene
  - 20. CRS: Corrosion Resistant Steel
  - 21. CWP: Cold Working Pressure
  - 22. CxA: Commissioning Agent
  - 23. db(A): Decibels (A weighted)
  - 24. DDC: Direct Digital Control
  - 25. DI: Digital Input
  - 26. DISS: Diameter Index Safety System

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- 27. DO: Digital Output
- 28. DVD: Digital Video Disc
- 29. DN: Diameter Nominal
- 30. DWV: Drainage, Waste and Vent
- 31. ECC: Engineering Control Center
- 32. EPDM: Ethylene Propylene Diene Monomer
- 33. EPT: Ethylene Propylene Terpolymer
- 34. ETO: Ethylene Oxide
- 35. F: Fahrenheit
- 36. FAR: Federal Acquisition Regulations
- 37. FD: Floor Drain
- 38. FED: Federal
- 39. FG: Fiberglass
- 40. FNPT: Female National Pipe Thread
- 41. FPM: Fluoroelastomer Polymer
- 42. GPM: Gallons Per Minute
- 43. HDPE: High Density Polyethylene
- 44. Hg: Mercury
- 45. HOA: Hands-Off-Automatic
- 46. HP: Horsepower
- 47. HVE: High Volume Evacuation
- 48. ID: Inside Diameter
- 49. IPS: Iron Pipe Size
- 50. Kg: Kilogram
- 51. kPa: Kilopascal
- 52. lb: Pound
- 53. L/s: Liters Per Second
- 54. L/min: Liters Per Minute
- 55. MAWP: Maximum Allowable Working Pressure
- 56. MAX: Maximum
- 57. MED: Medical
- 58. m: Meter
- 59. MFG: Manufacturer
- 60. mg: Milligram
- 61. mg/L: Milligrams per Liter
- 62. ml: Milliliter



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- 63. mm: Millimeter
- 64. MIN: Minimum
- 65. NF: Oil Free Dry (Nitrogen)
- 66. NPTF: National Pipe Thread Female
- 67. NPS: Nominal Pipe Size
- 68. NPT: Nominal Pipe Thread
- 69. OD: Outside Diameter
- 70. OSD: Open Sight Drain
- 71. OS&Y: Outside Stem and Yoke
- 72. OXY: Oxygen
- 73. PBPU: Prefabricated Bedside Patient Units
- 74. PH: Power of Hydrogen
- 75. PLC: Programmable Logic Controllers
- 76. PP: Polypropylene
- 77. PPM: Parts per Million
- 78. PSIG: Pounds per Square Inch
- 79. PTFE: Polytetrafluoroethylene
- 80. PVC: Polyvinyl Chloride
- 81. PVDF: Polyvinylidene Fluoride
- 82. RAD: Radians
- 83. RO: Reverse Osmosis
- 84. RPM: Revolutions Per Minute
- 85. RTRP: Reinforced Thermosetting Resin Pipe
- 86. SCFM: Standard Cubic Feet Per Minute
- 87. SDI: Silt Density Index
- 88. SPEC: Specification
- 89. SPS: Sterile Processing Services
- 90. STD: Standard
- 91. SUS: Saybolt Universal Second
- 92. SWP: Steam Working Pressure
- 93. TEFC: Totally Enclosed Fan-Cooled
- 94. TFE: Tetrafluoroethylene
- 95. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
- 96. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
- 97. T/P: Temperature and Pressure
- 98. USDA: U.S. Department of Agriculture

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- 99. V: Volt
- 100. VAC: Vacuum
- 101. VA: Veterans Administration
- 102. VAMC: Veterans Administration Medical Center
- 103. VAC: Voltage in Alternating Current
- 104. WAGD: Waste Anesthesia Gas Disposal
- 105. WOG: Water, Oil, Gas

## **1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- D. Section 05 50 00, METAL FABRICATIONS.
- E. Section 07 92 00, JOINT SEALANTS.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

## **1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - ASME Boiler and Pressure Vessel Code -
  - BPVC Section IX-2013....Welding, Brazing, and Fusing Qualifications
  - B31.1-2012.....Power Piping
- C. American Society for Testing and Materials (ASTM):
  - A36/A36M-2012.....Standard Specification for Carbon Structural Steel
  - A575-96(R2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
  - E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials
  - E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials
  - F1760-01(R2011).....Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
- D. International Code Council, (ICC):
  - IBC-2012.....International Building Code

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- IPC-2012.....International Plumbing Code
- E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
- SP-58-2009.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation
- SP-69-2003.....Pipe Hangers and Supports - Selection and Application
- F. Military Specifications (MIL):
- P-21035B.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)
- G. National Electrical Manufacturers Association (NEMA):
- MG 1-2011.....Motors and Generators
- H. National Fire Protection Association (NFPA):
- 51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
- 54-2012.....National Fuel Gas Code
- 70-2014.....National Electrical Code (NEC)
- I. NSF International (NSF):
- 5-2012.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
- 14-2012.....Plastic Piping System Components and Related Materials
- 61-2012.....Drinking Water System Components - Health Effects
- 372-2011.....Drinking Water System Components - Lead Content
- J. Department of Veterans Affairs (VA):
- PG-18-10.....Plumbing Design Manual
- PG-18-13-2011.....Barrier Free Design Guide

#### **1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

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- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements and will fit the space available.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Installing Contractor shall provide lists of previous installations for selected items of equipment. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
  - 1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
  - 2. Equipment and materials identification.
  - 3. Firestopping materials.
  - 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 5. Wall, floor, and ceiling plates.
- H. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.
- I. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale

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of not less than 1:32 (3/8 inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, controls, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

J. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment. Include complete list indicating all components of the systems with diagrams of the internal wiring for each item of equipment.
2. Include listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

## 1.5 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.

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2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos shall not be used.

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9. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.
- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
  1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
  2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
  3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
  4. All welds shall be stamped according to the provisions of the American Welding Society.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- D. Execution (Installation, Construction) Quality:
  1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the COR for resolution. Printed copies or electronic files of manufacturer's installation instructions shall be provided to the COR at least 10 working days prior to commencing installation of any item.
  2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely

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- accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution.
3. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved by VA.
  4. Installer Qualifications: Installer shall be licensed and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
  5. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or additional time to the Government.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall". Reference to the "code official" or "owner" shall be interpreted to mean the COR.
- G. Cleanliness of Piping and Equipment Systems:
1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
  2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
  3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
  4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.



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

##### **A. Protection of Equipment:**

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

#### **1.7 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad version provided on

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compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

- D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS FOR VARIOUS SERVICES**

- A. Non-pressure PVC pipe shall contain a minimum of 25 percent recycled content. Steel pipe shall contain a minimum of 25 percent recycled content.
- B. Plastic pipe, fittings and solvent cement shall meet NSF 14 and shall bear the NSF seal "NSF-PW". Polypropylene pipe and fittings shall comply with NSF 14 and NSF 61. Solder or flux containing lead shall not be used with copper pipe.
- C. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.
- D. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers shall comply with NSF 61 and NSF 372.
- E. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

### **2.2 FACTORY-ASSEMBLED PRODUCTS**

- A. Standardization of components shall be maximized to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
1. All components of an assembled unit need not be products of same manufacturer.

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2. Constituent parts that are alike shall be products of a single manufacturer.
  3. Components shall be compatible with each other and with the total assembly for intended service.
  4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, shall be the same make and model.

### **2.3 COMPATIBILITY OF RELATED EQUIPMENT**

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

### **2.4 SAFETY GUARDS**

- A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- B. All Equipment shall have moving parts protected from personal injury.

### **2.5 LIFTING ATTACHMENTS**

- A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

### **2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING**

- A. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided.

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Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
  - a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
  - b. Other wiring at boilers and water heaters, and to control panels, shall be NFPA 70 designation THWN.
  - c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1.

C. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

D. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.

E. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on

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drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.

- F. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

## **2.7 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local VAMC shops. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking.
- B. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.
- C. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- D. Valve Tags and Lists:
1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
  2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
  3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valve list shall be mounted in picture frames for mounting to a wall. COR shall instruct contractor where frames shall be mounted.
  4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling or access door.

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## **2.8 FIRESTOPPING**

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

## **2.09 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint.

## **2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

- A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) Submittals based on the International Building Code (IBC) requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.
- B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
  - 1. Concrete insert: Type 18, MSS SP-58.
  - 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
  - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
  - 1. Welded attachment: Type 22.
  - 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.
- E. For Attachment to Wood Construction: Wood screws or lag bolts.

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- F. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
  2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.
- H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
1. General Types (MSS SP-58):
    - a. Standard clevis hanger: Type 1; provide locknut.
    - b. Riser clamps: Type 8.
    - c. Wall brackets: Types 31, 32 or 33.
    - d. Roller supports: Type 41, 43, 44 and 46.
    - e. Saddle support: Type 36, 37 or 38.
    - f. Turnbuckle: Types 13 or 15.
    - g. U-bolt clamp: Type 24.
    - h. Copper Tube:
      - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.

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- 2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
  - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
  - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
    - i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
2. Plumbing Piping (Other Than General Types):
- a. Horizontal piping: Type 1, 5, 7, 9, and 10.
  - b. Chrome plated piping: Chrome plated supports.
  - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
  - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- I. Pre-insulated Calcium Silicate Shields:
1. Provide 360 degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
  2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
  3. Shield thickness shall match the pipe insulation.
  4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
    - a. Shields for supporting cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
    - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural



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steel (ASTM A36/A36M) wear plates welded to the bottom sheet  
metal jacket.

5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

## **2.11 PIPE PENETRATIONS**

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all firestopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
  - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- D. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.
- E. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- F. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

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- H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.
- K. Pipe passing through roof shall be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange shall extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane shall be provided with a clamping flange. The annular space between the sleeve and pipe shall be sealed watertight.

## **2.12 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.

## **2.13 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

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- B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

## **2.14 ASBESTOS**

- A. Materials containing asbestos are not permitted.

## **PART 3 - EXECUTION**

### **3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.
- B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.
- C. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.
- D. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.
- E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

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F. Cutting Holes:

1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced at no additional cost or time to the Government.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

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J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

K. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

L. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

M. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.

N. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve shall be provided in low point of casement pipe.

O. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

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### **3.2 TEMPORARY PIPING AND EQUIPMENT**

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are not allowed in potable water systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

### **3.3 RIGGING**

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to COR for evaluation prior to actual work.

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### **3.4 PIPE AND EQUIPMENT SUPPORTS**

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the COR.
- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.
- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.
- E. Overhead Supports:
  - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
  - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
  - 3. Tubing and capillary systems shall be supported in channel troughs.
- F. Floor Supports:
  - 1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
  - 2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.

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3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.

### **3.5 LUBRICATION**

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to COR in unopened containers that are properly identified as to application.
- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

### **3.6 PLUMBING SYSTEMS DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in



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accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate. Coordinate with the COR and Infection Control.

### **3.7 CLEANING AND PAINTING**

- A. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
  2. The following Material and Equipment shall NOT be painted:
    - a. Motors, controllers, control switches, and safety switches.
    - b. Control and interlock devices.
    - c. Regulators.

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- d. Pressure reducing valves.
  - e. Control valves and thermostatic elements.
  - f. Lubrication devices and grease fittings.
  - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
  - h. Valve stems and rotating shafts.
  - i. Pressure gages and thermometers.
  - j. Glass.
  - k. Name plates.
3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

### **3.8 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory built equipment.

### **3.9 STARTUP AND TEMPORARY OPERATION**

- A. Startup of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

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### **3.10 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

### **3.11 OPERATION AND MAINTENANCE MANUALS**

- A. All new and temporary equipment and all elements of each assembly shall be included.
- B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- C. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- D. Lubrication instructions, type and quantity of lubricant shall be included.
- E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- F. Set points of all interlock devices shall be listed.
- G. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.
- H. The control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- I. Emergency procedures for shutdown and startup of equipment and systems.

