



**SOLICITATION NUMBER**

**PROJECT NO. 542-13-115**

## **SPECIFICATIONS**

**FOR:** Water System Chemical Monitoring &  
Scald Protection Various Buildings

**AT:** VA Medical Center  
1400 Black Horse Road  
Coatesville, PA 19320-2096

**Final Construction Documents**

PROPERTY OF THE UNITED STATES OF AMERICA GOVERNMENT

**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS  
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**GENERAL REQUIREMENTS**

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## **PART 1 - GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for the replacement of plumbing fixtures for scald protection, installation of chemical and temperature monitoring systems, including connecting the monitoring system into the existing building electrical system, and installation of a telemetry system. Contractor shall also be responsible for the quality and delivery of all subcontracted work.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of S&B Christ Consulting, LLC, as Architect-Engineer, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. All employees of 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.
- E. All employees of Contractor and subcontractors shall comply with all additional security and privacy requirements of the Medical Center. Moreover, all employees of Contractor and subcontractors shall provide photo identification, as required by the VA security management program and Medical Center policy.
- F. Prior to commencing work Contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present. Competent person shall be experienced in pipeline construction, in particular shoring requirements and shall ensure all OSHA shoring requirements are met.
- G. Training:
  - 1. All employees of Contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by CONTRACTING OFFICER REPRESENTATIVE (COR) acting as the Construction Safety Officer with input from the facility Construction Safety Committee. The Contractor's site superintendent/CP and the foreman for each respective trade shall have the 30-hour OSHA Construction Safety course. Additionally, construction workers involved with the excavations shall have 1-hour specialized OSHA training for trenching and excavations.
  - 2. Submit training records of all such employees for approval before the start of work.
- H. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section

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

- A. ITEM I, CHEMICAL MONITORING SYSTEM: Work includes all labor and materials for the installation of a chemical monitoring system to measure pressure, temperature, chlorine residual, pH, and dissolved solids in accordance with these contract documents including, but not limited to, the following: analyzer mounting, sensor/flowcell mounting, electrical installation, relay connection, sensor connection, sensor wiring, junction box connection, and calibration and appurtenances.
- B. ITEM II, TEMPERATURE MONITORING SYSTEM: Work includes all labor and materials for the installation of a temperature monitoring system in accordance with these contract documents including, but not limited to, the following: connection to hot and cold potable water lines, connection to communications and data logging system and appurtenances.

- C. ITEM III, ELECTRICAL SYSTEM: Work includes all labor and materials for connection of the monitoring system to the existing electrical system in accordance with these contract documents including, but not limited to, the following: appropriately gauged wire, breakers, conduit and appurtenances.
- D. ITEM IV, TELEMETRY: Work includes all labor and materials for the construction of a System Control and Data Acquisition (SCADA) system to communicate the readings from the monitoring systems to one central location in accordance with these contract documents including, but not limited to, the following: antenna mounting, RF and cellular system, wiring, connection to existing power and proposed monitoring systems and appurtenances.

### 1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- ~~A.~~ A. AFTER AWARD OF CONTRACT, one (1) hard-copy set of specifications and drawings and three (3) electronic copies on CDs will be furnished.

### 1.4 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 Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
  - 1. Contractor'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. For working outside the "regular hours" as defined in the contract, the Contractor shall give 3 working days' notice to the Contracting Officers Representative. 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. Photographs shall not include an individual without their written permission.
  - 4. VA reserves the right to close down or shut down the project site and order Contractor's employees and subcontractors off the premises in the event of a national emergency. The Contractor may return to the site only with the written approval of the Contracting Officer.
- C. Key Control:
  - 1. The Contractor shall provide duplicate keys and lock combinations to the Contracting Officer Representative (COR) for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
- D. Document Control:
  - 1. Before starting any work, the Contractor and subcontractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
  - 2. The Contractor is responsible for safekeeping of all drawings, project 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.
- E. Motor Vehicle Restrictions
1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
  2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

## 1.5 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
1. American Society for Testing and Materials (ASTM):
    - E84-2009 ..... Surface Burning Characteristics of Building Materials
  2. National Fire Protection Association (NFPA):
    - 10-2010..... Standard for Portable Fire Extinguishers
    - 30-2008..... Flammable and Combustible Liquids Code
    - 51B-2009 ..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work
    - 70-2011..... National Electrical Code
    - 101-2012..... Life Safety Code
    - 241-2009..... Standard for Safeguarding Construction, Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

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

4. VHA Directive 2005-007

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to the Contracting Officer Representative (COR) and Facility Safety for review for compliance with VHA Directive 2005-007, NFPA 101 and NFPA 241. Prior to beginning work, all employees of the contractor and/or any subcontractors shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Provide documentation to the Contracting Officer Representative (COR) that all construction workers have undergone contractor's safety briefing.
- C. 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.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with the Contracting Officer Representative (COR).
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to the Contracting Officer Representative (COR).
- 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. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with the Contracting Officer Representative (COR). Obtain permits from facility Safety Manager least 48 hours in advance—designate contractor's responsible project-site fire prevention program manager to permit hot work.
- K. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to the Contracting Officer Representative (COR).
- L. 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.
- M. Dispose of waste and debris in accordance with NFPA 241. Remove from project site daily.
- N. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

**1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the 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.
- D. The Contractor shall prepare and submit a crane/rigging plan that complies with OSHA, Pennsylvania, and VA requirements. The plan shall address, at a minimum, operator certification and qualifications, proposed equipment, operation, storage, rigging, and safe operation. A qualified and experienced operator shall be the only individual authorized to operate the equipment and a spotter shall be used at all times the equipment is in operation. Contractor shall ensure the shoring design for the excavation accounts for the anticipated loads from equipment.  
(FAR 52.236-10)
- E. Working space and space available for storing materials shall be as determined by the Contracting Officer Representative (COR).
- F. Workmen are subject to rules of Medical Center applicable to their conduct.
- G. Contractor shall 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.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Maintain ADA accessible access to Medical Center areas required to remain in operation.
- H. Phasing: To insure such executions, Contractor shall furnish the Contracting Officer Representative (COR) with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Contracting Officer Representative (COR) two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, Contracting Officer Representative (COR) and Contractor, as follows:
  - 1. No two phases may be simultaneous. The work for each phase must be completed prior to beginning excavation for the next phase. The areas of work which must be phased are Areas A, B, C and D as shown on the drawings.
  - 2. The order of the phasing is subject to change and must be verified during the planning for each successive phase.
- I. All Buildings will be occupied during performance of work and access must be maintained.

1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. 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. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
- J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings if the site is to be left unoccupied and a trench plate is not used. Provide gates as required for access with necessary hardware, including hasps and padlocks. Padlocks shall have a four-number combination which will be communicated to required VA personnel. 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 Contracting Officer Representative (COR).
- K. Utilities Services: Maintain existing utility services for Medical Center at all times unless otherwise identified. 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 Contracting Officer Representative (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 Contracting Officer Representative (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 the Medical Center Director's prior knowledge and written approval. Refer to VA standard specification for additional requirements.
  2. Contractor shall submit a request to interrupt any such services to Contracting Officer Representative (COR), in writing, 48 hours 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 Contracting Officer Representative (COR).
  5. In case of a contract construction emergency, service will be interrupted on approval of Contracting Officer Representative (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 but are not required to be entirely removed,

shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

- M. To minimize interference of construction activities with flow of 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 unless approved by Contracting Officer Representative (COR).
  - 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Contracting Officer Representative (COR).
- N. Coordinate the work for this contract with other construction operations as directed by Contracting Officer Representative (COR). This includes the scheduling of traffic and the use of roadways.

## 1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey, with the Contracting Officer Representative (COR), of areas in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer Representative. This report shall list area:
  - 1. Existing condition and types of vegetation, location of existing utilities, impacted existing facilities such as sidewalks, bus stops, parking, and buildings.
  - 2. Shall note any discrepancies between drawings and existing conditions at site.
  - 3. Shall designate areas for working space, materials storage and routes of access to areas where alterations occur and which have been agreed upon by Contractor and Contracting Officer Representative (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 Contracting Officer Representative (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 Contracting Officer Representative (COR) together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing 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 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. 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.
  - 2. Protection of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

## 1.8 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.
- C. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Contracting Officer Representative (COR).
  - 2. Do not perform dust producing tasks within occupied areas without the approval of the Contracting Officer Representative (COR). For construction in any areas that will remain jointly occupied by the Medical Center and Contractor's workers, the Contractor shall:
    - a. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
    - b. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
    - c. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
    - d. Contractor shall not haul debris through patient-care areas without prior approval of the Contracting Officer Representative (COR) and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
    - e. 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.



- f. At completion, remove construction barriers outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

D. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from that have been part of the construction.

## 1.9 DISPOSAL AND RETENTION

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

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by Contracting Officer Representative (COR).
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Contractor shall be responsible for the proper disposal of contaminated materials from the demolition of sewage structures. Contractor is responsible for decontamination, sampling, or any other process or procedure that may be required by the agency accepting the material. Contractor shall submit the receipt of disposal to the COR with any other documentation showing that it was properly disposed of.