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Prevention and Control Legionella  
Project Number 549-15-517  
Submittal - 100% Construction Documents 06/17/16

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### **3.12 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

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**SECTION 22 05 23**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**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. American Society of Mechanical Engineers (ASME):  
A112.14.1-2003.....Backwater Valves
- C. American Society of Sanitary Engineering (ASSE):  
1001-2008.....Performance Requirements for Atmospheric Type  
Vacuum Breakers  
1003-2009.....Performance Requirements for Water Pressure  
Reducing Valves for Domestic Water Distribution  
Systems  
1011-2004.....Performance Requirements for Hose Connection  
Vacuum Breakers  
1013-2011.....Performance Requirements for Reduced Pressure  
Principle Backflow Preventers and Reduced  
Pressure Principle Fire Protection Backflow  
Preventers  
1015-2011.....Performance Requirements for Double Check  
Backflow Prevention Assemblies and Double Check  
Fire Protection Backflow Prevention Assemblies  
1017-2009.....Performance Requirements for Temperature  
Actuated Mixing Valves for Hot Water  
Distribution Systems

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- 1020-2004.....Performance Requirements for Pressure Vacuum  
Breaker Assembly
- 1035-2008.....Performance Requirements for Laboratory Faucet  
Backflow Preventers
- 1069-2005.....Performance Requirements for Automatic  
Temperature Control Mixing Valves
- 1070-2004.....Performance Requirements for Water Temperature  
Limiting Devices
- 1071-2012.....Performance Requirements for Temperature  
Actuated Mixing Valves for Plumbed Emergency  
Equipment

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

- A126-2004(R2009).....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe Fittings
- A276-2013a.....Standard Specification for Stainless Steel Bars  
and Shapes
- A536-1984(R2009).....Standard Specification for Ductile Iron  
Castings
- B62-2009.....Standard Specification for Composition Bronze  
or Ounce Metal Castings
- B584-2013.....Standard Specification for Copper Alloy Sand  
Castings for General Applications

E. International Code Council (ICC):

- IPC-2012.....International Plumbing Code

F. Manufacturers Standardization Society of the Valve and Fittings

Industry, Inc. (MSS):

- SP-25-2008.....Standard Marking Systems for Valves, Fittings,  
Flanges and Unions
- SP-67-2011.....Butterfly Valves
- SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded  
Ends
- SP-71-2011.....Gray Iron Swing Check Valves, Flanged and  
Threaded Ends
- SP-80-2013.....Bronze Gate, Globe, Angle, and Check Valves
- SP-85-2011.....Gray Iron Globe & Angle Valves, Flanged and  
Threaded Ends

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SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder  
Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

7th Edition 2005 Procedural Standards for Testing, Adjusting,  
Balancing of Environmental Systems

H. NSF International (NSF):

61-2012.....Drinking Water System Components - Health  
Effects

372-2011.....Drinking Water System Components - Lead Content

I. University of Southern California Foundation for Cross Connection  
Control and Hydraulic Research (USC FCCCHR):

9th Edition.....Manual of Cross-Connection Control

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Ball Valves.
  2. Gate Valves.
  3. Butterfly Valves.
  4. Balancing Valves.
  5. Check Valves.
  6. Globe Valves.
  7. Water Pressure Reducing Valves and Connections.
  8. Backflow Preventers.
- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
1. Include complete list indicating all components of the systems.
  2. Include complete diagrams of the internal wiring for each item of equipment.

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3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
4. Piping diagrams of thermostatic mixing valves to be installed.
- E. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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

- A. Valves shall be prepared for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Set butterfly valves closed or slightly open.
  6. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
  1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

### **PART 2 - PRODUCTS**

#### **2.1 VALVES, GENERAL**

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.



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- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.
- E. All valves used to supply potable water shall be lead free and meet the requirements of NSF 61 and NSF 372.
- F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

## 2.2 SHUT-OFF VALVES

- A. Cold, Hot and Re-circulating Hot Water:
  - 1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be non-lead solder.
  - 2. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A536, ductile iron.
  - 3. 100 mm DN100 (4 inches) and larger:
    - a. Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.
    - b. Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve

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materials shall be epoxy coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, Buna-N//EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated.

- B. Brine Solutions: Valves for brine solution service shall be ball type of same material as used for pipe.

### **2.3 CHECK VALVES**

- A. 75 mm or DN75 (3 inches) and smaller shall be Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.
- B. 100 mm or DN100 (4 inches) and larger:
1. Check valves shall be Class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.
  2. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

### **2.4 BACKFLOW PREVENTERS**

- A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).
- B. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM

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A276. The seat disc shall be the elastomer type suited for water service. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet. Reduced pressure backflow preventers shall be installed in the following applications.

1. Deionizers.
  2. Sterilizers.
  3. Stills.
  4. Dialysis, Deionized or Reverse Osmosis Water Systems.
  5. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
  6. Water service entrance from loop system.
  7. Dental equipment.
  8. Power washer.
  9. Medical equipment.
  10. Process equipment.
  11. Autopsy, on each hot and cold water outlet at each table or sink.
  12. Reclaimed water systems.
- C. The pipe applied or integral atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be cast bronze. The seat disc shall be the elastomer type suited for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers shall be installed in the following applications.
1. Hose bibs and sinks with threaded outlets.
  2. Disposers.
  3. Showers (telephone/handheld type).
  4. Hydrotherapy units.
  5. All kitchen equipment, if not protected by air gap.
  6. Ventilating hoods with wash down system.
  7. Film processor.
  8. Detergent system.
  9. Fume hoods.

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10. Glassware washers.
  11. Service sinks (integral with faucet only).
  12. Laundry tubs (integral with faucet only).
  13. Sitz baths.
- D. The hose connection vacuum breaker shall be ASSE listed 1011. The main body shall be cast brass with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to hose thread outlets. Hose connection vacuum breakers shall be installed in the following locations requiring non-continuous pressure:
1. Hose bibbs and wall hydrants.
- E. The pressure vacuum breaker shall be ASSE listed 1020. The main body shall be brass. The disc and O-ring seal shall be the elastomer type. The valve seat and disc float shall be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials shall be suitable for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Pressure vacuum breakers shall be installed in the following locations requiring continuous pressure and no backpressure including equipment with submerged inlet connections:
1. Lawn Irrigation.
- F. The laboratory faucet vacuum breaker shall be ASSE listed 1035. The main body shall be cast brass. Dual check valves with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to laboratory faucets for non-continuous pressure applications.
- G. The double check backflow prevention assembly shall be ASSE listed 1015 and supply with full port, OS&Y, positive-seal, resilient gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276. The seat disc shall be the

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elastomer type suited for water service. The first and second check valve shall be accessible for maintenance without removing the device from the line. Double check valves shall be installed in the following location requiring continuous pressure subject to backpressure and backsiphonage conditions.

1. Lawn Irrigation.
2. Food Processing Equipment.
3. Laundry equipment.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe.
- D. Valves shall be installed in a position to allow full stem movement.
- E. Check valves shall be installed for proper direction of flow and as follows:

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1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

F. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

G. Install pressure gages on outlet of backflow preventers.

H. Do not install bypass piping around backflow preventers.

### **3.3 LABELING AND IDENTIFYING**

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Calibrated balancing valves.
2. Master, thermostatic, water mixing valves.
3. Manifold, thermostatic, water-mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

### **3.4 ADJUSTING**

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.

B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services-  
Prevention and Control Legionella  
Project Number 549-15-517  
Submittal - 100% Construction Documents 06/17/16

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- D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer's Representative (COR).

### **3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

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**SECTION 22 05 33**  
**HEAT TRACING FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirement for supplying, installing, and testing of the electric heat tracing system of the plumbing piping. Freeze protection shall be utilized for domestic water piping in areas subject to freezing temperatures. Ice and snow melting shall be utilized for gutters, downspouts, roof drain bodies and roof drain leaders exposed to snow and ice accumulation.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 22 07 11, PLUMBING INSULATION.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Institute of Electrical and Electronic Engineers (IEEE):  
515.1-2012.....Standard for the Testing, Design, Installation,  
and Maintenance of Electrical Resistance Trace  
Heating for Commercial Applications
- C. International Code Council, (ICC):  
IPC-2012.....International Plumbing Code
- D. National Fire Protection Association (NFPA):  
70-2011.....National Electrical Code (NEC)
- E. Underwriters' Laboratories, Inc. (UL):  
508-99 (R2013).....Standard For Industrial Control Equipment

**1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.



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- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 33, HEAT TRACING FOR PLUMBING PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Rated capacity.
  - 2. Length of cable.
  - 3. Cable spacing.
  - 4. Electrical power requirements.
  - 5. Controls.
  - 6. Enclosures.
  - 7. Accessories.
- D. The shop drawings shall include plans, sections, details, wiring diagrams, and attachments to other work. The wiring diagrams shall include power, signal, and control wiring.
- E. Field quality control test reports shall be submitted.
- F. Operation and Maintenance data in accordance with section 1.6.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Ten years' experience in design, engineering, manufacture and support of specified system and components.
- B. Product Requirements:
  - 1. Pipe or tank tracing cable assembly shall be factory assembled, immersed in water for a minimum of 12 hours, and then tested for insulation resistance, high potential breakdown and continuity before leaving the factory.
  - 2. Factory Mutual approved heating cable that has the same wattage per lineal foot (power output), throughout its entire length.
  - 3. UL Listed, thermostat and contactor panel.
  - 4. UL Listed Control/Monitor Panel.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

#### **1.6 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments, construction revisions and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

### **PART 2 - PRODUCTS**

#### **2.1 SELF-REGULATING PARALLEL RESISTANCE HEATING CABLES**

- A. Self-regulating parallel resistance heating cables shall comply with IEEE 515.1.
- B. The heating element shall be a pair of parallel No. 16 AWG tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core, which varies heat output in response to temperature along its length. Cables shall be terminated with waterproof, factory assembled non heating leads with connects at one end and seal the opposite end watertight. The cable shall be capable of crossing over itself without overheating.
- C. The electrical insulating jacket shall be flame-retardant polyolefin.

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- D. The cable cover shall be tinned copper or stainless steel braid, and polyolefin outer jacket with UV inhibitor.
- E. The maximum power on operating temperature shall be 65 degrees C (150 degrees F).
- F. The maximum power off exposure temperature shall be 85 degrees C (185 degrees F).
- G. The capacities and characteristics shall be:
  - 1. Maximum heat output 9.8 W/m (3.0 W/foot).
  - 2. Pipe Diameter: shall be as indicated on the drawings.
  - 3. Spiral wrap pitch: single.
  - 4. Volts: 120.
  - 5. Phase: single.
  - 6. Hertz: 60.

## **2.2 CONTROLS**

- A. Pipe mounting thermostats for Freeze protection shall have be a remote bulb unit with adjustable temperature range from minus 1 to 10 degrees C (34 to 50 degrees F). The thermostat shall be snap action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable. The thermostat shall be remote bulb on capillary, resistance temperature device, or thermistor for direct sensing of pipe wall temperature. The control enclosure shall be corrosion resistant and waterproof.
- B. The enclosure shall be the NEMA 4X type.
- C. A minimum 30 amp contactor shall be provided to energize cable or close other contactors. Provide relay with contacts to indicate operational status, on/off, and for interface with central energy management and control system.

## **2.3 ACCESSORIES**

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Warning Labels: Shall comply with NFPA 70.
- C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 0.08 mm (3 mils) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

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1. Width for Markers on Pipes with Outside Dimension, Including Insulation, Less Than 150 mm (6 inches): 19 mm (3/4 inch) minimum.
2. Width for Markers on Pipes with Outside Dimension, Including Insulation, 150 mm (6 inches) or Larger: 38 mm (1-1/2 inches) minimum.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Inspect surfaces and substrates of electric heating cables for compliance with requirements of this specification. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- B. Notify COR if the existing substrate conditions are unsuitable for application of heating cables in accordance with manufacturer's recommendations.
- C. If the installation of the heat tracing is unsatisfactory, then the Contractor shall correct the installation at no cost to the Government.

#### **3.2 INSTALLATION**

- A. Electric heating cable shall be installed for the following applications:
  1. Freeze protection of plumbing piping: Self-regulating parallel-resistance heating cable.
- B. Electric heating cable shall be installed across expansion, construction, and control joints according to the manufacturer's recommendations using cable protection conduit and slack cable to allow for movement without damage to cable.
- C. Electric heating cable for pipe freeze protection shall be installed according to the following:
  1. Electric heating cables shall be installed after piping has been tested and before insulation is installed.
  2. Electric heat cables shall be installed according to IEEE 515.1
  3. Insulation shall be installed or applied over piping with electric cables. Refer to Section 22 07 11, PLUMBING INSULATION.
  4. Warning tape shall be installed on pipe insulation where piping is equipped with electric heating cables.
- D. Field adjustable switches and circuit breaker trip ranges shall be set.
- E. Heating cables including leads shall be protected from damage.

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### 3.3 TESTS

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
  - 2. Test cables for electrical continuity and insulation integrity before energizing.
  - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- D. If deficiency is found, Contractor shall correct all deficiencies at no cost to the Government.
- E. Prepare test and inspection reports.

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**SECTION 22 07 11**  
**PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Field applied insulation for thermal efficiency and condensation control for the following:
1. Plumbing piping and equipment.
- B. Definitions:
1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
  2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
  4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
  5. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
  6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
  7. FSK: Foil-scrim-Kraft facing.
  8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
  9. Density: kg/m<sup>3</sup> - kilograms per cubic meter (Pcf - pounds per cubic foot).
  10. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watts per square meter (BTU per hour per square foot).

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- b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
13. HWR: Hot water recirculating.
14. CW: Cold water.
15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

## **1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
- E. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.
- F. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING: Insulation over heating cables.

## **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 basic designation only.
- B. American Society for Testing and Materials (ASTM):  
B209-2014.....Standard Specification for Aluminum and  
Aluminum-Alloy Sheet and Plate

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C411-2011.....	Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
C449-2007 (R2013).....	Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
C450-2008 (R2014).....	Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
Adjunct to C450.....	Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.
C533-2013.....	Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
C534/C534M-2014.....	Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
C547-2015.....	Standard Specification for Mineral Fiber Pipe Insulation
C552-2014.....	Standard Specification for Cellular Glass Thermal Insulation
C553-2013.....	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C591-2013.....	Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
C680-2014.....	Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs
C612-2014.....	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
C1126-2014.....	Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation



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- C1136-2012.....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal  
Insulation
- C1710-2011.....Standard Guide for Installation of Flexible  
Closed Cell Preformed Insulation in Tube and  
Sheet Form
- D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics  
(Woven and Treated) for Roofing and  
Waterproofing
- E84-2015a.....Standard Test Method for Surface Burning  
Characteristics of Building Materials
- E2231-2015.....Standard Practice for Specimen Preparation and  
Mounting of Pipe and Duct Insulation to Assess  
Surface Burning Characteristics
- C. Federal Specifications (Fed. Spec.):
- L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly  
(Vinyl Chloride) and Poly (Vinyl Chloride -  
Vinyl Acetate), Rigid.
- D. International Code Council, (ICC):
- IMC-2012.....International Mechanical Code
- E. Military Specifications (Mil. Spec.):
- MIL-A-3316C (2)-1990....Adhesives, Fire-Resistant, Thermal Insulation
- MIL-A-24179A (2)-1987...Adhesive, Flexible Unicellular-Plastic Thermal  
Insulation
- MIL-PRF-19565C (1)-1988.Coating Compounds, Thermal Insulation, Fire-and  
Water-Resistant, Vapor-Barrier
- MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread,  
Glass and Wire-Reinforced Glass
- F. National Fire Protection Association (NFPA):
- 90A-2015.....Standard for the Installation of Air-  
Conditioning and Ventilating Systems
- G. Underwriters Laboratories, Inc (UL):
- 723-2008 (R2013).....Standard for Test for Surface Burning  
Characteristics of Building Materials

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1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler  
Pipe for Visible Flame and Smoke  
Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available  
from NAIMA with free download; <http://www.pipeinsulation.net>

#### **1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
- D. Shop Drawings:
  - 1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used and state surface burning characteristics.
    - c. Insulation accessory materials: Each type used.
    - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
    - e. Make reference to applicable specification paragraph numbers for coordination.
    - f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

#### **1.5 QUALITY ASSURANCE**

- A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

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B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through

4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:

**4.3.3.1** Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.

4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).

4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.

2. Test methods: ASTM E84, UL 723, and ASTM E2231.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

- C. Every package or standard container of insulation or accessories delivered to the job site for use shall have a manufacturer's stamp or label giving the name of the manufacturer, description of the material, and the production date or code.

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- D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

#### **1.6 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version 11 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

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## **1.7 STORAGE AND HANDLING OF MATERIAL**

- A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

## **PART 2 - PRODUCTS**

### **2.1 MINERAL FIBER OR FIBER GLASS**

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m<sup>3</sup> (nominal 3 pcf),  $k = 0.037$  (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, or Class B-3, Density 16 kg/m<sup>3</sup> (nominal 1 pcf),  $k = 0.045$  (0.31) or Class B-5, Density 32 kg/m<sup>3</sup> (nominal 2 pcf),  $k = 0.04$  (0.27) or at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1,  $k = 0.037$  (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

### **2.2 MINERAL WOOL OR REFRACTORY FIBER**

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (842 degrees F).

### **2.3 RIGID CELLULAR PHENOLIC FOAM**

- A. Preformed (molded) pipe insulation, ASTM C1126, Type III, grade 1,  $k = 0.021$  (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket (ASJ) and with PVC premolded fitting covering.
- B. Equipment Insulation, ASTM C1126, Type II, grade 1,  $k = 0.021$  (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket (ASJ).

### **2.4 CELLULAR GLASS CLOSED-CELL**

- A. Comply with Standard ASTM C552, density 120 kg/m<sup>3</sup> (7.5 pcf) nominal,  $k = 0.033$  (0.29) at 24 degrees C (75 degrees F).

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- B. Pipe insulation for use at process temperatures below ambient air to 482 degrees C (900 degrees F) with or without all service vapor retarder jacket (ASJ).
- C. Pipe insulation for use at process temperatures for pipe and tube below ambient air temperatures or where condensation control is necessary are to be installed with a vapor retarder/barrier system of with or without all service vapor retarder sealed jacket (ASJ) system. Without ASJ shall require all longitudinal and circumferential joints to be vapor sealed with vapor barrier mastic.
- D. Cellular glass thermal insulation intended for use on surfaces operating at temperatures between -268 and 482 degrees C (-450 and 900 degrees F). It is possible that special fabrication or techniques for pipe insulation, or both, shall be required for application in the temperature range from 121 to 427 degrees C (250 to 800 degrees F).

## **2.5 POLYISOCYANURATE CLOSED-CELL RIGID**

- A. Preformed (fabricated) pipe insulation, ASTM C591, Type IV,  $K=0.027(0.19)$  at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with PVC premolded fitting covers.
- B. Equipment and duct insulation, ASTM C591, Type IV,  $K=0.027(0.19)$  at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

## **2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

- A. ASTM C534/C534M,  $k = 0.039 (0.27)$  at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

## **2.7 CALCIUM SILICATE**

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II.

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D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Surface Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m <sup>3</sup> (lb/ ft <sup>3</sup> )	240 (15)	352 (22)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> degrees F)@ mean temperature of 93 degrees C (199 degrees F)	0.065 (0.45)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

## 2.8 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.
- B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.
- D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations conveying fluids below ambient

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temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

- E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.
- H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an



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internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

- I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

## 2.9 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C (300 degrees F)), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

## 2.10 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

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- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-PRFC-19565C, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

## **2.11 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.
- E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

## **2.12 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick

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(28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch)  
Kraft paper.

- F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

### **2.13 FIRESTOPPING MATERIAL**

- A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

### **2.14 FLAME AND SMOKE**

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

## **PART 3 - EXECUTION**

### **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer's Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).
- E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and

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below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

- F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.
- G. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.
- H. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating's maximum temperature limit) or jacket material.
- I. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- J. Plumbing work not to be insulated unless otherwise noted:
  - 1. Piping and valves of fire protection system.
  - 2. Chromium plated brass piping.
  - 3. Water piping in contact with earth.
  - 4. Distilled water piping.
- K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

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- L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- M. Firestop Pipe insulation:
1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
  2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
    - a. Pipe risers through floors
    - b. Pipe chase walls and floors
    - c. Smoke partitions
    - d. Fire partitions
    - e. Hourly rated walls
- N. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (3/4 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipe insulations. Provide freeze protection for cold water make-up piping and equipment where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).
- O. Provide vapor barrier systems as follows:
1. All piping exposed to outdoor weather.
  2. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) below ambient air temperature.
  3. Brine piping.
- P. Provide metal jackets over insulation as follows:
1. All plumbing piping exposed to outdoor weather.
  2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.

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3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

Q. Provide PVC jackets over insulation as follows:

1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

### **3.2 INSULATION INSTALLATION**

A. Mineral Fiber Board:

1. Vapor retarder faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. (Bio-based materials shall be utilized when possible.) Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain unfaced board:
  - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
  - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
  - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with vapor retarder ASJ or FSK. Seal all facings, laps, and termination points and do not use staples or other attachments that may puncture ASJ or FSK.

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- a. Water filter, chemical feeder pot or tank.
- b. Pneumatic, cold storage water and surge tanks.
- 4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with unsealed ASJ or FSK.
  - a. Domestic water heaters and hot water storage tanks (not factory insulated).
  - b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.
- B. Molded Mineral Fiber Pipe and Tubing Covering:
  - 1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellular glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
  - 2. Contractor's options for fitting, flange and valve insulation:
    - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
    - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
    - c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

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- d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
  - 3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.
- C. Rigid Cellular Phenolic Foam:
- 1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
  - 2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
  - 3. Provide secure attachment facilities such as welding pins.
  - 4. Apply insulation with joints tightly drawn together.
  - 5. Apply adhesives, coverings, neatly finished at fittings, and valves.
  - 6. Final installation shall be smooth, tight, neatly finished at all edges.
  - 7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
  - 8. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.
    - a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
    - b. Waste piping from electric water coolers and icemakers to drainage system.
    - c. Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment (including trap) to main vertical waste pipe.
    - d. MRI quench vent piping.
    - e. Bedpan sanitizer atmospheric vent
    - f. Brine water piping.
    - g. Cold water piping, exterior only.
- D. Cellular Glass Insulation:
- 1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.



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2. Underground piping other than or in lieu of that specified in  
Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory  
jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000  
mm (10 ft x 10 ft) asphalt impreganted glass fabric, bituminous  
mastic and outside protective plastic film.
    - a. 75 mm (3 inches) thick for hot water piping.
    - b. As scheduled at the end of this section for chilled water piping.
    - c. Underground piping: Apply insulation with joints tightly butted.  
Seal longitudinal self-sealing lap. Use field fabricated or  
factory made fittings. Seal butt joints and fitting with  
jacketing as recommended by the insulation manufacturer. Use 100  
mm (4 inch) wide strips to seal butt joints.
    - d. Provide expansion chambers for pipe loops, anchors and wall  
penetrations as recommended by the insulation manufacturer.
    - e. Underground insulation shall be inspected and approved by the COR  
as follows:
      - 1) Insulation in place before coating.
      - 2) After coating.
    - f. Sand bed and backfill: Minimum 75 mm (3 inches) all around  
insulated pipe or tank, applied after coating has dried.
    - g. All piping up to 482 degrees C (900 degrees F) requiring  
protection from physical heavy contact/abuse including in  
mechanical rooms and exposures to the public.
  3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.
- E. Polyisocyanurate Closed-Cell Rigid Insulation:
1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided  
for exterior piping and equipment for temperature up to 149 degree C  
(300 degree F).
  2. Install insulation, vapor retarder and jacketing per manufacturer's  
recommendations. Particular attention should be paid to  
recommendations for joint staggering, adhesive application, external  
hanger design, expansion/contraction joint design and spacing and  
vapor retarder integrity.
  3. Install insulation with all joints tightly butted (except expansion)  
joints in hot applications). Provide insulation contractions joints  
for very cold process temperatures.

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4. If insulation thickness exceeds 65 mm (2-1/2 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
5. For cold applications, vapor retarder shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall be used to attach the vapor retarder or jacketing. No wire ties capable of penetrating the vapor retarder shall be used to hold the insulation in place. Stainless steel banding shall be used for cold applications to attach PVC or metal jacketing.
6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane or polyisocyanurate spray-foam to fill PVC elbow jacket is prohibited on cold applications.
7. For cold applications, the vapor retarder on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor retarder adhesive tape. Bio-based materials shall be utilized when possible.
8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints). Bio-based materials shall be utilized when possible.
9. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph "Quality Assurance". Refer to paragraph "General Requirements" for items not to be insulated.
10. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.

F. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
2. Pipe and tubing insulation:
  - a. Use proper size material. Do not stretch or strain insulation.

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- b. To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer.  
Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
  - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.
  3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
  4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
- G. Calcium Silicate:
1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

<b>Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)</b>				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 8)	Greater than 200 (8)
93-260 degrees C (199-500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	Greater than 150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

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### 3.3 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Greater
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-15 degrees C (40-60 degrees F) (Brine piping)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F) (Brine piping)	Polyiso-cyanurate Closed-Cell Rigid(Exterior	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

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<b>Insulation Thickness Millimeters (Inches)</b>					
		<b>Nominal Pipe Size Millimeters (Inches)</b>			
	Locations only)				
(4-15 degrees C (40-60 degrees F) (Brine piping)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25 (1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F) (Brine piping)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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**SECTION 22 11 00**  
**FACILITY WATER DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. Section 07 84 00, FIRESTOPPING.
- E. Section 07 92 00, JOINT SEALANTS.
- F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- G. Section 22 07 11, PLUMBING INSULATION.