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

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

(FAR 52.236-9)

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is not required for this project as long as the area of disturbance remains below one acre. The apparent low bidder, Contractor and affected subcontractors shall be responsible for protecting the VA property, storm drains, and waterways from erosion and debris that may be affected by water

runoff. The Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

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

#### **1.11 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the Contracting Officer Representative (COR). Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Contracting Officer Representative (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 foundation walls, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.12 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
  - 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by S&B Christ Consulting LLC., PULS, Inc., and Advanced GeoServices.

(FAR 52.236-4)

- B. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

### **1.13 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 LAYOUT OF WORK**

- A. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

### **1.15 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 Contracting Officer Representative (COR)'s review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Contracting Officer Representative (COR) within 15 calendar days after each completed phase and after the acceptance of the project by the Contracting Officer Representative (COR).
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

### **1.16 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center approved by the COR. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. Contractor shall submit a traffic control plan along with their phasing plan for approval by the COR prior to construction. Contractor shall coordinate the use of all roadways, driveways and walkways with COR prior to closure. Access to facilities must be maintained at all times. Vehicular access must be maintained in at least one direction without prior approval from the COR. If vehicular access is restricted to one way flow, Contractor shall provide a flagger at both ends of construction to control the flow of traffic and shall comply with all temporary signage requirements of the Manual on Uniform Traffic Control Devices (MUTCD).

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

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

2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

#### **1.18 TEMPORARY TOILETS**

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

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

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

- E. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
  - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Contracting Officer Representative (COR)'s discretion) of use of water from Medical Center's system.

#### **1.20 RELOCATED EQUIPMENT ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Contracting Officer Representative (COR).
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

#### **1.21 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 Contracting Officer Representative (COR) verbally, and then with a written follow up.

**- - - E N D - - -**

# **CONSTRUCTION SAFETY STANDARDS**

**DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER  
COATESVILLE, PENNSYLVANIA 19320**

**UPDATED: 01/12**

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**MICHAEL CARCANAGUE, PE  
DIRECTOR, FACILITIES ENGINEERING SERVICE**

**ATTACHMENT #1**

**DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER**  
**COATESVILLE, PENNSYLVANIA 19320**

**GUIDELINES**

This digest of construction safety and health requirements has been compliance of all Safety, Health and Fire Protection Regulations, which must be observed while working at this health care facility. The source of these regulations is:

1. U.S. Department of Labor Standards - OSHA 29 CFR 1910  
(General Industry) 1995 Edition
2. U.S. Department of Labor Standards - OSHA 29 CFR 1926  
(Construction Safety) 1995 Edition
3. National Fire Protection Association Codes
4. Department of Veterans Affairs Safety Policies and Procedures

The enforcement of all safety regulations contained within this digest is carried out by the Medical Center's Safety Officer representing the Director, Facilities Engineering Service. The Medical Center's Safety Officer will make inspections of contractor personnel performing work on the station, advising them of mandatory safety procedures. If flagrant violations are observed the Safety Officer can order shutdown of activities until he can contact the Director, Facilities Engineering Service to present his appraisal of the situation. Private contractor construction work at this facility is also subject to inspection by U.S. Department of Labor, Occupational Safety and Health Administration, Philadelphia Office.

Note: Construction Contractor are required to have employees tested for TB, treated as necessary, and provide a letter of certification that their employees are "TB FREE" with their other required documentation prior to the start of construction.

ATTACHMENT #1

**STANDARDS**

1. ABRASIVE GRINDING

- A. All abrasive wheel bench and stand grinders shall be provided with safety guards which cover the spindle ends, nut and flange projections and are strong enough to withstand the effects of a bursting wheel.
- B. An adjustable work rest of rigid construction shall be used on floor and bench-mounted grinders, fixed base, off-hand grinding machines with the work rest kept adjusted to a maximum clearance of 1/8 inch between rest and wheel.
- C. All abrasive wheels shall be closely inspected and ring tested before mounting to ensure that they are free from defects.

2. ACCIDENT RECORD KEEPING REQUIREMENTS

- A. Within 48 hours after its occurrence, an employee accident which is fatal to one or more employees or which results in the hospitalization of five or more employees shall be reported by the employer, either orally or in writing, to the nearest OSHA Area Director.
- B. Records as prescribed in the record keeping requirements booklet shall be kept for all accidents that result in fatality, hospitalization, lost workdays, medical treatment, job transfer, termination or loss of consciousness.
- C. All injuries sustained by contractors while on VA property must be reported to the Safety Office at Extension 2104.

3. AIR TOOLS

- A. Pneumatic power tools shall be secured to the hose in a positive manner to prevent accidental disconnection.
- B. Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent them from being accidentally expelled.
- C. The manufacturer's safe operating pressure for all hoses, fittings and utilization equipment shall not be exceeded.

4. BELT SANDING MACHINES

- A. Belt sanding machines shall be provided with guards at each nip point where the sanding belt runs onto a pulley.
- B. The unused run of the sanding belt shall be guarded against accidental contact.



5. BOILERS

Boilers provided by the contractor shall be deemed to be in compliance with the requirements of this part when evidence of current and valid certification by an insurance company or regulatory authority attesting to the safe installation, inspection and testing is presented.

6. CHAINS

(See wire ropes, chains, hooks, etc., #63).

7. COMPRESSED AIR, USE OF

Compressed air used for cleaning purposes shall not exceed 35 psi when the nozzle end is obstructed or dead ended and then only with effective chip guarding and personal protective equipment.

8. COMPRESSED GAS CYLINDERS - (OSHA PART 1926.350 Thru 1926.354)

A. Valve protection caps shall be in place when compressed gas cylinders are transported, moved or stored.

B. Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved.

C. Compressed gas cylinders shall be secured in an upright position at all times, except when cylinders are actually being hoisted or carried.

D. Cylinders shall be kept at a safe distance or shielded from welding or cutting operations. Cylinders shall be kept at a safe distance from radiators or other heat sources or where they can contact an electrical circuit.

E. Oxygen and fuel gas regulators shall be in proper working order while in use.

9. CONCRETE, CONCRETE FORMS AND SHORING

A. All equipment and material used shall comply with ANSI A10.9 "Safety Requirements for Concrete Construction and Masonry Work".

B. Employees shall not be permitted to work above vertically protruding reinforcing steel, unless it has been protected to eliminate the hazard of impalement.

C. Powered and rotating-type concrete toweling machines that are manually guided shall be equipped with a dead man type operating control.

D. Formwork and shoring shall safely support all loads imposed during concrete placement. Drawings or plans of formwork and shoring systems shall be available at the job site.

## 10. CONVEYORS

A. Conveyor systems shall be equipped with an audible warning signal which can be sounded immediately before starting up the conveyor.

B. Where conveyors pass over work areas or aisles, guards shall be provided to protect employees from falling material.

C. Conveyors shall be in compliance with ANSI B20.1, "Safety Code for conveyors, cableways and related equipment".

## 11. CRANES AND DERRICKS

A. The contractor shall comply with the manufacturer's specifications and limitations.

B. Rated load capacities, recommended operating speeds and special hazard warnings or instructions shall be posted on all equipment and be visible from the operator's station.

C. Equipment shall be inspected before each use and all deficiencies corrected before further use.

D. Accessible areas within the swing radius of the revolving superstructure shall be barricaded.

E. Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work, or where insulating barriers not a part of or an attachment to the equipment or machinery have been erected to prevent physical contact with the lines, no part of a crane or its load shall be operated within 10 feet of a line rated 50 kV or below; 10 feet + 0.4 inches for each 1 kV over 50 kV for lines rated over 50 kV; or twice the length of the line insulator, but never less than 10 feet.

F. (For rules pertaining to Rigging Equipment, see item #62).

## 12. DISPOSAL CHUTES

A. Whenever materials are dropped more than 20 feet to any exterior point, an enclosed chute shall be used.

B. When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected opening.

13. DRINKING WATER

- A. An adequate supply of portable water will be provided in all places of employment.
- B. Portable drinking water containers shall be capable of being tightly closed and be equipped with a tap.
- C. The common drinking cup is prohibited.
- D. Unused disposable cups shall be kept in a sanitary container and a receptacle shall be provided for used cups.

14. ELECTRICAL

- A. All electrical work shall be in compliance with the current National Electrical Code, unless otherwise provided by OSHA regulations.
- B. The noncurrent-carrying metal parts of fixed, portable and plug-connected equipment shall be grounded. Portable tools and appliances protected by an approved system of double insulation need not be grounded.
- C. Extension cords shall be the 3-wire type, shall be protected from damage and shall not be fastened with staples, hung from nails, or suspended from wires. Splices shall have soldered wire connections with insulation equal to the cable. Worn or frayed cords shall not be used.
- D. Exposed bulbs on temporary lights shall be guarded to prevent accidental contact. except where bulbs are deeply recessed in the reflector. Temporary lights shall not be suspended by their electric cords unless designed for this use.
- E. Receptacles for attachment plugs shall be of the approved, concealed contact type. Where different voltages, frequencies, or types of current are supplied, receptacles shall be of such design that attachment plugs are not interchangeable.
- F. Each disconnecting means for motors and appliances and each service feeder or branch circuit at the point where it originates shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident.

15. EXCAVATING AND TRENCHING - (OSHA PART 1926.652)

- A. Before opening any excavation, efforts shall be made to determine if there are underground utilities in the area and they shall be located and protected during the excavation operations.

B. The walls and faces of all excavations and trenches more than 4 feet deep, in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.

C. A means of egress such as but not limited to a ladder, stairway or ramp shall be located in every excavation or trench 4 feet (1.22M) or more in depth so as to require no more than 25 feet \*7.62M) of lateral travel for employees.

D. In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.

E. Daily inspections of excavations will be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees.

## 16. EXPLOSIVES AND BLASTING

A. Only authorized and qualified persons shall be permitted to handle and use explosives.

B. Explosive material shall be stored in approved facilities as required by provisions of the Internal Revenue Service regulations published in 26 CFR 181, "Commerce in Explosive".

C. Smoking and open flames shall not be permitted within 50 feet of explosives storage magazines.

D. Procedures that permit safe and efficient loading shall be established before loading is started.

## 1.7 EYE AND FACE PROTECTION - (OSHA 1926.102)

A. Eye and face protection shall be provided when machines or operations present potential eye or face injury.

B. Eye and face protective equipment shall meet the requirements of ANSI Z87.1, "Practice for Occupational Eye and Face Protection".

C. Employees involved in welding operations shall be furnished with filter lenses of the proper shade number.

D. Employees exposed to laser beams shall be furnished suitable laser safety goggles which will protect for the specific wave-length of the laser and be of optical density (O.D.) adequate for the energy involved.

## 18. FIRE PROTECTION

A. The Medical Center's fire fighting program is to be followed throughout all phases of the construction and demolition work involved.

- B. Fire fighting equipment will be conspicuously located and readily accessible at all times and be maintained in operating condition.
- C. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.
- D. All construction employees shall receive fire/safety orientation from their supervisors via the general contractor.

19. FLAGMAN

- A. When signs, signals and barricades do not provide the necessary protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls shall be provided.
- B. Flagman shall be provided with and shall wear a red or orange warning garment while flagging. Warning garments worn at night shall be of reflectorized material.

20. FLAMMABLE AND COMBUSTIBLE LIQUIDS

- A. Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- B. No more than 25 gallons of flammable or combustible liquid shall be stored in a room outside of an approved storage cabinet. No more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one- storage cabinet. No more than three storage cabinets may be located in a single storage area.
- C. Inside storage rooms for flammable and combustible liquids shall be of fire-resistive construction, have self-closing fire doors at all openings, 4-inch sill or depressed floors, a ventilation system that provides at least six air changes within the room per hour and electrical wiring and equipment approved for Class 1, Division 1 locations.
- D. Storage in containers outside buildings shall not exceed 1,100 gallons in any one pile or area. The storage area shall be graded to divert possible spills away from buildings or other exposures, or shall be surrounded by a curb or dike. Storage areas shall be located at least 20 feet from any building and shall be free from weeds, debris and other combustible materials.
- E. Flammable liquids shall be kept in closed containers when not actually in use.
- F. Conspicuous and legible signs prohibiting smoking shall be posted in service and refueling areas.

21. FLOOR OPENINGS, OPEN SIDES, HATCHWAYS, ETC.

- A. Floor openings shall be guarded by a standard railing and toeboards or covers. In general, the railing shall be provided on all exposed sides, except at entrances to stairways. Temporary floor openings shall have standard railings.

B. Every open-sided floor or platform, 6 feet or more above adjacent floor or ground level, shall be guarded by a standard railing, or the equivalent, on all open sides except where there is entrance to a ramp, stairway, or fixed ladder.

C. Floor holes, into which persons can accidentally walk, shall be covered with a floor hole cover or standard strength and construction or be guarded by a standard railing with toeboard on all exposed sides.

D. Runways 4 feet or more shall have standard railings on all open sides, except runways more than 18 inches wide used exclusively for special purposes may have the railings on one side omitted where operating conditions necessitate.

## 22. GASES, VAPORS, FUMES, DUSTS AND MISTS

A. Exposure to toxic gases, vapors, fumes, dusts and mists at a concentration above those specified in the "Threshold Limit Values of Airborne Contaminants" of the ACGIH, shall be avoided.

B. Administrative or engineering controls must be implemented whenever feasible to comply with TLV's.

D. When engineering and administrative controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed. Any equipment and technical measures used for this purpose must first be approved for each particular use by a competent industrial hygienist or other technically qualified person.

## 23. GENERAL DUTY CLAUSE

A. Hazardous conditions or practices not covered in an OSHA standard may be covered under Section 5 (a) (1) of the Occupational Safety and Health Act of 1970 which states, "Each employee shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees".

## 24. GENERAL REQUIREMENTS

A. The contractor shall initiate and maintain such programs as may be necessary to provide for frequent and regular inspections of the job site, materials and equipment.

B. The contractor shall instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury.

C. The contractor shall ensure that all employees are familiar with the requirements set forth in this standard.

25. HAND TOOLS - (OSHA PART 1926.300)

- A. Contractors shall not issue or permit the use of unsafe hand tools.
- B. Wrenches shall not be used when jaws are sprung to the point that slippage occurs. Impact tools shall be kept free of mushroomed heads. The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool.
- C. Electric power operated tools shall either be approved double insulated or be properly grounded.
- E. When power-operated tools are designed to accommodate guards, they shall be equipped with such guards when in use.

26. HEAD PROTECTION - (OSHA PART 1926.100)

- A. Head protective equipment (helmets) shall be worn in areas where there is a possible danger of head injuries from impact, flying or falling objects, or electrical shock and burns.
- B. Helmets for protection against impact and penetration of falling and flying objects shall meet the requirements of ANSI Z89.1.
- C. Helmets for protection against electrical shock and burns shall meet the requirements of ANSI Z89.2.

27. HEARING PROTECTION

- A. Feasible engineering or administrative controls shall be utilized to protect employees against sound levels in excess of those shown in Table D-2.
- B. When engineering or administrative controls fail to reduce sound levels within the limits of Table D-2, ear protective devices shall be provided and used.
- C. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.
- D. In all cases, where the sound levels exceed the values shown in Table D-2 of the Safety and Health Standards, a continuing, effective hearing conservation program shall be administered.
- E. Table D-2, Permissible Noise Exposures.

<u>DURATION PER DAY HOURS:</u>	<u>SOUND LEVEL dBA</u> <u>SLOW RESPONSE</u>
8.....	90
6.....	92

4.....	95
3.....	97
2.....	100
1-1/2.....	102
1.....	105
1/2.....	110
1/4 or less.....	115

F. Plain cotton is not an acceptable protective device.

## 28. HEATING DEVICES, TEMPORARY

A. Fresh air shall be supplied in sufficient quantities to maintain the health and safety of workers.

B. Solid fuel salamanders are prohibited in buildings and on scaffolds.

C. When heaters are used, they shall rest on suitable heat insulating material or at least 1-inch concrete, or equivalent and be located at least 10 feet from any combustible materials.

## 29. HOISTS, MATERIAL AND PERSONAL

A. The contractor shall comply with the manufacturer's specifications and limitations.

B. Rated load capacities, recommended operating speeds and special hazard warnings or instructions shall be posted on cars and platforms.

C. Material hoisting entrances of material hoists shall be protected by substantial full width gates or bars.

D. Hoisting doors or gates of personnel hoists shall be not less than 6 feet 6 inches high and be protected with mechanical locks, which cannot be operated from the landing side and are accessible only to persons on the car.

E. Solid overhead protective coverings shall be provided on the top of the hoist cage or platform.

## 30. HOOKS

(See Wire Ropes, Chains, Hooks, etc., #62).

## 31. HOUSEKEEPING

A. Form and scrap lumber with protruding nails and other debris, shall be kept clear from all work areas.



- B. Combustible scrap and debris shall be removed at regular intervals.
- C. Containers shall be provided for collection and separation of all refuse. Covers shall be provided on containers used for flammable or harmful substances.
- D. Wastes shall be disposed of at frequent intervals.
- E. All external industrial waste bins shall be guarded by a fence no less than four feet in height. The length of the fence as such to prevent entry by staff or patients.

## 32. ILLUMINSION

- A. Construction areas, ramps, runways, corridors, offices, shops and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress.
- B. Table D-3: Minimum Illumination Intensities in Foot-Candles.

<u>Foot Candles:</u>	<u>Area or Operation:</u>
5.....	General construction area lighting.
3.....	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling and field maintenance areas.
5.....	Indoors; warehouses, corridors, hallways and exit ways.
5.....	Tunnels, shafts and general underground work areas (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking and scaling. Bureau of Mines approved cap lights shall be acceptable for use in tunnel heading).
10.....	General construction plant and shops (e.g. bath plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active storerooms, mess halls, indoor toilets, and workrooms).
30.....	First aid stations, infirmaries and offices.

## 33. JOINTERS

- A. Each hand-fed planer and jointer with a horizontal head shall be equipped with a cylindrical cutting head. The opening in the table shall be kept as small as possible.

- B. Each hand-fed jointer with a horizontal cutting head shall have an automatic guard which will cover the section of the head on the working side of the fence or gage.
- C. A jointer guard shall automatically adjust itself to cover the unused portion of the head and shall remain in contact with the material at all times.
- D. Each hand-fed jointer with horizontal cutting head shall have a guard, which will cover the section of the head back of the gage or fence.