**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. American Society of Mechanical Engineers (ASME):
  - A13.1-2007 (R2013).....Scheme for Identification of Piping Systems
  - B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300
  - B16.9-2012.....Factory-Made Wrought Buttwelding Fittings
  - B16.11-2011.....Forged Fittings, Socket-Welding and Threaded
  - B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings
  - B16.15-2013 .....Cast Copper Alloy Threaded Fittings: Classes 125 and 250
  - B16.18-2012.....Cast Copper Alloy Solder Joint Pressure Fittings
  - B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

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- B16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings: Classes 150, 300, 600, 900, 1500, and  
2500
- B16.51-2013.....Copper and Copper Alloy Press-Connect Fittings  
ASME Boiler and Pressure Vessel Code -  
BPVC Section IX-2015....Welding, Brazing, and Fusing Qualifications
- C. American Society of Sanitary Engineers (ASSE):  
1010-2004.....Performance Requirements for Water Hammer  
Arresters
- D. American Society for Testing and Materials (ASTM):  
A47/A47M-1999 (R2014)...Standard Specification for Ferritic Malleable  
Iron Castings
- A53/A53M-2012.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and  
Seamless
- A183-2014.....Standard Specification for Carbon Steel Track  
Bolts and Nuts
- A269/A269M-2014e1.....Standard Specification for Seamless and Welded  
Austenitic Stainless Steel Tubing for General  
Service
- A312/A312M-2015.....Standard Specification for Seamless, Welded,  
and Heavily Cold Worked Austenitic Stainless  
Steel Pipes
- A403/A403M-2014.....Standard Specification for Wrought Austenitic  
Stainless Steel Piping Fittings
- A536-1984 (R2014).....Standard Specification for Ductile Iron  
Castings
- A733-2013.....Standard Specification for Welded and Seamless  
Carbon Steel and Austenitic Stainless Steel  
Pipe Nipples
- B32-2008 (R2014).....Standard Specification for Solder Metal
- B43-2014.....Standard Specification for Seamless Red Brass  
Pipe, Standard Sizes
- B61-2008 (R2013).....Standard Specification for Steam or Valve  
Bronze Castings

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B62-2009.....Standard Specification for Composition Bronze  
or Ounce Metal Castings  
B75/B75M-2011.....Standard Specification for Seamless Copper Tube  
B88-2014.....Standard Specification for Seamless Copper  
Water Tube  
B584-2014.....Standard Specification for Copper Alloy Sand  
Castings for General Applications  
B687-1999 (R2011).....Standard Specification for Brass, Copper, and  
Chromium-Plated Pipe Nipples  
C919-2012.....Standard Practice for Use of Sealants in  
Acoustical Applications  
D1785-2012.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe, Schedules 40, 80,  
and 120  
D2000-2012.....Standard Classification System for Rubber  
Products in Automotive Applications  
D2564-2012.....Standard Specification for Solvent Cements for  
Poly (Vinyl Chloride) (PVC) Plastic Piping  
Systems  
D2657-2007.....Standard Practice for Heat Fusion Joining of  
Polyolefin Pipe and Fittings  
D2855-1996 (R2010).....Standard Practice for Making Solvent-Cemented  
Joints with Poly (Vinyl Chloride) (PVC) Pipe  
and Fittings  
D4101-2014.....Standard Specification for Polypropylene  
Injection and Extrusion Materials  
E1120-2008.....Standard Specification for Liquid Chlorine  
E1229-2008.....Standard Specification for Calcium Hypochlorite  
F2389-2010.....Standard Specification for Pressure-rated  
Polypropylene (PP) Piping Systems  
F2620-2013.....Standard Practice for Heat Fusion Joining of  
Polyethylene Pipe and Fittings  
F2769-2014.....Standard Specification for Polyethylene of  
Raised Temperature (PE-RT) Plastic Hot and  
Cold-Water Tubing and Distribution Systems



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E. American Water Works Association (AWWA):

- C110-2012.....Ductile-Iron and Gray-Iron Fittings
- C151-2009.....Ductile Iron Pipe, Centrifugally Cast
- C153-2011.....Ductile-Iron Compact Fittings
- C203-2008.....Coal-Tar Protective Coatings and Linings for  
Steel Water Pipelines - Enamel and Tape - Hot  
Applied
- C213-2007.....Fusion-Bonded Epoxy Coating for the Interior  
and Exterior of Steel Water Pipelines
- C651-2014.....Disinfecting Water Mains

F. American Welding Society (AWS):

- A5.8M/A5.8-2011-AMD1....Specification for Filler Metals for Brazing and  
Braze Welding

G. International Code Council (ICC):

- IPC-2012.....International Plumbing Code

H. Manufacturers Specification Society (MSS):

- SP-58-2009.....Pipe Hangers and Supports - Materials, Design,  
Manufacture, Selection, Application, and  
Installation
- SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends  
for General Service
- SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder  
Joint, Grooved and Flared Ends

I. NSF International (NSF):

- 14-2015.....Plastics Piping System Components and Related  
Materials
- 61-2014a.....Drinking Water System Components - Health  
Effects
- 372-2011.....Drinking Water System Components - Lead Content

J. Plumbing and Drainage Institute (PDI):

- PDI-WH 201-2010.....Water Hammer Arrestors

K. Department of Veterans Affairs:

- H-18-8-2013.....Seismic Design Handbook

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#### **1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTIONS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. All items listed in Part 2 - Products.
- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

#### **1.5 QUALITY ASSURANCE**

- A. A certificate shall be submitted prior to welding of steel piping showing the Welder's certification. The certificate shall be current and no more than one year old. Welder's qualifications shall be in accordance with ASME BPVC Section IX.
- B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.
- C. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.
- D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more

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

#### **1.6 SPARE PARTS**

- A. For mechanical press-connect fittings, provide tools required for each pipe size used at the facility.

#### **1.7 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version //\_\_\_\_// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results

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of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.
- B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

### **2.2 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS**

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material to be the same for the size specified inside the building.
- B. 75 mm (3 inch) Diameter and Greater: Ductile iron, AWWA C151, 2413 kPa (350 psig) pressure class, exterior bituminous coating, and cement lined. Bio-based materials shall be utilized when possible. Provide flanged and anchored connection to interior piping.
- C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings are as specified in paragraph "Above Ground (Interior) Water Piping". Use brazing alloys, AWS A5.8M/A5.8, Classification BCuP.
- D. Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psig) working pressure conforming to AWWA C153, capable of deflecting a minimum of 20 degrees in each direction. Flexible expansion joint size shall match the pipe size it is connected to and 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 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be factory tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to AWWA C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. The flexible expansion fitting shall not expand or exert an axial thrust under internal water pressure. Provide piping joint restraints at each mechanical joint end

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connection and piping restraints at the penetration of the building wall. The restraints shall be provided to address the developed thrust at the change of piping direction.

### **2.3 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless steel, ASTM A312, schedule 10 shall be used.
- B. Fittings for Copper Tube:
  - 1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
  - 2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400. Mechanical grooved couplings, 2070 kpa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
  - 3. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, NSF 61 approved, 50 mm (2 inch) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements and un-pressed fitting identification feature.
  - 4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
  - 5. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

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C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ASME B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403/A403M. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, 4138 kPa (600 psig), ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

E. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

**2.4 EXPOSED WATER PIPING**

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

1. Pipe: ASTM B43, standard weight.
2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish.
3. Nipples: ASTM B687, Chromium-plated.
4. Unions: MSS SP-72, MSS SP-110, brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

**2.5 TRAP PRIMER WATER PIPING**

A. Pipe: Copper tube, ASTM B88, type K, hard drawn.

B. Fittings: Bronze castings conforming to ASME B16.18 Solder joints.

C. Solder: ASTM B32 alloy type Sb5. Provide non-corrosive flux.

**2.6 STRAINERS**

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and

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equipment subject to sediment damage and where shown on drawings.

Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

## **2.7 DIELECTRIC FITTINGS**

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

## **2.8 STERILIZATION CHEMICALS**

A. Hypochlorite: ASTM E1120.

B. Liquid Chlorine: ASTM E1229.

## **2.9 WATER HAMMER ARRESTER**

A. Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:

1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All medical washing equipment.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.

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3. All pipe runs shall be laid out to avoid interference with other work/trades.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
  - a. All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA as required.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
  - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split un-plated cast iron.
    - 2) All plates shall be provided with set screws.
    - 3) Pipe Hangers: Height adjustable clevis type.
    - 4) Adjustable Floor Rests and Base Flanges: Steel.
    - 5) Concrete Inserts: "Universal" or continuous slotted type.
    - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
    - 7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
    - 8) Rollers: Cast iron.
    - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
    - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.



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- 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
  - 12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
  7. Penetrations:
    - a. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.
    - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.
    - c. Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.
  8. Mechanical press-connect fitting connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. Ensure the tube is

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completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.

B. Domestic Water piping shall conform to the following:

1. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

### 3.2 TESTS

- A. General: Test system either in its entirety or in sections. Submit testing plan to COR 10 working days prior to test date.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 1035 kPa (150 psig) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested. Pressure gauge shall have 1 psig increments.
- C. Re-agent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 1380 kPa (200 psig) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.
- E. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

### 3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

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B. Use liquid chlorine or hypochlorite for sterilization.

**3.4 DEMONSTRATION AND TRAINING**

A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

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**SECTION 22 13 00**  
**FACILITY SANITARY AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- D. Section 07 92 00, JOINT SEALANTS: Sealant products.
- E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- F. Section 22 07 11, PLUMBING INSULATION.

**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. American Society of Mechanical Engineers (ASME):
  - A13.1-2007.....Scheme for the Identification of Piping Systems
  - A112.36.2M-1991(R 2012).Cleanouts
  - A112.6.3-2001 (R2007)...Standard for Floor and Trench Drains
  - B1.20.1-2013.....Pipe Threads, General Purpose (Inch)
  - B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings
  - B16.4-2011.....Standard for Grey Iron Threaded Fittings
    - Classes 125 and 250
  - B16.15-2013.....Cast Copper Alloy Threaded Fittings, Classes
    - 125 and 250
  - B16.18-2012.....Cast Copper Alloy Solder Joint Pressure Fittings
  - B16.21-2011.....Nonmetallic Flat Gaskets for Pipe Flanges

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- B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint  
Pressure Fittings
- B16.23-2011.....Cast Copper Alloy Solder Joint Drainage  
Fittings: DWV
- B16.24-2001 (R2006).....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings
- B16.29-2012.....Wrought Copper and Wrought Copper Alloy Solder-  
Joint Drainage Fittings: DWV
- B16.39-2009.....Malleable Iron Threaded Pipe Unions Classes  
150, 250, and 300
- B18.2.1-2012.....Square, Hex, Heavy Hex, and Askew Head Bolts  
and Hex, Heavy Hex, Hex Flange, Lobed Head, and  
Lag Screws (Inch Series)
- C. American Society of Sanitary Engineers (ASSE):
  - 1001-2008.....Performance Requirements for Atmospheric Type  
Vacuum Breakers
  - 1018-2001.....Performance Requirements for Trap Seal Primer  
Valves - Potable Water Supplied
  - 1044-2001.....Performance Requirements for Trap Seal Primer  
Devices - Drainage Types and Electronic Design  
Types
  - 1079-2012.....Performance Requirements for Dielectric Pipe  
Unions
- D. American Society for Testing and Materials (ASTM):
  - A53/A53M-2012.....Standard Specification for Pipe, Steel, Black  
And Hot-Dipped, Zinc-coated, Welded and  
Seamless
  - A74-2013a.....Standard Specification for Cast Iron Soil Pipe  
and Fittings
  - A888-2013a.....Standard Specification for Hubless Cast Iron  
Soil Pipe and Fittings for Sanitary and Storm  
Drain, Waste, and Vent Piping Applications
  - B32-2008.....Standard Specification for Solder Metal
  - B43-2009.....Standard Specification for Seamless Red Brass  
Pipe, Standard Sizes
  - B75-2011.....Standard Specification for Seamless Copper Tube

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B88-2009.....Standard Specification for Seamless Copper  
Water Tube

B306-2013.....Standard Specification for Copper Drainage Tube  
(DWV)

B584-2013.....Standard Specification for Copper Alloy Sand  
Castings for General Applications

B687-1999 (R 2011).....Standard Specification for Brass, Copper, and  
Chromium-Plated Pipe Nipples