#### 34. LADDERS

- A. The use of ladders with broken or missing rungs or steps, broken or split side rails, or with other faulty or defective construction is prohibited. When ladders with such defects are discovered, they shall immediately be withdrawn from service.
- B. Portable ladders shall be placed on a substantial base at a 4-1 pitch, have clear access at top and bottom, extend a minimum of 36 inches above the landing and be secured against movement while in use.
- C. Portable metal ladders shall not be used for electrical work or where they may contact electrical conductors.
- D. Job-made ladders shall be constructed for this intended use. Cleats shall be inset into side rails 1/2 inch, or filler blocks used. Cleats shall be uniformly spaced, 12 inches, top-to-top.

#### 35. LASERS

- A. Only qualified and trained employees shall be assigned to install, adjust and operate laser equipment.
- B. Employees shall wear proper eye protection where there is a potential exposure to laser light greater than 0.005 watts (5 milli-watts).
- C. Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight, or at change of shifts, the laser shall be turned off.
- D. Employees shall not be exposed to light intensities above: Direct staring - 1 micro-watt per square centimeter; incidental observing - 1 milli-watt per square centimeter; diffused reflected light - 2-1/2 watts per square centimeter. Employees shall not be exposed to microwave power densities in excess of 10 milli-watts per square centimeter.

36. LIQUIFIED PETROLEUM GAS

- A. Each system shall have containers, valves, connectors, manifold valve assemblies and regulators of an approved type.
- B. All cylinders shall meet DOT specifications.
- C. Every container and vaporizer shall be provided with one or more approved safety relief valves or devices.
- D. Containers shall be placed on firm foundations and secured in an upright position.
- E. Portable heaters shall be equipped with an approved automatic device to shut off the flow of gas in the event of flame failure.
- F. Storage of LPG within buildings is prohibited.
- G. Storage locations shall have at least one 20-B:C rated fire extinguisher.

37. MEDICAL SERVICES AND FIRST AID

- A. The employer shall ensure the availability of medical personnel for advice and consultation on matters of occupational health.
- B. When a medical facility is not reasonably accessible for the treatment of injured employees, a person trained to render first aid shall be available at the work site.

38. MOTOR VEHICLES AND MECHANIZED EQUIPMENT

- A. All vehicles in use shall be checked at the beginning of each shift to assure that all parts, equipment and accessories that affect safe operation are in proper operating condition and free from defects. All defects shall be corrected before the vehicle is placed in service.
- B. No contractor shall use any motor vehicle, earthmoving, or compacting equipment having an obstructed view to the rear unless:
  - The vehicle has a reverse signal alarm distinguishable from the surrounding noise level, or
  - The vehicles backed up only when an observer signals that it is safe to do so.
- C. Heavy machinery, equipment or parts thereof shall be substantially blocked to prevent falling or shifting before employees are permitted to work under or between them.

39. NOISE

(See hearing protection, #27).

40. PERSONAL PROTECTIVE EQUIPMENT

- A. The contractor is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where the need is indicated for using such equipment to reduce the hazard to the employees.
- B. Lifelines, safety belts and lanyards shall be used only for employee safeguarding.

41. POWDER-ACTUATED TOOLS

- A. Only trained employees shall be allowed to operate powder-actuated tools.
- B. All powder-actuated tools shall be tested daily using the manufacturers recommended procedure to insure all safety devices are in proper working condition. Any tool found not in proper working order shall be removed from service until repaired.
- C. Tools shall not be loaded until immediately before use.

42. POWER TRANSMISSION AND DISTRIBUTION

- A. Existing conditions shall be determined before starting work by an investigation or a test.
- B. Electric equipment and lines shall be considered energized until determined otherwise by testing or until grounding.
- C. Operating voltage of equipment and lines shall be determined before working on or near energized parts.
- D. Rubber protective equipment shall comply with the provisions of the ANSI series and shall be visually inspected before use.

43. POWER TRANSMISSION, MECHANICAL

- A. Belts, gears, pulleys, sprockets, spindles, drums, flywheels, chains or other reciprocating, rotating, or moving parts of equipment shall be guarded if such parts are exposed to contact by employees or otherwise constitute a hazard.
- B. Guarding shall meet the requirement of ANSI B15.1, "Safety Code for Mechanical Power Transmission Apparatus".

44. RADIATION, IONIZING

- A. Pertinent Provisions of the Atomic Energy Commission's Standards for Protection Against Radiation (10 CFR Part 20), relating to protection against occupational radiation exposure, shall apply.
- B. Persons handling radioactive materials or x-rays shall be specially trained, or licensed if required.

45. RAILINGS

- A. A standard railing shall consist of top rail, intermediate rail and posts and have a vertical height of approximately 42 inches from upper surface of top rail to the floor, platform, etc.
- B. The top rail of a railing shall be smooth-surfaced, with a strength to withstand at least 200 pounds. The intermediate rail shall be approximately halfway between the top rail and floor.
- C. A stair railing shall be of construction similar to a standard railing, but the vertical height shall be not more than 34 inches nor less than 30 inches from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.
- D. (See toeboards, #58).

46. RESPIRATORY PROTECTION

- A. In emergencies, or when feasible engineering or administrative controls are not effective in controlling toxic substances, appropriate respiratory protective equipment shall be provided by the employer and shall be used.
- B. Respiratory protective devices shall be approved by the National Institute for Occupational Safety and Health (NIOSH) or acceptable to the U.S. Department of Labor for the specific containment to which the employee is exposed.
- C. Respiratory protective devices shall be appropriate for the hazardous material involved and the extent and nature of the work performed.
- D. Employees required to use respiratory protective devices shall be instructed in their use.
- E. Respiratory protective equipment shall be inspected regularly and maintained in good condition.

47. ROLLOVER PROTECTIVE STRUCTURES (ROPS)

- A. Rollover protective structures (ROPS) applies to the following types of materials handling equipment: To all rubber-tired, self-propelled scrapes, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type loaders and motor graders, with or without attachments that are used in construction work. This requirement does not apply to side-boom pipe-laying tractors.
- B. Above equipment manufactured on or after 9/1/72 shall have ROPS.
- C. Above equipment manufactured on or after 1/1/72 shall have ROPS by 4/1/73.

D. Above equipment manufactured between 7/1/71 and 12/31/71 shall have ROPS by 7/1/73

F. Above equipment manufactured between 7/1/70 and 6/30/71 shall have ROPS by 1/1/74

F. Above equipment manufactured between 7/1/69 and 6/30/70 shall have ROPS by 7/1/74.

G. Above equipment manufactured before 7/1/69 are not required to have ROPS as of this printing.

48. SAFETY NETS

A. Safety nets shall be provided when workplaces are more than 25 feet above the surface where the use of ladders, scaffolds and platforms, temporary floors, safety lines, or safety belts are impractical.

B. Where nets are required, operations shall not be undertaken until the nets are in place and have been tested.

49. SAWS, BANDS

A. All portions of band saw blades shall be enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table.

B. Band saw wheels shall be fully encased.

50. SAWS, PORTABLE CIRCULAR

A. All portable, power-driven circular saws shall be equipped with guards above and below the base plate or shoe. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work and shall automatically return to the covering position when the blade is removed from the work.

B. (See #25 of this digest).

51. SAWS, RADIAL

A. Radial saws shall have an upper guard, which completely encloses the upper half of the saw blade. The sides of the lower exposed portion of the blade shall be guarded by a device that will automatically adjust to the thickness of and remain in contact with the material being cut.

B. Radial saws used for ripping shall have non-kickback fingers or dogs.

C. Radial saws shall be installed so that the cutting head will return to the starting position when released by the operator.

52. SAWS, SWING OR SLIDING CUT-OFF

- A. All swing or sliding cut-off saws shall be provided with a hood that will completely enclose the upper half of the saw.
- B. Limit stops shall be provided to prevent swing or sliding type cut-off saws from extending beyond the front or back edges of the table.
- C. Each swing or sliding cut-off saw shall be provided with an effective device to return the saw automatically to the back of the table when released at any point of its travel.
- D. Inverted sawing of sliding cut-off saws shall be provided with a hood that will cover the part of the saw that protrudes above the top of the table or material being cut.

53. SAWS, TABLE

- A. Circular table saws shall have a hood over the portion of the saw above the table, so mounted that the hood will automatically adjust itself to the thickness of and remain in contact with the material being cut.
- B. Circular table saws shall have a spreader aligned with the blade, spaced no more than 1/2 inch behind the largest blade mounted in the saw. This provision does not apply when grooving, dadoing, or rabbeting.
- C. Circular table saws used for ripping shall have non-kickback finger or dogs.
- D. Feed rolls and blades of self-feed circular saws shall be protected by a hood or guard to prevent the hands of the operator from coming in contact with the in-running rolls at any time.