B813-2010.....Standard Specification for Liquid and Paste  
Fluxes for Soldering of Copper and Copper Alloy  
Tube

B828-2002 (R 2010).....Standard Practice for Making Capillary Joints  
by Soldering of Copper and Copper Alloy Tube  
and Fittings

C564-2012.....Standard Specification for Rubber Gaskets for  
Cast Iron Soil Pipe and Fittings

D1785-2012.....Standard Specification for Poly(Vinyl Chloride)  
(PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-2011.....Standard Practice for Underground Installation  
of Thermoplastic Pipe for Sewers and Other  
Gravity-Flow Applications

D2564-2012.....Standard Specification for Solvent Cements for  
Poly(Vinyl Chloride) (PVC) Plastic Piping  
Systems

D2665-2012.....Standard Specification for Poly(Vinyl Chloride)  
(PVC) Plastic Drain, Waste, and Vent Pipe and  
Fittings

D2855-1996 (R 2010).....Standard Practice for Making Solvent-Cemented  
Joints with Poly(Vinyl Chloride) (PVC) Pipe and  
Fittings

D5926-2011.....Standard Specification for Poly(Vinyl Chloride)  
(PVC) Gaskets for Drain, Waste, and Vent (DWV),  
Sewer, Sanitary, and Storm Plumbing Systems

F402-2005 (R 2012).....Standard Practice for Safe Handling of Solvent  
Cements, Primers, and Cleaners Used for Joining  
Thermoplastic Pipe and Fittings

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- F477-2010.....Standard Specification for Elastomeric Seals  
(Gaskets) for Joining Plastic Pipe
- F1545-1997 (R 2009).....Standard Specification for Plastic-Lined  
Ferrous Metal Pipe, Fittings, and Flanges
- E. Cast Iron Soil Pipe Institute (CISPI):
- 2006.....Cast Iron Soil Pipe and Fittings Handbook
- 301-2012.....Standard Specification for Hubless Cast Iron  
Soil Pipe and Fittings for Sanitary and Storm  
Drain, Waste, and Vent Piping Applications
- 310-2012.....Specification for Coupling for Use in  
Connection with Hubless Cast Iron Soil Pipe and  
Fittings for Sanitary and Storm Drain, Waste,  
and Vent Piping Applications
- F. Copper Development Association, Inc. (CDA):
- A4015.....Copper Tube Handbook
- G. International Code Council (ICC):
- IPC-2012.....International Plumbing Code
- H. Manufacturers Standardization Society (MSS):
- SP-123-2013.....Non-Ferrous Threaded and Solder-Joint Unions  
for Use With Copper Water Tube
- I. National Fire Protection Association (NFPA):
- 70-2014.....National Electrical Code (NEC)
- J. Plumbing and Drainage Institute (PDI):
- WH-201 (R 2010).....Water Hammer Arrestors Standard
- K. Underwriters' Laboratories, Inc. (UL):
- 508-99 (R2013).....Standard For Industrial Control Equipment

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in  
accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and  
SAMPLES.
- B. Information and material submitted under this section shall be marked  
"SUBMITTED UNDER SECTION 22 13 00, FACILITY SANITARY AND VENT PIPING",  
with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and  
optional features and accessories. Include dimensions, weights,

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materials, applications, standard compliance, model numbers, size, and capacity.

1. Piping.
2. Floor Drains.
3. Penetration Sleeves.
4. Pipe Fittings.
5. Exposed Piping and Fittings.

- D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

### **1.5 QUALITY ASSURANCE**

- A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

### **1.6 AS-BUILT DOCUMENTATION**

- A. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad version 11 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- B. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 SANITARY WASTE, DRAIN, AND VENT PIPING**

- A. Cast iron waste, drain, and vent pipe and fittings.
  1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
    - a. Pipe buried in or in contact with earth.



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- b. Sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
- c. Interior waste and vent piping above grade.
- 2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
- 3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
- 4. Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.
- 5. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

## **2.2 EXPOSED WASTE PIPING**

- A. Chrome plated brass piping of full iron pipe size shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
- 1. The Pipe shall meet ASTM B43, regular weight.
- 2. The Fittings shall conform to //ASME B16.15// //ASTM D2665//.
- 3. Nipples shall conform to ASTM B687, Chromium-plated.
- 4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

## **2.3 SPECIALTY PIPE FITTINGS**

- A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

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1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
  2. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 861 kPa (125 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

#### **2.4 CLEANOUTS**

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the

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carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

## **2.5 FLOOR DRAINS**

- A. General Data: floor drain shall comply with ASME A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe.
- B. Type AA (FD-AA) floor sink shall comply with ASME A112.6.3. The type AA floor sink shall be 16" x 16" x 12" deep cast iron body with seepage flange, internal dome strainer, acid resisting epoxy coated interior and top, and 1/2 heavy duty non-tilting loose set grate. A clamping device shall be provided.

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## **2.6 TRAPS**

- A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as the piping they are connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

## **2.7 PENETRATION SLEEVES**

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

# **PART 3 - EXECUTION**

## **3.1 PIPE INSTALLATION**

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.
- G. The piping shall be installed free of sags and bends.
- H. Seismic restraint shall be installed where required by code.
- I. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends.

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Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- J. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- L. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

### **3.2 JOINT CONSTRUCTION**

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

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1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.

2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

### **3.3 SPECIALTY PIPE FITTINGS**

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

### **3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES**

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.

2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.

3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.

4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.

5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.

E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

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- F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
  2. All plates shall be provided with set screws.
  3. Height adjustable clevis type pipe hangers.
  4. Adjustable floor rests and base flanges shall be steel.
  5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  6. Riser clamps shall be malleable iron or steel.
  7. Rollers shall be cast iron.
  8. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- G. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- H. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- I. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
  2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

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### 3.5 TESTS

- A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.
- B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
  - 1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
  - 2. For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.
  - 3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
  - 4. Final Tests: Either one of the following tests may be used.
    - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of .25 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
    - b. Peppermint Test: Introduce 60 ml (2 ounces) of peppermint into each line or stack.

- - - E N D - - -



**SECTION 22 14 29**  
**SUMP PUMPS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Sump pumps. See schedule on Drawings for pump capacity and head.
- B. A complete listing of all acronyms and abbreviations are included in  
Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING

**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. American National Standard Institute (ANSI)/Hydraulic Institute (HI):
  - 1.1-1.2-2014.....Rotodynamic Centrifugal Pumps for Nomenclature and Definitions
  - 1.3-2013.....Rotodynamic Centrifugal Pumps for Design and Application
  - 1.4-2014.....Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation, and Maintenance
- C. ASTM International (ASTM):
  - A48/A48M-2003 (R2012)...Standard Specification for Gray Iron Castings
  - A532/A532M-2010 (R2014).Standard Specification for Abrasion-Resistant Cast Irons
  - B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications
- D. National Electrical Manufacturers Association (NEMA):
  - ICS 6-1993 (R2001, R2006) Industrial Control and Systems: Enclosures
  - 250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

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E. Underwriters' Laboratories, Inc. (UL):

508-1999 (R2013).....Standards for Industrial Control Equipment

#### **1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 14 29, SUMP PUMPS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Pump:
    - a. Manufacturer and model.
    - b. Operating speed (rpm).
    - c. Capacity.
    - d. Characteristic performance curves.
  - 2. Electric Motor:
    - a. Manufacturer.
    - b. Speed.
    - c. Current Characteristics and W (HP).
    - d. Efficiency.
  - 3. Control panel.
  - 4. Sensors.
- D. Certified copies of all the factory and construction site test data sheets and reports.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
  - 1. Include complete list which indicates all components of the system.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance, and troubleshooting

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## **1.5 QUALITY ASSURANCE**

- A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopREFERRED.gov>.

## **1.6 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CADD provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures

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followed for all tests, and a certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 SUMP PUMP**

- A. Centrifugal, vertical, submersible pump and motor, designed for 140 degrees F maximum water service. Driver shall be electric motor. Support shall be rigid type. Provide perforated, suction strainer. Systems may include one, two, or more pumps with alternator as required by Contract Documents. Pumps shall be capable of continuous duty cycle.
  - 1. Pump housings may be cast iron, bronze, aluminum or stainless steel. Cast iron and aluminum housings for submersible pumps shall be epoxy coated. Bio-based materials shall be utilized when possible.
- B. Impeller: Statically and dynamically balanced, keyed and secured to shaft, cast iron ASTM A532/A532M.
- C. Shaft: Stainless steel or other approved corrosion-resisting metal.
- D. Bearings: As required to hold shaft alignment, anti-friction type for thrust permanently lubricated. Bio-based materials shall be utilized when possible.
- E. Seal: Double, Mechanical.
- F. Motor: Maximum 40 degrees C (104 degrees F) ambient temperature rise above the maximum fluid temperature being pumped , oil filled, lifting eye, capacitor start type, voltage and phase as shown in schedule on Electrical drawings conforming to NEMA Type 6P. Size the motor capacity to operate pump without overloading the motor at any point on the pump curve. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
- G. Automatic Control and Level Alarm: Furnish a control panel in a NEMA 1 enclosure for indoors or in a NEMA 4X enclosure for outdoors. The controls shall be suitable for operation with the electrical characteristics listed on the Electrical drawings. The control panel shall have a level control system with switches to start and stop pumps automatically, and to activate a high water alarm. The level control system shall include sensors in the sump that detect the level of the liquid. The pump is also connected to a control which has the ability to prevent oil from being pumped. The same unit shall activate an alarm when oil is detected. The sensors may be float type switches, ultrasonic level sensors, or transducers. The high water alarm shall

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have a red beacon light at the control panel and a buzzer, horn, or bell. The alarm shall have a silencing switch. Provide auxiliary contacts for remote communication with, and alarm monitoring to, the BAS using a BACnet compatible open-protocol type interface to DDC Controls System.

1. The circuitry of the control panel shall include:
    - a. Power switch to turn on/off the automatic control mechanism
    - b. HOA switches to manually override automatic control mechanism
    - c. Run lights to indicate when pumps are powered up
    - d. Level status lights to indicate when water in sump has reached the predetermined on/off and alarm levels
    - e. Magnetic motor contactors
    - f. Disconnect/breaker for each pump
    - g. Automatic motor overload protection
    - h. Wiring terminal block
    - i. Dead front
    - j. Auxiliary contacts
    - k. Control circuit protection
    - l. Fused control step down transformer
  2. Sensors that detect the level of water in the sump shall be so arranged as to allow the accumulation of enough volume of liquid below the normal on-level that the pump will run for a minimum cycle time as recommended by the pump manufacturer. Sensors shall be located to activate the alarm adequately before the water level rises to the inlet pipe.
  3. Provide two separate power supplies to the control panel, one for the control/alarm circuitry and one for power to the pump motors. Each power supply is to be fed from its own breaker so that if a pump overload trips a breaker, the alarm system shall still function. Each power supply is to be wired in its own conduit.
  4. Wiring from the sump to the control panel shall have separate conduits for the pump power and for the sensor switches. All conduits are to be sealed at the basin and at the control panel to prevent the intrusion of moisture and of flammable and/or corrosive gases.
- H. Sump: Furnish fiberglass basin with gas tight covers. Cover shall have 275 mm by 381 mm (11 inch by 15 inch) manhole with bolted cover, vent

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connection, openings for pumps and controls. Sump shall be sized to allow an adequate volume of water to accumulate for a minimum one minute cycle of pump operation.

- I. Provide a check and ball valve in the discharge of each pump. Provide valve box with cover outside the sump basin. Refer to Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.
- J. Removal/Disconnect System: In a system utilizing a submersible pump, where sump depth, pump size, or other conditions make removal of the pump unusually difficult or unsafe, a manufacturer's removal/disconnect system shall be provided. The system shall consist of a discharge fitting mounted on vertical guide rails attached to the sump or quick connect pipe fitting connection to piping. The pump shall be fitted with an adapter fitting that easily connects to/disconnects from the discharge fitting as the pump is raised from or lowered into the sump. The discharge piping shall connect to the discharge fitting so that it is disconnected without workers entering the pit.

### **PART 3 - EXECUTION**

#### **3.1 STARTUP AND TESTING**

- A. Pump installation to comply with ANSI/HI 1.4 for sump pumps.
- B. Leak Test: Charge piping system and test for leaks. Test until there are no leaks. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- C. The tests shall include system capacity and all control and alarm functions.
- D. When any defects are detected, correct defects and repeat test.
- E. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to startup and testing.

#### **3.2 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units.

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**SECTION 22 31 11**  
**WATER SOFTENERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide sodium cycle, cation exchange, pressure type, water softening equipment complete with piping services, electrical services, controls, accessories and auxiliary equipment.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**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. American Society of Mechanical Engineers (ASME):
  - B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings:  
Classes 25, 125, 250
  - B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150  
and 300
  - B40.100-2013.....Pressure Gauges and Gauge Attachments
- ASME Boiler and Pressure Vessel Code -  
BPVC Section VIII-1-2015 Rules for Construction of Pressure  
Vessels, Division 1  
BPVC Section X-2015.....Fiber-Reinforced Plastic Pressure Vessels
- C. American Society of Sanitary Engineering (ASSE):
  - 1013-2011.....Performance Requirements for Reduced Pressure  
Principle Backflow Preventers and Reduced  
Pressure Principle Fire Protection Backflow  
Preventers
- D. ASTM International (ASTM):
  - A6/A6M-2014.....Standard Specification for General Requirements  
for Rolled Structural Steel Bars, Plates,  
Shapes, and Sheet Piling

Dallas VA Medical Center: Task Order VA257-15-J-2681- AE Design Services-  
Prevention and Control Legionella  
Project Number 549-15-517  
Submittal - 100% Construction Documents 06/17/16

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- A53/A53M-2012.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc Coated, Welded and  
Seamless
- D1785-2012.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe, Schedules 40, 80  
and 120
- E. American Water Works Association (AWWA):
- B300-2010.....Hypochlorites
- B301-2010.....Liquid Chlorine
- C511-2007.....Reduced-Pressure Principle Backflow Prevention  
Assembly
- C651-2014.....Disinfecting Water Mains
- F. Federal Specifications (Fed. Spec.):
- A-A-694D-2002.....Sodium Chloride, Technical
- G. Department of Health and Human Services, Food and Drug Administration  
(FDA):
- CFR 21, Chapter 1, Part 173.25, Ion-Exchange Resins
- CFR 21, Chapter 1, Part 175.300, Resinous and Polymeric Coatings (Bio-  
based materials shall be utilized when  
possible.)
- H. International Code Council (ICC):
- IPC-2012.....International Plumbing Code
- I. National Electrical Manufacturers Association (NEMA):
- ICS 6-1993 (R2001, R2006) Industrial Control and Systems:  
Enclosures
- J. NSF International (NSF):
- 61-2014a.....Drinking Water System Components - Health  
Effects
- 372-2011.....Drinking Water System Components - Lead Content
- K. Underwriters' Laboratories, Inc. (UL):
- 979-2005 (R2014).....Standard for Water Treatment Appliances

#### 1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in  
accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND  
SAMPLES.



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- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 31 11, WATER SOFTENERS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Softener tank construction, coatings and linings. Bio-based materials shall be utilized when possible.
  2. Tank distribution system design.
  3. Main operating valve.
  4. Control system and flow meter.
  5. Wiring diagram for controls.
  6. Exchange resin.
  7. Brine system.
  8. Accessories including pressure gages and test kit.
  9. Performance data including normal and maximum flow and pressure drop. Certification that required performance shall be achieved.
  10. Piping.
- D. Complete detailed layout, setting, arrangement, and installation drawings including electrical/pneumatic controls. Drawings shall also show all parts of the apparatus including relative positions, dimensions, and sizes and general arrangement of connecting piping.
- E. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

#### **1.5 QUALITY ASSURANCE**

- A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

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# **1.6 PROJECT CONDITIONS**

- A. Water sample shall be tested by USEPA certified testing laboratory.  
 Sample shall be taken by water softener equipment contractor.

B. Influent Water Analysis:

Component	Concentration (mg/L)
Alkalinity	_____
Aluminum	_____
Arsenic	_____
Barium	_____
Cadmium	_____
Carbonate Hardness as Calcium Carbonate	_____
Free Carbon Dioxide Calcium Carbonate	_____
Methyl Orange as Calcium Carbonate	_____
Noncarbonate Hardness as Calcium Carbonate	_____
Phenolphthalein as Calcium Carbonate	_____
Total Hardness as Calcium Carbonate	_____
Chlorides	_____
Residual Chlorine	_____
Chromium	_____
Copper	_____
Fluoride	_____
Dissolved Iron	_____
Total Iron	_____
Lead	_____
Magnesium	_____
Manganese	_____
Mercury	_____
Nickel	_____
Nitrates	_____
Odor	_____
Dissolved Oxygen	_____
Conductivity pH	_____
Color by Platinum Standard Comparison	_____
Silica	_____
Silver	_____
Sodium	_____

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Sodium Potassium	_____
Total Dissolved Solids	_____
Sulphate	_____
Turbidity in Nethlometric Turbidity units	_____
Zinc	_____

Confirm the analysis with current samples and tests.

C. Design Parameters: See schedule on drawings.

#### 1.7 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CADD version 11 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures

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followed for all tests, and certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead is prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.

### **2.2 SOFTENING SYSTEM**

- A. Vertical, down flow, pressure type with automatic controls to operate on sodium cycle. Automatic-alternating duplex units. Designed for 690 kPa (100 psig) working pressure. All materials exposed to water shall be considered as generally safe by the Food and Drug Administration (FDA). System shall comply with UL 979.
- B. Performance Requirements:
  - 1. Continuous flow of zero hardness soft water (use hardness test strips) with influent water conditions and flows listed in Part 1, with only one of the duplex units in service.
  - 2. Exchanger material shall not wash out of apparatus during any softening run regardless of rate of flow.
  - 3. Turbidity and color of treated water shall not increase above that of raw water.
  - 4. Dirty or turbid water shall not occur during any softening run, regardless of changes in demand rate.
  - 5. Strainer system, gravel bed, and exchange material shall not become fouled, either by turbidity in the raw water, or by dirt, rust or scale from pipe to the extent to render backwash ineffective.
  - 6. Regeneration shall be accomplished within a period of 75 minutes and occur not more than once per day. Regeneration period shall be that part of cycle of operation from the time unit has delivered its softening capacity until it is ready to be delivering soft water again, including all backwashing, brining and brine washout, complete. Amount of salt necessary to completely recondition unit after a capacity run shall not exceed 240 kg per cubic meter (15 pounds per cubic foot) of existing material.
- C. Softener Tanks:

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1. Butt-welded steel conforming to ASTM A6/A6M. Test hydrostatically at 1.5 times the design pressure and provide certification. Conform to ASME Boiler and Pressure Vessel Code, Section VIII. Provide stamp on tank and written certification. Sidewall height shall be adequate to allow 50 percent of the mineral bed depth for expansion. Tanks shall have openings for mineral filling and removal. Provide steel supports welded to tank before testing and labeling to hold tanks in operating position above floor. Exterior shall be degreased, cleaned, and coated with manufacturer's standard prime and finish coatings. Interior shall have near-white sandblast and lined with phenolic epoxy, 0.20 to 0.25 mm (8 to 10 mils) thick. Interior coating shall be chemically inert, non-toxic, odorless and meet the requirements of CFR 21, Chapter 1, Part 175.300. Bio-based materials shall be utilized when possible.
  2. Fiberglass Reinforced Plastic (FRP): Polyester reinforced by a continuous roving glass filament overwrap. Hydrostatically test at design pressure and provide certification to comply with ASME Boiler and Pressure Vessel Code, Section X. Support on a molded structural base. Tanks shall have flanged openings for mineral filling and removal. Provide vacuum breaker.
- D. Distribution System: Soft water collector and backwash water distributor shall be non-clogging, single point and hub radial laterals, designed to not cause channeling in the bed, PVC, Schedule 80. The distributor system shall be fully covered by one layer of quartz under-bedding with no debris or fines mesh size from 16 to 40 and above.
- E. Exchange Material: Solid virgin high capacity styrene base resinous material. Material shall be stable over the entire pH range with resistance to bead fracture from attrition or osmotic shock. Particle size 20 to 50 mesh and contain no agglomerates, shells, plates or other shapes that might interfere with the functioning of the softener. Exchange capacity as  $\text{CaCO}_3$  shall be considered to be 840 grains per cubic meter (23.8 grains per cubic foot) at 240 kg per cubic meter (15 pounds per cubic foot) salt dosage. Resin shall not require dosing or addition of any chemical, mixture, or solution to the water requiring treatment, or the water used for backwashing, other than NaCl for

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regeneration. Resin shall be FDA compliant under CFR 21, Chapter 1,  
Part 173.25.

- F. Brine Measuring Tank with Cover: Rotationally molded high density polyethylene. Tank sized to provide a minimum of four regenerations per load of salt at a full salting. Tank shall include elevated salt plate and a chamber to house the brine valve assembly.
- G. Brine System Controls: Automatic valve shall open to admit brine to softener and close to prevent air admission to the softener. During refill, the valve shall regulate flow of soft water to the brine tank. Provide float-operated safety valve to prevent brine tank overfill.
- H. System Controls:
1. The controller shall be completely automatic and shall sequence all steps of regeneration and return the softener to a service or stand-by mode and alternate the duplex units. Selectable time or flow meter initiated regeneration. The initiating time or volume set points shall automatically reset upon initiation of the regeneration sequence. Controller shall permit manual initiation of regeneration.
  2. Computer-based field-programmable controller with selectable flow meter based and time clock based operating cycles. The controller shall utilize alphanumeric, self-prompting programming for simple startup. EEPROM memory shall store program data eliminating need for battery back up on configuration input after power loss. Self-diagnostic and capable of emitting an audible error signal and displaying error-specific messages. Lockout function to prevent unauthorized access to the program data. Sealed keypad with capability of all programming functions. Fluorescent alphanumeric display on face of controller. Enclose controls in NEMA ICS 6; Type 4X enclosure mounted approximately 1.5 meters (5 feet) above the floor.
  3. Operating conditions shall be continuously monitored and display shall show time of day, volume remaining before next regeneration, number of regenerations in last 14 days, number of days since last regeneration, instantaneous flow rate, resettable totalized flow since the last regeneration, time of next regeneration, and identify the cycle that is in progress.

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4. Flow shall be regulated to prevent resin loss, operate between 200 and 690 kPa (29 and 100 psig) supply pressure, and prevent noise and hydraulic shock. Control shall permit only one unit to regenerate at a time.
  5. Flow meter shall have turndown range of 60/1, minimum accuracy of +/-1 percent of maximum range, repeatability of +/-0.5 percent of full range. Install with manufacturer's recommended straight pipe before and after the meter.
  6. Main operating valve shall be a fully automatic multiport diaphragm type or valve nest constructed of cast iron or corrosion resistant alloy material with hard-coat anodization and final coat of fluoroelastomer polymer. Coating shall resist 1000 hour/5 percent salt spray test without sign of corrosion. Bio-based materials shall be utilized when possible. Valves shall be slow opening and closing, free of water hammer; diaphragm assembly shall be fully guided. All valve parts accessible for service. The main operating valve shall include a valve mounted automatic self-adjusting brine injector to draw brine and control rinse at a constant rate regardless of water pressure in the range of 200 to 690 kPa (29 to 100 psig). Valve shall have soft water sampling cock and indicator to show system status.
- I. Sampling Cocks: Provide for hard and soft water.
- J. Sodium Chloride: Fed. Spec. A-A-694D. Provide sufficient quantity for ten regenerations.

### **2.3 EXTERNAL SOFTENER PIPING**

- A. Pipe: ASTM A53/A53M, galvanized, Schedule 40.
- B. Fittings: Malleable iron, ASME B16.3, or coated cast iron, ASME B16.1, Class 125.
- C. Flanges: ASME B16.1, Class 125.
- D. Threaded Joints: Shall be made with ends reamed out. Apply bituminous base lubricant or fluorocarbon resin tape to male threads only. Bio-based materials shall be utilized when possible.

### **2.4 BRINE PIPING**

- A. Polyvinyl chloride (PVC), ASTM D1785, Schedule 80 with solvent welded joints.

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## **2.5 VALVES**

- A. Ball: Carbon steel body, stainless steel trim, reinforced Teflon seat and seal, full port, threaded ends.

## **2.6 PRESSURE GAGES**

- A. ASME B40.100, Grade A, 1 percent accuracy, 115 mm (4-1/2 inches) diameter, all metal case, bottom connected. White dials, black hands, graduated from 0 to 690 kPa (0 to 100 psig) and identity labeled. Provide gages with gage cocks at softener hard water inlet and soft water outlet to show pressure drop thru softener.

## **2.7 REDUCED PRESSURE BACKFLOW PREVENTER**

- A. Provide on suction side of water softener serving boilers. Parts shall be made of corrosion-resistant materials and shall be of heavy duty construction, 861 kPa (125 psig) class minimum. Backflow preventer shall meet the requirements of ICC IPC, ASSE 1013, and AWWA C511.