54. SCAFFOLDS - (OSHA PART 1926.451)

- A. Scaffolds shall be erected on sound, rigid footing, capable of carrying the maximum intended load.
- B. Scaffolds and their components shall be capable of supporting, without failure, at least 4 times the maximum intended load.
- C. Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor, except needle beam scaffolds and floats. Scaffolds 4 feet to 10 feet in height, having a minimum dimension in either direction of less than 45 inches, shall have standard guardrails installed on all open sides and ends of the platform.
- D. There shall be a screen with maximum 1/2 inch openings between the toeboard and the mid-rail, where persons are required to work or pass under the scaffold.

- E. All planking shall be scaffold grade as recognized by grading rules for the species of wood used. The maximum permissible spans for 2 x 10 inches or wider planks are shown in the following table:

MATERIAL

	FULL THICKNESS UNDRESSED LUMBER		NORMAL THICKNESS LUMBER		
Working load (p.s.f.).....	25	50	75	25	50
Permissible span (ft.).....	10	8	6	8	6

The maximum permissible span for 1-1/4 x 9 inch or wider plank of full thickness is 4 feet, with medium loading of 50 p.s.f.

- F. Scaffold planking shall be overlapped a minimum of 12 inches or secured from movement.
- G. Scaffold planks shall extend over their end supports not less than 6 inches, nor more than 12 inches.
- H. All scaffolding and accessories having any defective parts shall be immediately replaced or repaired.

55. STAIRS

- A. Every flight of stairs having four or more risers shall be equipped with standard stair railings or standard handrails.
- B. On all structures 20 feet or over in height, stairways, ladders, or ramps shall be provided.
- C. Rise height and tread width shall be uniform throughout any flight of stairs.
- D. Hollow pan-type stairs shall be filled to the level of the nosing with solid material.

56. STEEL ERECTION

- A. Permanent floors shall be installed so there is not more than eight stories between the erection floor and the upper-most permanent floor, except when structural integrity is maintained by the design.
- B. During skeleton steel erection, a tightly planked temporary floor shall be maintained within two stories or 30 feet, whichever is less - that portion of each tier of beams on which any work is being performed.



- C. During skeleton steel erection, where the requirements of the preceding paragraph cannot be met and where scaffolds are not used, safety nets shall be installed and maintained whenever the potential fall distance exceeds two stories or 25 feet.
- D. A safety railing of ½ inch wire rope or equivalent shall be installed around the perimeter of all temporarily floored buildings, approximately 42 inches high, during structural steel assembly.
- E. When placing structural members, the load line shall not be released until the member is secured by at least two bolts, or the equivalent, at each connection drawn up wrench tight.

#### 57. STORAGE

- A. All materials stored in tiers shall be secured to prevent sliding, falling or collapse.
- B. Aisles and passageways shall be kept clean and in good repair.
- C. Storage of materials shall not obstruct exits.
- D. Materials shall be stored with due regard to their fire characteristics.
- G. Weeds and grass in outside storage areas shall be kept under control.
- H. Storage of flammable liquids inside buildings is not permitted.
- I. Storage of flammable liquids inside buildings is not permitted.
- J. All tools must be locked up when not in the immediate care of your employees, and at the end of each workday.

#### 58. TOEBOARDS - (Floor and Wall Openings and Stairways).

- A. Railings protecting floor openings, platforms, scaffolds, etc., shall be equipped with toeboards wherever, beneath the open side, persons can pass, there is moving machinery, or there is equipment with which falling material could cause a hazard.
- C. A standard toeboard shall be at least 4 inches in height and may be of any substantial material either solid or open, with openings not to exceed 1 inch in greatest dimension.

#### 59. TOILETS

- A. Toilets shall be provided according to the following; 20 or fewer persons - one facility; 20 or more persons - one toilet seat and one urinal per 40 persons; 200 or more persons - one toilet seat and one urinal per 50 workers.

- B. This requirement does not apply to mobile crews having transportation readily available to nearby toilet facilities.

60. WASHING FACILITIES

- A. The employer shall provide adequate washing facilities for employees engaged in the application of harmful substances or in operations where harmful contaminants are used.
- B. Washing facilities shall be in close proximity to the work-site and shall be equipped to remove all harmful substances.

61. WELDING, CUTTING AND HEATING

- A. Whenever any welding, burning, heating or cutting operation is to be performed, the contractor must secure a permit from the Fire Department. Requests for permits should be made by the contractor's authorized supervisory representative. Upon completion of the above operation, the permit shall be returned to the Fire Department.
- B. Contractors shall instruct employees in the safe use of welding equipment.
- C. Proper precautions (isolating welding and cutting, removing fire hazards from the vicinity, providing a fire watch, etc.) for fire prevention shall be taken in areas where welding or other "Hot Work" is being done. No welding, cutting or heating shall be done where the application of flammable paints, or the presence of other flammable paints, or the presence of other flammable compounds, or heavy dust concentrations creates a fire hazard.
- D. Welding and cutting operations shall be shielded by non-combustible, or flame-proof shields.
- E. When electrode holders are to be left unattended, the electrodes shall be removed and the holders shall be placed or protected so that they cannot make electrical contact with employees or conducting objects.
- F. All arc welding and cutting cables shall be completely insulated. There shall be no repairs or splices within 10 feet of the electrode holder, except where splices are insulated equal to the cable. Defective cable shall be repaired or replaced.
- G. Fuel gas and oxygen hose shall be easily distinguishable and shall not be interchangeable. Hoses shall be inspected at the beginning of each shift and shall be repaired or replaced if defective.
- H. Mechanical ventilation or airline respirators shall be provided when welding, cutting or heating:

\*\* zinc-, lead-, cadmium-, mercury-, or beryllium-bearing, based or coated materials in

- enclosed spaces.
- \*\* stainless steel with inert equipment.
- \*\* in confined spaces.
- \*\* where an unusual condition can cause an unsafe accumulation of contaminants.
- I. Proper eye protective equipment to prevent exposure of personnel shall be provided (See Item #17c).
- J. (See Compressed Gas Cylinders, #8).

This Medical Center is equipped with sophisticated Smoke Detectors directly tied into our Fire Alarm System and the on-site Fire Department.

These on-site units can be activated very easily with any products of combustion and therefore can create an actual ALARM condition. Prior notification of all heat and smoke producing operations will enable us to shut down that particular FIRE ZONE until the contractors are finished with their work.

## 62. WIRE ROPES, CHAINS, ROPES

- A. Wire ropes, chains, ropes and other rigging equipment shall be inspected prior to use and as necessary to assure their safety. Defective gear shall be removed from service.
- B. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments.
- C. When U-bolts are used for eye splices, the U-bolt shall be applied so that the “U” section is in contact with the dead end of the rope.

## 63. WOODWORKING MACHINERY

- A. All fixed power-driven woodworking tools shall be provided with a disconnect switch that can be either locked or tagged in the off position.
- B. All woodworking tools and machinery shall meet applicable requirements of ANSI 01.1, “Safety Code for Woodworking Machinery”.

## 64. SMOKING POLICY

- A. Smoking is not permitted in any building.
- B. Smoking is permitted outside and in the smoking huts of our grounds.

65. DISCOVERY OF FIRE

A. In the event a fire is discovered the following steps will be carried out:

**RESCUE** - Remove anyone in danger from the area.

**ALARM** - Turn in the alarm.

**CONTAIN** - Close doors prevent spread

**EXTINGUISH** - Only if it is safe.

B. All contractor personnel will familiarize themselves with all fire equipment and fire alarm pull box station locations.

C. Dial 4911 and give location and type of fire.

D. Evacuation plans are posted on each floor in the corridors for your use in the event of a fire. When the fire alarm sounds in the building where workmen are located, they must evacuate the building and wait for all clear signal from Fire Department.

E. In the event of a fire **DO NOT** use elevators - use stairwell exits for means of escape.

66. CARDIAC ARREST

In the event a contractor's employee suffers an apparent heart attack a fellow employee should go to the nearest phone, dial "911" report that there is a possible cardiac arrest and give the exact location.

**Reference: 29 CFR1910.126 OSHA Safety and  
Health Standard**

**67. CONFINED SPACE ENTRY - (OSHA 1910.146)**

Any work which requires entry into a confined space, such as manholes, shall conform to OSHA 1910.146, Confined Space Entry, and this Medical Center's Confined Space Entry Program. Contractor will be informed of the hazards associated with such spaces by the VA Engineering Staff, and will supply the VA with evidence of an appropriate confined space program and worker training in Confined Space Entry. Contractor will supply all equipment necessary to work safely in a confined space. Contractor will coordinate entry into such spaces with VA Safety Staff.

**68. LOCK OUT/TAG OUT HAZARDOUS ENERGY - (OSHA 1910.147)**

All equipment shall be locked out or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. Do not attempt to operate any switch, valve, or other energy isolating device where it is locked (or tagged) out.

If more than one crew, department, etc is involved, one authorized employee will coordinate the lock/out tag/out to ensure that all control measures are applied and there is continuing of protection for the group.

**DEPT. OF VETERANS AFFAIRS (VA)**

**CUTTING AND WELDING PERMIT**

Date: \_\_\_\_\_ Bldg. #: \_\_\_\_\_ Floor/Area: \_\_\_\_\_

Welder's Name: \_\_\_\_\_ Shop/Company: \_\_\_\_\_

Nature of  
Job: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Is Fire Watch required: \_\_\_\_\_ Fire Watcher: \_\_\_\_\_

The location has been examined. The proper precautions have been taken.  
Permission is granted for this work. (See precautions on reverse side)

Permit Expires: \_\_\_\_\_

SIGNED: \_\_\_\_\_  
(Authorizing Fire Dept. Official)

Time Work Started: \_\_\_\_\_

Time Work Finished: \_\_\_\_\_

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**FINAL CHECK-UP**

The work area was inspected 30 minutes after the work was completed and was found fire safe.  
The work area is to include all adjacent areas (including floors above and below), to which any fire or  
heat might spread.

SIGNED: \_\_\_\_\_  
(Supervisor of Fire Watcher)

ATTACHMENT #2

**ATTENTION**

**BEFORE APPROVING ANY CUTTING OR WELDING PERMIT, THE FIRE DEPARTMENT REPRESENTATIVE OR HIS APPOINTEE SHALL INSPECT THE WORK AREA AND CONFIRM THAT THE PROPER PRECAUTIONS HAVE BEEN TAKEN.**

**NECESSARY PRECAUTIONS**

	YES	NO
1. Cutting and welding equipment is in good condition.	_____	_____
2. Sprinklers are in service.	_____	_____
3. Floor swept clean within 35 ft of combustibles.	_____	_____
4. Combustible floors wet down or shielded within 35 ft.	_____	_____
5. All combustible or flammable liquids removed from the area.	_____	_____
6. All wall and floor openings are covered and protected from open flame.	_____	_____
7. Enclosed equipment cleaned of all combustibles.	_____	_____
8. Enclosed containers purged of flammable vapors.	_____	_____
9. Proper fire extinguisher provided in the work area.	_____	_____
10. Personnel instructed in proper operation of fire alarm.	_____	_____
11. Was fire watch provided?	_____	_____
12. Proper utilities secured such as LP gas, oxygen, natural gas, etc.?	_____	_____
13. Proper fire alarm equipment secured?	_____	_____
14. Final check up completed 30 minutes after work was completed?	_____	_____

I HAVE BEEN INFORMED AND UNDERSTAND THE PROVISIONS OF THIS PERMIT. I UNDERSTAND THIS PERMIT CAN BE REVOKED AT ANY TIME IF I, OR MY EMPLOYEES, FAIL TO FOLLOW THE PRECAUTIONS OUTLINED ABOVE.

SIGNED: \_\_\_\_\_  
(Supervisor's Signature & Date)

DEMOLITION FOR CONSTRUCTION PROJECTS IN  
VA MEDICAL CENTER BUILDINGS:

- a. The contractor shall provide plastic barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust.
- b. The contractor shall utilize HEPA (High Efficiency Particulate Air) equipped air filtration units rated at 99% capture of 0.5 microns including pollen, mold spores and dust particles. The contractor shall insure that continuous negative air pressures are maintained for the duration of the demolition of this project unless otherwise authorized by the COR in writing.
- c. The contractor shall compartmentize by the demolition are creating a barrier reaching from floor to concrete structural ceiling before any demolition is started in any Medical Center Buildings. Surround the affected area entirely and seal with duct tape at the ceiling, floor and sides.
- d. The contractor shall use non-combustible systems or devices to seal existing penetrations of pipe, plastic pipe or conduits, unenclosed cables, or other non – metallic materials in Medical Center Buildings and penetrations that occur from demolition in those buildings.
- e. The contractor shall broom clean at the end of each workday and remove debris as they are created. The contractor shall transport the debris outside the construction area in containers with tightly fitting lids that shall be approved by the COR.
- f. Medical Center staff at the pre-construction meeting will complete a Pre-Construction Risk Assessment (PCRA).



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Pre-Construction Risk Assessment		
Infection Control / Safety Construction Permit		
Location of Construction: Bldg #		Project Start Date:
Project Coordinator:		Estimated Duration:
Contractor Performing Work:		Permit Expiration Date:
Supervisor:		Telephone:
Description of project:		
<b>Construction Activities</b>		
<p>The following projects do not require completion of the Pre-construction risk assessment form:</p> <ol style="list-style-type: none"> <li>1. Paint and wallpaper in business offices and non-patient areas.</li> <li>2. Paint in patient room if closed for painting and less than 3 sq.ft. of wall needs patched. Filter for room unit changed after painting.</li> <li>3. Installation of soap dispenser/needle box/paper towel holder in patient room</li> <li>4. Repair of window blind.</li> <li>5. Ceiling tile replacement for areas less than 50% of the total square footage of the room, if not in business offices and non-patient areas.</li> <li>6. Ceiling tile replacement for area less than 5 2 X 2 tiles in a patient area if patient is out of the immediate area and clean up can be accomplished before patient returns.</li> <li>7. Minimum repair of nurse call system/TV/Bed/Telephone.</li> <li>8. Check or replace electric outlet.</li> <li>9. Replace light bulb.</li> <li>10. Unstop sink/commode with no water on floor.</li> <li>11. Unstop commode when water on floor requires maintenance to have Housekeeping clean area immediately.</li> <li>12. Repair medical gas outlet. (Front Body)</li> <li>13. Air balance readings.</li> <li>14. Check air-conditioning.</li> </ol>		
Yes	No	
<b>Will there be noise generated that will impact a department adjacent to, above, or below the construction area?</b>		
		a. If so, these departments must be notified.
		b. How are you going to reduce the noise to an acceptable level?
Yes	No	
<b>Will there be vibration generated that will impact a department adjacent to, above, or below the construction area?</b>		
		a. If so, these departments must be notified each time this type of work will be performed.
		b. How are you going to reduce the vibration to an acceptable level?
Yes	No	
<b>Are Emergency Procedures in place and posted on each job for accidental events that could greatly impact Patient Care or Life Safety to the facility? Included in these procedures are such things as:</b>		
		<ul style="list-style-type: none"> <li>• Emergency telephone numbers of key departments.</li> <li>• A plan that describes where main valves, switches, and controls are for the area in case of an emergency.</li> <li>• A plan for unexpected outages.</li> </ul>
<b>Environment</b>		
Yes	No	<b>Are any of the following environmental hazards present?</b>
		Will hazardous chemicals be used on this project? How will fumes and odors be controlled? <b>MSDS Sheets are required. IF YES SUBMIT LIST OF CHEMICALS. FUMES WILL BE EXHAUSTED TO THE OUTSIDE.</b>
		Is asbestos abatement required on this job? <b>If so, notify Safety and FES at the activation.</b>
		Will there be hot work done on this project? If there are, then a hot work permit must be posted on the job site. All hot work must have a fire watch assigned to each area while the hot work is being performed.
		Will there be a Confined Space Entry required on this project? If so, the Medical Center's confined space entry program must be followed.
<b>Utility Failures</b>		
Yes	No	<b>Will any of the following systems be out of service at any time during the project?</b>
		• Fire alarm <b>(If out for more than 4 hours, Interim Life Safety Measures must be implemented.)</b>
		• Sprinkler <b>(If out for more than 4 hours, Interim Life Safety Measures must be implemented.)</b>
		• Electrical
		• Domestic water
		• Oxygen
		• Sewage
		• H V A C

Yes	No	
		<b>Will there be any work that will require activation of the Interim Life Safety Measures during this project? Some things that trigger ILSM's to be implemented are but not limited to:</b> <ul style="list-style-type: none"> <li>Any construction that impacts an EXIT or stairs,</li> <li>Any construction that impacts major breaches in a fire or smoke wall,</li> <li>Taking the main fire protection system out of service (sprinkler),</li> <li>Taking the main fire alarm system out of service,</li> <li>Taking the "area" fire or fire alarm systems out of service for more than 4 hours within a 24-hour period.</li> </ul>
		<b>Implementation of the ILSM requires a fire watch and the ILSM forms to be completed (forms are to be obtained from the Medical Center Fire Department)</b>
<b>Additional Safety Concerns</b>		
Yes	No	
		Will construction affect exit routes from occupied areas adjacent to construction site?
		Will project affect traffic patterns in area?
		<b>The following must be completed prior to any construction activities.</b>
		<ul style="list-style-type: none"> <li>Separation wall must be constructed prior to project beginning.</li> <li>Fire protection systems must remain intact.</li> <li>Provide extra fire extinguishers in work areas.</li> <li>Maintain exit lights in work area.</li> <li>Maintain negative air in construction area (24/7) through duration of project.</li> <li>There cannot be any return air from within the construction area to the rest of the building.</li> <li>Redirect exiting not to go through construction area.</li> <li>Put signs on doors into construction area "Construction Area – Do Not Enter".</li> <li>Maintain daily logs and keep a current Hot Work Permit.</li> <li>Place tacky mats at doors interior and exterior exiting construction area.</li> <li>All debris removal must be by covered cart.</li> <li>Maintain clean and orderly work area.</li> <li>How will this project affect the departments above, below and adjacent to this project?</li> </ul>
<b>Air Quality and Infection Control</b>		
The construction activity types are defined by the amount of dust that is generated, the duration of the activity, and the amount of shared HVAC systems. Contact CVAMC's Safety Office and Infection Preventionist if any activity is questionable under these guidelines.		
Yes	No	
		Will dust be generated during this project? <b><i>If yes, explain location of and plan for interim dust barriers or attach floor plan with barriers clearly marked. DUST BARRIERS, ICRA WALLS WILL BE IN PLACE AND MAINTAINED FOR THE DURATION OF THE PROJECT</i></b>
		Will debris removal be necessary? <b><i>If yes, explain plan for debris removal and control. DEBRIS CARTS AND DUMPSTERS WILL BE USED AND COVERED</i></b>
		Negative airflow ventilation and filtration in place and assessed for effectiveness.
		Exhaust fans in place and functioning.
		Is supply duct to area closed and HEPA filtration unit in place and functioning in adjacent patient care area?
		Will work be done in a sterile area? <b><i>If so, how are you going to maintain sterile atmosphere in work area and access to and from work area?</i></b>
<b>Type A Inspections and Non-Invasive Activities or Small scale, Short duration Activities</b>		
Yes	No	
		Removal of ceiling tiles for visual inspection (e.g 1 tile per 50 square feet)
		Painting (but not sanding)
		Wall covering—Describe work to be done:
		Electrical trim work. Describe:
		Minor plumbing. Describe:
<b>Type B Small scale, short duration activities that create minimal dust.</b>		
Yes	No	
		Installation of telephone and computer cabling
		Access to chase spaces
		Cutting of walls or ceiling where dust migration can be controlled.