## **2.8 WATER TESTING EQUIPMENT**

- A. Furnish water testing hardness test strips which measure 0-25 grains of hardness with minimum bottle of 50 strips with color code chart for reading test strips.

# **PART 3 - EXECUTION**

## **3.1 REQUIRED TECHNICAL SERVICES**

- A. Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendation, put system into service, make all adjustments required for full conformance to design and specified requirements, and perform all demonstrations and tests.

## **3.2 FLUSHING AND DISINFECTING**

- A. Flush and disinfect new water lines and softener interiors in accordance with AWWA C651.
- B. Material:
  - 1. Liquid chlorine: AWWA B301.
  - 2. Hypochlorite: AWWA B300.

## **3.3 STARTUP AND TESTING**

- A. Operating: Tests shall be conducted in presence of COR. It is prohibited, for testing purposes, to add to or subtract from exchange material used in apparatus, neither will any regenerating agent, other than the solution specified, be permitted.



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B. Procedure:

1. Regenerate system to demonstrate operation of multiport valve.
2. Operate each softener at constant maximum required capacity for ten minutes after soft water is produced. When necessary, waste softened water to sewer to maintain above flow rate. Contractor shall submit samples to a USEPA certified testing laboratory. A certified test report shall be prepared indicating hardness levels are within the specified range. Hardness shall be less than 50 mg/L or as specified.
3. Demonstrate all features of the control system including diagnostics and flow and cycle indications.

**3.4 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units.

**3.5 MAINTENANCE SERVICE**

- A. Provide full maintenance contract for 12 months by service technician of water softener manufacturers, including preventative maintenance as required for proper operation of water softener equipment. Servicing company shall be within 2 hours drive and be capable of responding within 6 to 8 hours.

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**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.
- D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety

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requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

**B. Definitions:**

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
  - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Are periodically inspected by a NRTL.
  - c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

**1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:

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1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

#### **1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  1. Components of an assembled unit need not be products of the same manufacturer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.

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- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
  - 1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
  - 2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
  - 3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

#### **1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

#### **1.8 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  - 1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  - 2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

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3. Damaged equipment shall be repaired or replaced, as determined by the COR.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

#### **1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:
  1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
  2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
  3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical

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Center's Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.

4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.

5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

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2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

- D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
1. Nominal system voltage.
  2. Equipment/bus name, date prepared, and manufacturer name and address.



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3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.
6. Site-specific level of PPE.

#### **1.12 SUBMITTALS**

- A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  3. Submit each section separately.
- E. The submittals shall include the following:
  1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
  2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.

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3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation instructions.
  - e. Safety precautions for operation and maintenance.
  - f. Diagrams and illustrations.
  - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

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- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  2. Each type of conduit coupling, bushing, and termination fitting.
  3. Conduit hangers, clamps, and supports.
  4. Duct sealing compound.
  5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

#### **1.14 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

#### **1.15 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of

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one year from the date of acceptance of the entire installation by the  
Contracting Officer for the Government.

**1.16 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.
- C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

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

**PART 3 - EXECUTION (NOT USED)**

---END---

**SECTION 31 20 11**  
**EARTHWORK (SHORT FORM)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

**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 materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Contracting Officer Representative's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure.

D. The term fill means fill or backfill as appropriate.

**1.3 RELATED WORK:**

A. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

**1.4 CLASSIFICATION OF EXCAVATION:**

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed;

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together with any type of materials regardless of character of material and obstructions encountered.

B. Classified Excavation: Removal and disposal of all material not defined as rock.

C. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m<sup>3</sup> (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m<sup>3</sup> (1/2 cubic yard) or more.

#### **1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:**

Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation of satisfactory subgrade soil. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

#### **1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:**

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.

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3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.

4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation.

#### **1.7 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 elevations.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

D. Furnish to Contracting Officer Representative, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

E. Qualifications of the commercial testing laboratory or Contractor's Testing facility shall be submitted.

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

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

B. American Nursery and Landscape Association (ANLA):

2004.....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):

T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

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

- C33-03.....Concrete Aggregate
- D698-e1.....Laboratory Compaction Characteristics of Soil  
Using Standard Effort
- D1140-00.....Amount of Material in Soils Finer than the No.  
200 (75-micrometer) Sieve
- D1556-00.....Standard Test Method for Density and Unit Weight  
of Soil in Place by the Sand-Cone Method
- D1557-09.....Laboratory Compaction Characteristics of Soil  
Using Modified Effort
- 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)
- D6938-10.....Standard Test Methods for Density of Soil and  
Soil-Aggregate in Place by Nuclear Methods  
(Shallow Depth)

E. Standard Specifications of State

Department of Transportation, latest revision.

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m<sup>3</sup> (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.
- B. Granular Fill:
  - 1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140.
  - 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).
- C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.



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- D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.
- E. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends
- F. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toleune, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Contracting Officer Representative.
- G. Buried Warning and Identification Tape: Polyethylene plasticwarning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:
- |         |                                    |
|---------|------------------------------------|
| Red:    | Electric                           |
| Yellow: | Gas, Oil, Dangerous Materials      |
| Orange: | Telephone and Other Communications |
| Blue:   | Water Systems                      |
| Green:  | Sewer Systems                      |
| White:  | Steam Systems                      |
| Gray:   | Compressed Air                     |

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- H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.
- I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m (3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.
- J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION:**

- A. Clearing: Clearing within the limits of earthwork operations as described or designated by the Contracting Officer Representative. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical.
- B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be 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 the areas within 4500 mm (15 feet) of new construction and 2250 mm (7'-6") of utility lines if such removal is approved in advance by the Contracting Officer Representative. Remove materials from the Medical Center. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area

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and plant species. Building materials shall not be stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

- D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Contracting Officer Representative. Eliminate foreign material, 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 the 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 the soil is wet so that the tilth of the soil will be destroyed.

2. 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 the Medical Center .

- E. 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.

### **3.2 EXCAVATION:**

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope to its angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

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1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
  2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support under disturbed foundations, as directed by Contracting Officer Representative, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Contracting Officer Representative.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from Contracting Officer Representative. Approval by the Contracting Officer Representative is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in pervious zones below subgrade elevation in layered soils to prevent uplift.
- C. Blasting: Blasting shall not be permitted.
- D. Building Earthwork:

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1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. 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 suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
  - d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the Contracting Officer Representative.
  - e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
  - f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
  - g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the

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utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

- 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.
- 3) Clean, coarse-grained sand.
- 4) Clean, coarsely graded natural gravel, crushed stone. Maximum particle size shall not exceed 75 mm (3 inches).

2. Sanitary and storm sewer trenches:

- a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for 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. The bottom quadrant of the pipe shall be bedded on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
  - 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 the pipe of 300

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mm (12 inches) above top of pipe. Place and tamp fill material by hand.

- c. Place and compact as specified the 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.
- e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
- f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
- g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
  - 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
  - 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW,

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GP, SW, and SP are included in this class as specified in ASTM D2487.

- 3) Clean, coarse-grained sand classified .
- 4) Clean, coarsely graded natural gravel, crushed stone. Maximum particle size shall not exceed 75 mm (3 inches).

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the Contracting Officer Representative as unsuitable, and replace with acceptable material

G. Finished elevation of subgrade shall be as follows:

1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

### **3.3 FILLING AND BACKFILLING:**

- A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by Contracting Officer Representative.
- B. Proof-rolling Existing Subgrade: - Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, the existing subgrade shall be compacted.
- C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.
- D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the Contracting Officer Representative. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the



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specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

- F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Contracting Officer Representative sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

### **3.4 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 unfinished areas fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet) at a minimum five percent (5%) slope.
- D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.
- E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.
- F. Finish subgrade in a condition acceptable to the Contracting Officer Representative at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade

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the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

- G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

### **3.5 LAWN AREAS:**

- A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by Contracting Officer Representative before seeding or sodding operation begins.
- B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.
- C
- E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

### **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.

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- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the Contracting Officer Representative 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 debris, rubbish, and excess material from the Medical Center.

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**SECTION 32 90 00**

**PLANTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The work in this section consists of furnishing and installing plant, soils, edging turf, grasses and landscape materials required as specified in locations shown.

**1.2 RELATED WORK**

- A. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.3 DEFINITIONS**

- A. Backfill: The earth used to replace earth in an excavation.
- B. Balled and Burlapped Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they were grown, with ball size not less diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball.
- C. Balled and Potted Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is

not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- I. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- K. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, turf and grasses, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- L. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- N. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

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

- A. Notify the Contracting Officer's Representative of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant and landscape materials from the job site immediately.
- B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants. Keep bulk materials in dry storage away from contaminants.
2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers with appropriate certificates.

D. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

E. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

F. Handle planting stock by root ball.

G. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.

H. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than 6 hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock: Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet, condition.
- J. Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding". Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage, seed contamination and drying.
- K. Deliver sprigs in air tight bags to keep from drying out. Sprigs delivered unwrapped, shall be kept moist in burlap or other accepted material until planting.
- L. Deliver plugs within 24 hours of harvesting, keep moist until planting.
- M. All pesticides and herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Deliver materials in original, unopened containers showing, certified analysis, name and address of manufacturer, product label, manufacturer's application instructions specific to the project and indication of conformance with state and federal laws, as applicable.

#### **1.5 PROJECT CONDITIONS**

- A. Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
- C. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
- E. Plant trees, shrubs, and other plants after finish grades and irrigation system components are established unless otherwise indicated.

1. When planting trees, shrubs, and other plants, protect irrigation system components and promptly repair damage caused by planting operations.

#### **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.

##### **B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.**

1. Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association with 3 years experience in landscape installation.
2. Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
3. Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network and submit one copy of certificate to the Contracting Officer's Representative:

a. Certified Landscape Technician (CLT) - Exterior

4. Pesticide Applicator: Licensed in state of project, commercial.

##### **C. A qualified Arborist shall be licensed and required to submit one copy of license to the Contracting Officer's Representative.**

##### **D. Include an independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.**

##### **E. For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange**



capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60, "Diagnosis and Improvement of Saline and Alkali Soils".
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer's Representative. A minimum of 3 representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.
  - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
  - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- F. Provide quality, size, genus, species, variety and sources of plants indicated, complying with applicable requirements in ANSI Z60.1.
- G. Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  1. Measure trees and shrubs with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4 inch (100 mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
  2. Measure other plants with stems, petioles, and foliage in their normal position.
- H. Contracting Officer's Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality.

Contracting Officer's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Contracting Officer's Representative of plant material sources seven days in advance of delivery to site.

I. Include product label and manufacturer's literature and data for pesticides and herbicides.

J. Conduct a pre-installation conference at Project site.

#### **1.7 SUBMITTALS**

A. Submit product data for each type of product indicated, including soils:

1. Include quantities, sizes, quality, and sources for plant materials.
2. Include EPA approved product label, MSDS (Material Safety Data Sheet) and manufacturer's application instructions specific to the Project.

3. Include color photographs indigital format of each required species and size of plant material as it will be furnished to the Project.

Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of 3 photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Submit samples and manufacturer's literature for each of the following for approval before work is started.

1. Trees and Shrubs: 3 samples of each variety and size. Maintain approved samples on-site as a standard for comparison.
2. Organic and Compost Mulch: 1-pint (0.5-liter) volume of each organic and compost mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Mineral Mulch: 2 lb (1.0 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be

typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.

- a. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
4. Submit edging materials and accessories in manufacturer's standard size, to verify color selected.
5. Erosion Control Materials: 12 by 12 inches (300 by 300 mm).
6. Root Barrier: Width of panel by 12 inches (300 mm).
7. Landscape Membranes: 12 by 12 inches (300 by 300 mm).
8. Tree Wrap: Width of panel by 12 inches (300 mm).
- C. Qualification data for qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Prior to delivery, provide notarized certificates attesting that each type of manufactured product, from the manufacturer, meet the requirements specified and shall be submitted to the Contracting Officer's Representative for approval:
  1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).
  2. Seed and Turf Materials notarized certificate of product analysis.
  3. Manufacturer's certified analysis of standard products.
  4. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Material Test Reports: For standardized ASTM D5268 topsoil and imported or manufactured topsoil.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

#### **1.8 PLANT AND TURF ESTABLISHMENT PERIOD**

- A. The establishment period for plants and turf shall begin immediately after installation, with the approval of the Contracting Officer's Representative, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the

Establishment Period the Contractor shall maintain the plants and turf as required in Part 3.