<b>Type C</b>		<b>Any work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies.</b>
Yes	No	
		Sanding of walls for painting or wall covering
		Removal of x□ floor coverings □ ceiling tile □ casework (>50% of surface area) Describe:
		New wall construction
		Minor ductwork or electrical work above ceilings
		Major cabling activities
		Activity cannot be completed within a single work shift
<b>Type D</b>		<b>Major demolition and construction projects.</b>
Yes	No	
		Will require heavy demolition or removal of a complete ceiling system
		New construction
		Activities which require consecutive work shifts

GROUP 1 LOWEST	GROUP 2 MEDIUM	GROUP 3 HIGH	GROUP 4 HIGHEST
1.) Office areas 2.) Hallways 3.) FES/EMS areas	1) Bldg. #69 Therapy areas 2) Respiratory Therapy 2) Outpatient Clinics 4) CBOC's 5) Mental Health Units 6) VACANT AREA ADJACENT TO OCCUPIED AREA 7) CLCs(1B Med, 59B, 138A,	1) Pharmacy 2) Radiology/ CT Scanner 3) Urgent Care 4) Laboratories 5) AMCU	1) SPS; AMCU; 2) Respiratory Isolation Rooms – 1B Med RM 244B, Urgent Care Bldg 2, Rm B06D

Contact the Infection Preventionist or Safety Office for risk assessment of any area not listed above.

CONSTRUCTION ACTIVITY (from previous page) <i>Check type of activity</i>		INFECTION CONTROL RISK GROUP (see above) <i>Check risk group</i>	
	TYPE A: Inspection, non-invasive activity		GROUP 1: Lowest Risk
	TYPE B: Small scale, short duration projects		GROUP 2: Medium Risk
	TYPE C: Activity generates moderate to high levels of dust, requiring >1 work shift for completion		GROUP 3: High Risk
	TYPE D: Major duration and construction activities Requiring consecutive work shifts		GROUP 4: Highest Risk

#### CLASSIFICATION OF REQUIRED PREVENTIVE MEASURES

CONSTRUCTION ACTIVITY- INFECTION CONTROL RISK GROUP	TYPE "A"	TYPE "B"	TYPE "C"	TYPE "D"
Group I	I	I	II	III/IV
Group 2	I	I	III	IV
Group 3	II	III	III/IV	IV
Group 4	III	III/IV	III/IV	IV

**An Infection Control—Safety Construction Permit is required for Class III or higher projects. Refer to shaded area on Construction Activity/Risk Group Matrix (above).**

CLASS I	1. Execute work by methods to minimize raising dust from construction operations.	2. Immediately replace any ceiling tile displaced for visual inspection.
CLASS II	1. Provide active means to prevent air-borne dust from dispersing into atmosphere 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Wipe surfaces with disinfectant.	6. Contain construction waste before and during transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA filtered vacuum before Leaving work area. 8. Place dust mat at entrance and exit of work area as needed. 9. Remove or isolate HVAC system in areas where work is being performed.

CLASS III	<ol style="list-style-type: none"> <li>1. Obtain infection control permit before construction begins.</li> <li>2. Isolate HVAC system in area where work is being done to Prevent contamination of the duct system.</li> <li>3. Complete all critical barriers before construction begins.</li> <li>4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>5. Contain construction waste before and during transport in Tightly covered containers.</li> <li>6. Seal holes, pipes, conduits, etc. appropriately.</li> </ol>	<ol style="list-style-type: none"> <li>7. Place dust mat at entrance and exit of work area. Replace as needed.</li> <li>8. Do not remove barriers from work area until completed project is inspected by Safety and Epidemiology Depts. and thoroughly cleaned.</li> </ol> <p><b>After work is completed:</b></p> <ol style="list-style-type: none"> <li>9. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.</li> <li>10. Remove isolation of HVAC system.</li> </ol>
Class IV	<ol style="list-style-type: none"> <li>1. Obtain infection control permit before construction begins.</li> <li>2. Isolate HVAC system in area where work is being done to Prevent contamination of duct system.</li> <li>3. Complete all critical barriers or implement control cube method before construction begins.</li> <li>4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.</li> <li>5. Seal holes, pipes, conduits, and punctures appropriately.</li> <li>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 the work site.</li> </ol>	<ol style="list-style-type: none"> <li>7. All personnel entering work site are required to wear shoe covers</li> <li>8. Contain construction waste before and during transport in tightly covered containers. Cover transport receptacles or carts. Tape covering.</li> <li>9. Do not remove barriers from work area until completed project is inspected by Safety and Epidemiology Depts. and thoroughly cleaned.</li> </ol> <p><b>After work is completed:</b></p> <ol style="list-style-type: none"> <li>10. Vacuum work area with HEPA filtered vacuums.</li> <li>11. Wet mop with disinfectant.</li> <li>12. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.</li> <li>13. Remove isolation of HVAC system.</li> </ol>

**Additional concerns for all classes:**

1. SIGNATURE OF RECORD ALL ONSITE CONSTRUCTION WORKERS FOR REVIEW OF FIRE AND LIFE SAFETY PROCEDURES AT COATESVILLE VAMC.
2. REVIEW OF INFECTION PREVENTION TRAINING AND CONSTRUCTION SAFETY CHECK LIST.
3. Maintain manpower and equipment including dust mops, wet mops, brooms, buckets, and clean wiping rags for cleaning fine dust from floors and adjacent occupied areas.
4. Contain work areas outside of construction barriers, including spaces above ceilings, with full height polyethylene sheet barrier, tightly taped.
5. Clean up dust tracked outside of construction area immediately.
6. Temporary construction barriers and closures above ceiling must be dust tight.
7. Removal of debris must be in covered containers.
8. Intermediate jobs that create a moderate amount of dust inside room and is made negative by use of hepa-equipped unit with minimum 10 ACH, and all air discharged outside, hepa unit must run 2 hours after completion of job and Housekeeping must clean room before unit is removed from room. All work and use of hepa unit must be documented and Copy forward to Infection Prevention and Control and Safety. **NOTE: all duct vents to be sealed off during work!**

**Additional Requirements or Concerns:**

- THIS PROJECT IS TYPE , GROUP , CLASS
  - SUBMITT EMERGENCY PROCEDURES TO BE POSTED
  - POST PCRA AND APPROPRIATE CONSTRUCTION SIGNAGE FOR LIMITED ACCESS AND PROPER PPE IN WORK AREA
  - CONTRACTOR TO NOTIFY COATESVILLE VAMC CO, COTR, POLICE AND SAFETY OFFICE IF A FEDERAL OR STATE REGULATOR ARRIVE ONSITE TO INSPECT JOBSITE.
3. TB risk assessment: for 2014 probability/severity is a 2, which requires continuing evaluation including the annual risk assessment for Coatesville VMAC (CY 2013) places the facility in what the CDC defines as medium risk.. Based on the number of infectious TB patients hospitalized in the last year (<6) and TST/QuantiFeron conversion data among healthcare workers the risk is low for transmission. The risk of tuberculosis transmission within the facility will be assessed annually and as needed.
- Dumpsters to have 6' high chain link enclosures.

Permit Request By	Safety Approval	Infection Preventionist Approval
Date:	Date:	Date:

**SECTION 01 32 16.15**  
**PROJECT SCHEDULES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 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.

**1.3 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The Contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents. These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

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

#### **1.4 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.

#### **1.5 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 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.
  - 2. 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.
  - 3. 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.
  - 4. 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.
- C. 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.
- D. 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.
- E. 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.

#### **1.6 PAYMENT TO THE CONTRACTOR:**

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

#### **1.7 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor 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. Schedule update meetings may be held in conjunction with other construction meeting with prior approval by the COR. Job progress will be reviewed to verify:
  1. Actual start and/or finish dates for updated/completed activities/events.
  2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  5. Completion percentage for all completed and partially completed activities/events.
  6. Logic and duration revisions required by this section of the specifications.
  7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and Contracting Officer Representative (COR) for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.2 and 1.5. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted



to the COR within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.