#### **1.9 PLANT AND TURF MAINTENANCE SERVICE**

A. Provide initial maintenance service for trees, shrubs, ground cover and other plants by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 12 months from date of planting completion

B. Obtain continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

#### **1.10 APPLICABLE PUBLICATIONS**

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

B. American National Standards Institute (ANSI):

Z60.1-04.....Nursery Stock

C. Association of Official Seed Analysts (AOSA): Rules for Testing Seed.

D. American Society For Testing And Materials (ASTM):

B221-08.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles, and Tubes

C33/C33M-11.....Concrete Aggregates

C136-06.....Sieve Analysis of Fine and Coarse Aggregates

C516-08.....Vermiculite Loose Fill Thermal Insulation

C549-06.....Perlite Loose Fill Insulation

C602-07.....Agricultural Liming Materials

D977-05.....Emulsified Asphalt (AASHTO M140)

D5268-07.....Topsoil Used for Landscaping Purposes

E. Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.

- F. Turfgrass Producers International (TPI): Guideline Specifications to Turfgrass Sodding.
- G. United States Department of Agriculture (USDA): Handbook No. 60  
Diagnosis and Improvement of Saline and Alkali Soils; Federal Seed Act Regulations.

#### **1.11 WARRANTY**

- A. 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 from final acceptance, unless noted otherwise below. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.
  - 1. Plant and Turf Warranty Periods will begin from the date of Government acceptance of the project or phase for beneficial use and occupancy .
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    - b. Ground Covers, Biennials, Perennials, Turf, and Other Plants: 12 months.
    - c. Annuals: 3 months.
  - 2. The Contractor shall have completed, located, and installed all plants and turf according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.
  - 3. The Contractor will replace any dead plant material and any areas void of turf immediately, unless required to plant in the succeeding planting season. Provide extended warranty for period equal to original warranty period for replacement plant materials. Replacement plant and turf warranty will begin on the day the work is completed.
  - 4. Replacement of relocated plants, that the Contractor did not supply, is not required unless plant failure is due to improper handling and care during transplanting. Loss through Contractor negligence requires replacement in plant type and size.
  - 5. The Government will reinspect all plants and turf at the end of the Warranty Period. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty Period will end on the date of this inspection provided the Contractor has

complied with the warranty work required by this specification. The Contractor shall also comply with the following requirements:

- a. Replace plants that are more than 25 percent dead, missing or defective plant material prior to final inspection.
  - b. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
  - c. Mulch and weed plant beds and saucers. Just prior to final inspection, treat these areas to a second application of approved pre-emergent herbicide.
  - d. Complete remedial measures directed by the Contracting Officer's Representative to ensure plant and turf survival.
  - e. Repair damage caused while making plant or turf replacements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
    - b. Structural failures including plantings falling or blowing over.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

## **PART 2 - PRODUCTS**

### **2.1 PLANT MATERIAL**

- A. Plant and turf materials: ANSI Z60.1; will conform to the varieties specified and be true to botanical name as listed in Hortus Third; nursery-grown plants and turf material true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings; healthy, normal and unbroken root systems developed by transplanting or root pruning; well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf; free of disease, pests, eggs, larvae, and defects such as knots, sun scald, windburn, injuries, abrasions, and disfigurement.

1. Ground cover and vine plants: Provide the number and length of runners for the size specified on the Drawings, together with the proper age for the grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Spray all plants budding into leaf or having soft growth with an anti desiccant at the nursery before digging.
2. The minimum acceptable sizes of all plants, measured before pruning with branches in normal position, shall conform to the measurements designated. Plants larger in size than specified may be used with the approval of the Contracting Officer's Representative, with no change in the contract price. When larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.
3. Provide nursery grown plant material conforming to the requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in a manner that will not cause damage to branches, shape, and future development after planting.
4. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
5. Bare root (BR) plants shall have the root system substantially intact, but with the earth carefully removed. Cover roots with a thick coating of mud by "puddling" after the plants are dug.
6. Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers, but shall not be root bound.
7. Make substitutions only when a plant (or alternates as specified) is not obtainable and the Contracting Officer's Representative authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant with the same essential characteristics and an equitable adjustment of the contract price.
8. Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

## **2.2 INORGANIC SOIL AMENDMENTS**

- A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36 mm) sieve and a minimum of 75 percent passing through No. 60 (0.25 mm) sieve.
  2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36 mm) sieve and a minimum of 55 percent passing through No. 60 (0.25 mm) sieve.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35 mm) sieve and a maximum of 10 percent passing through No. 40 (0.425 mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: ASTM C549, horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30 mm) sieve.
- G. Coarse Sand shall be concrete sand, ASTM C33 Fine Aggregate, clean, sharp free of limestone, shale and slate particles, and toxic materials.
- H. Vermiculite: ASTM C516, horticultural grade and free of any toxic materials.
- I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## **2.3 ORGANIC SOIL AMENDMENTS**

- A. Organic matter: Commercially prepared compost. Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1 inch (25 mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.



2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: A natural product of sphagnum moss peat derived from a fresh-water site, except as otherwise specified. Peat shall be shredded and granulated to pass through a 1/2 inch (13 mm) mesh screen with a pH range of 3.4 to 4.8 and conditioned in storage piles for at least 6 months after excavation.
- C. Wood derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

#### **2.4 PLANT AND TURF FERTILIZERS**

- A. Soil Test: Evaluate existing soil conditions and requirements prior to fertilizer selection and application to minimize the use of all fertilizers and chemical products. Obtain approval of Contracting Officer's Representative for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Fertilizers to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

C. Slow-Release Fertilizer: Granular or pellet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Plant Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.

2. Nutrient Composition shall be 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## **2.5 PLANTING SOILS**

A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D5268 topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.

B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with planting soil when quantities are insufficient.

2. Mix existing, native surface topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.

C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources can be used if sufficient topsoil is not available on site to meet the depth as specified herein. The Contractor shall furnish imported topsoil. At least 10 days prior to topsoil delivery, notify the Contracting Officer's Representative of the source(s) from which topsoil is to be furnished. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs, or marshes.

## **2.6 BIOSTIMULANTS**

- A. Biostimulants: Contain soil conditioners, VAM fungi, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions.

## **2.7 LANDSCAPE MEMBRANES**

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101 g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.
- B. Composite Fabric shall be woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

## **2.8 MULCH**

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood, Ground or shredded bark, Wood and bark chips .
    - a. Straw for lawn seed bed mulch: Stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold or other objectionable material. Straw shall be in an air dry condition and suitable for placing with blower equipment.
    - b. Wood cellulose fiber for use with hydraulic application of grass seed and fertilizer: Consist of specially prepared wood cellulose fiber, processed to contain no growth or germination inhibiting factors, and dyed an appropriate color to facilitate visual metering of the application of materials. On an air dry weight basis, the wood cellulose fiber shall contain a maximum of 12 percent moisture, plus or minus 3 percent at the time of manufacture. The pH range shall be from 3.5 to 5.0. The wood cellulose fiber shall be manufactured so that:
      - 1) After addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other approved additives, the fibers in the material will become uniformly suspended to form an homogeneous slurry.

- 2) When hydraulically sprayed on the ground, the material will form a blotter like cover impregnated uniformly with grass seed.
  - 3) The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil.
2. Size Range shall be 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum .
  3. Color shall be natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1 inch (25 mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

## **2.9 EROSION CONTROL**

- A. Erosion control blankets: Biodegradable wood excelsior, straw, or coconut fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended biodegradable staples, 6 inches (150 mm) long.
- B. Erosion control fiber mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended biodegradable staples, 6 inches (150 mm) long.
- C. Erosion control mats: Cellular, non-biodegradable slope stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3 inch (75 mm) nominal mat thickness. Include manufacturer's recommended biodegradable anchorage system for slope conditions.

## **2.10 EDGING**

- A. Steel edging: Standard commercial steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
1. Edging Size: 3/16 inch (4.8 mm) wide by 4 inches (100 mm) deep.
  2. Stakes: Tapered steel, a minimum of 12 inches (300 mm) long.

3. Accessories: Standard tapered ends, corners, and splicers.

4. Finish: Standard paint .

5. Paint color: Green .

B. Natural cut edging shall edge plant beds with an excavated 'V' cut to provide a clear division line between the plant bed and adjacent turf. Do not use any artificial or manufactured products to form plant bed edges.

#### **2.11 WATER**

A. Water shall not contain elements toxic to plant life.

#### **2.12 ANTIDESICCANT**

A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide a protective film over plant surfaces permeable enough to permit transpiration.

#### **2.13 TURF SELECTIONS**

1.

B. Grasses shall be:

1. Bermudagrass

#### **2.14 SOD**

A. Sod: Approved , including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding". Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Sod Species: Grass species as noted, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

#### **2.15 PESTICIDES**

A. Consider IPM (Integrated Pest Management) practices to minimize the use of all pesticides and chemical products. Obtain approval of Chief Engineer for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Pesticides to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project

conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
  - 5. Special conditions may exist that warrant a variance in the specified planting dates or conditions. Submit a written request to the Contracting Officer's Representative stating the special conditions and proposal variance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Contracting Officer's Representative and replace with new planting soil.

### **3.2 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain approval by the Contracting Officer's Representative of layout before excavating or planting. The Contracting Officer's Representative may approve adjustments to plant material locations to meet field conditions.
- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

### **3.3 PLANTING AREA ESTABLISHMENT**

- A. Loosen subgrade of planting areas to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Apply fertilizer directly to subgrade before loosening.
  - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
  - 3. Spread planting soil to a depth of 4 inches (100 mm) but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

- a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Contracting Officer's Representative acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### **3.4 EXCAVATION FOR TREES AND SHRUBS**

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45 degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  1. Excavate approximately 3 times as wide as ball diameter.
  2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
  5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  6. Maintain supervision of excavations during working hours.
  7. Keep excavations covered or otherwise protected.
  8. Use topsoil to form earth saucers or water basins for watering around plants. Basins to be 2 inches (50 mm) high for shrubs and 4 inches (100 mm) high for trees.
- B. Subsoil and topsoil removed from excavations may not be used as planting soil.



- C. Notify Contracting Officer's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Notify Contracting Officer's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow water to percolate away before positioning trees and shrubs.

### **3.5 GROUND COVER AND PLANT INSTALLATION**

- A. Set out and space ground cover and plants other than trees, shrubs, and vines 9 inches (225 mm) apart in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- H. Plant ground cover in areas to receive erosion control materials through the material after erosion control materials are in place.

### **3.6 MULCH INSTALLATION**

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches (300 mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated. Keep mulch out of plant crowns and off buildings, pavements, utility standards/pedestals, and other structures.
  - 1. Organic Mulch in Planting Areas: Apply 3 inch (75 mm) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades.

### **3.7 EDGING INSTALLATION**

- A. Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
- B. For Natural Cut Edging provide a uniform lazy 'V' cut with one vertical side adjacent to turf areas 5 inches (125 mm) deep and a second side angled 10 inches (250 mm) toward center of plant bed for a clear cut division line between the plant bed and adjacent turf.

### **3.8 PLANT MAINTENANCE**

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring plant saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

### **3.9 TURF AREA PREPARATION AND GRADING**

- A. For newly graded subgrades loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Apply fertilizer directly to subgrade before loosening, at rates recommended by the soils analysis.
  - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
  - 3. Spread planting soil to a depth of 4 inches (100 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

- a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
  - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Finish grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

### **3.10 PREPARATION FOR EROSION-CONTROL MATERIALS.**

- A. Prepare area as specified in "Turf Area Preparation and Grading" Article.
- B. For erosion control mats, install planting soil in two lifts, with second lift equal to thickness of erosion control mats. Install erosion control mat and fasten with biodegradable materials as recommended by material manufacturer.
- C. Fill cells of erosion control mat with planting soil and compact before planting.
- D. For erosion control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten with biodegradable materials as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

### **3.11 SODDING**

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently until sod is established.

### **3.12 TURF RENOVATION**

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
- I. Apply sod as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

### **3.13 TURF MAINTENANCE**

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide

materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

### **3.14 SATISFACTORY TURF**

A. Turf installations shall meet the following criteria as determined by Contracting Officer's Representative:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

### **3.15 PESTICIDE APPLICATION**

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and

manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Contracting Officer's Representative before each application is performed.

- B. Pre-Emergent Herbicides (Selective and Non-Selective): Applied to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Applied only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

### **3.16 CLEANUP AND PROTECTION**

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- D. Erect temporary fencing or barricades and warning signs, as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- E. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- F. Remove nondegradable erosion control measures after grass establishment period.
- G. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

--- END ---