- D. Following approval of the CPM schedule, the VA, the Contractor 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.

## **1.8 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.

## **1.9 CHANGES TO THE SCHEDULE**

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

- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 – 4 (Changes) and VAAR 852.236 – 88 (Changes – Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.10 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer- produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 – 4 (Changes) and VAAR 852.236 – 88 (Changes – Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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## **SECTION 01 33 23**

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

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

- 1.1 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL REQUIREMENTS.
- 1.2 For the purposes of this contract, samples (including laboratory samples to be tested), test reports, certificates, and manufacturers' literature and data shall also be subject to the 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 (including any laboratory samples to be tested) 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 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.
- 1.7 The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1.8 Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1.9 Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit samples required in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  - 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.
  3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.
1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
  3. Samples and laboratory tests shall be sent directly to an approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to COR for appropriate action.
  6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the 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.
  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 (SIMULTANEOUSLY) for approval to:  
S&B Christ Consulting, LLC.

8485 West Sunset Road, Suite 105  
Las Vegas, NV 89113

AND

CONTRACTING OFFICER REPRESENTATIVE (COR)

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 for approval shall be sent to Architect-Engineer, in care of COR, VA Medical Center, to BOTH (SIMULTANEOUSLY):

S&B Christ Consulting, LLC.  
8485 West Sunset Road, Suite 105  
Las Vegas, NV 89113

AND

CONTRACTING OFFICER REPRESENTATIVE (COR)

**--- E N D ---**

SUBMITTAL REGISTER			PROJECT TITLE LOCATION: VAMC, COATESVILLE, PA											
			CONTRACTOR:										PROJECT NO.	
			TYPE OF SUBMITTAL							DATE		REVIEW ACTION	REMARKS	
ITEM NUMBER	SPEC. REFERENCE	DESCRIPTION OF SUBMITTAL	SHOP DRAWING	SAMPLE	GUARANTEE	MFR'S DATA	CERTIFICATE	TEST REPORT	OTHER AS NOTED	SUBMITTAL FORWARD	SUBMITTAL REC'D BY			SUBMITTAL RETURNED BY GOV'T
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ACTION CODES:    A= APPROVED                      AN= APPROVED AS NOTED                      D= DISAPPROVED

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. 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)**

A. 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)**

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

AA Aluminum Association Inc.

<http://www.aluminum.org>

AABC Associated Air Balance Council

<http://www.aabchg.com>

AAMA American Architectural Manufacturer's Association

<http://www.aamanet.org>



AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>

AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASAE	American Society of Agricultural Engineers <a href="http://www.asae.org">http://www.asae.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>

AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>

EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.et1.com">http://www.et1.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
FPS	The Forest Products Society <a href="http://www.forestprod.org">http://www.forestprod.org</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HI	Hydraulic Institute <a href="http://www.pumps.org">http://www.pumps.org</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>

ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org/">http://www.ieee.org/</a>
IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>

NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NLMA	Northeastern Lumber Manufacturers Association, Inc. <a href="http://www.nelma.org">http://www.nelma.org</a>
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>
NWWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>
OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>
PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>

RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SCMA	Southern Cypress Manufacturers Association <a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>
SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings <a href="http://www.sspc.org">http://www.sspc.org</a>
STI	Steel Tank Institute <a href="http://www.steeltank.com">http://www.steeltank.com</a>
SWI	Steel Window Institute <a href="http://www.steelwindows.com">http://www.steelwindows.com</a>
TCA	Tile Council of America, Inc. <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900

UBC      The Uniform Building Code  
          See ICBO

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

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

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

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

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

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**SECTION 01 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 and the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
    - d. Description of the Contractor's environmental protection personnel training program.
    - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
    - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.

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

## **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 2-year (design year) storm or in accordance with local requirements if more stringent. 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. Topsoil use and requirements are specified in Section 31 20 11, EARTHWORK.
    - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
  5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features 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 and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
  7. Manage and control spoil areas on and off Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the 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 Pennsylvania Department of Environmental Protection and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
  3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer Representative. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the Contracting Officer Representative. Repetitive impact noise on the property shall not exceed the following dB limitations:

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

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	SAWS	75
GENERATORS	75	VIBRATORS	75
COMPRESSORS	75		

- b. Use shields or other physical barriers to restrict noise transmission.
  - c. Provide soundproof housings or enclosures for noise-producing machinery.
  - d. Use efficient silencers on equipment air intakes.
  - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
  - f. Line hoppers and storage bins with sound deadening material.
  - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB (A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the 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 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 (e.g., 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 01 00 00, GENERAL REQUIREMENTS.

B. Section 02 41 00, DEMOLITION

C. Lead paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL

## 1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the 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. To the greatest extent possible, utilize a single mixed debris recycling facility within a 50-mile radius of the medical center.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

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

#### 1.4 TERMINOLOGY

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

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

## **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Contracting Officer's Representative a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, and 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 certified or approved to receive and recycle 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, and 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.

- 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, and invoices. Include net total costs for each disposal.

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## **SECTION 02 41 00 DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

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

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

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTHWORK.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- G. 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.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
  - 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.



3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the 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.

G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, and Article 1.7 INFECTION PREVENTION MEASURES.

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

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

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

### **PART 3 - EXECUTION**

#### **3.1 DEMOLITION:**

A. Completely demolish and remove identified utilities, including all appurtenances related or connected thereto, as noted below:

1. As required for installation of new utility service lines.
2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer Representative. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be

disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer Representative. When Utility lines are encountered that are not indicated on the drawings, the Contracting Officer Representative shall be notified prior to further work in that area.

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

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to 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 15 00**  
**CONCRETE ACCESSORIES**

**PART 1 - GENERAL**

**1.1 REFERENCES**

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

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4                    (1995; R 2004) Basic Hardboard

ASTM INTERNATIONAL (ASTM)

ASTM C920                    (2011) Standard Specification for Elastomeric Joint Sealants

ASTM D1751                    (2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752                    (2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D5249                    (2010) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

**1.2 SUBMITTALS**

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following:

1. Product Data
  - a. Preformed Expansion Joint Filler

**1.3 DELIVERY, STORAGE, AND HANDLING**

A. Protect material delivered and placed in storage off the ground from moisture, dirt, and other contaminants. Deliver sealants in the manufacturer's original unopened containers. Remove sealants from the site whose shelf life has expired.

**PART 2 - PRODUCTS**

**2.1 CONTRACTION JOINT STRIPS**

A. Use 1/8 inch thick tempered hardboard contraction joint strips conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips must

**2.2 PREFORMED EXPANSION JOINT FILLER**

A. Use preformed expansion joint filler material conforming to ASTM D1751 or ASTM D1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D1752. Submit certified manufacturer's test reports for premolded expansion joint filler strips to verify compliance with applicable specification. Unless otherwise indicated, filler material must be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, must conform to ASTM D5249.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Provide joint locations and details, including materials and methods of installation of joint fillers, as specified and indicated. In no case may any fixed metal be continuous through an expansion or contraction joint.
- B. Contraction Joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Make joints 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.
1. Joint Strips: Provide strips of the required dimensions and as long as practicable. After the first floating, groove the concrete with a tool at the joint locations. Insert the strips in the groove and depress them until the top edge of the vertical surface is flush with the surface of the slab. Float and finish the slab as specified. Work the concrete adjacent to the joint the minimum necessary to fill voids and consolidate the concrete. Where indicated, saw out the top portion of the strip after the curing period to form a recess for sealer. Discard the removable section of PVC or HIPS strips and leave the insert in place. Maintain true alignment of the strips during insertion.
  2. Sawed Joints: Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Start cutting as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement. Remove sludge and cutting debris. Form reservoir for joint sealant.
  3. Expansion Joints: Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. Neatly finish the edges of the joint with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, install the filler strips at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove use oil-free compressed air.

### **3.2 CONSTRUCTION JOINTS**

- A. Treat construction joints coinciding with expansion and contraction joints as expansion or contraction joints as applicable.

**-- END OF SECTION --**

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Perform all work in accordance with ACI MCP SET Parts 2 and 3.

**1.2 REFERENCES**

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI MCP SET                      (2012) Manual of Concrete Practice

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C1064/C1064M	(2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1260	(2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C143/C143M	(2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C1567	(2011) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2010b) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C31/C31M	(2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2011) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2012) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2011) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2012) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2011) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D2628	(1991; R 2011) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates
ASTM D98	(2005) Calcium Chloride
ASTM E1155	(1996; R 2008) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E1155M	(1996; R 2008) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers (Metric)
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials

#### U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

### 1.3 SYSTEM DESCRIPTION

A. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced. Provide a minimum of three specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

#### B. Strength

1. Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength,  $f'_c$ , and no individual acceptance test result falls below  $f'_c$  by more than 500 psi.

#### C. Construction Tolerances

1. Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in Part 4 of ACI MCP SET.

#### D. Concrete Mixture Proportions

1. Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. Specified compressive strength  $f'_c$  shall be 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 1-1/2 inch, in accordance with ACI MCP SET Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement ratio is 0.45.

### 1.4 SUBMITTALS

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following:

1. Product Data
  - a. Welded Wire Fabric
2. Design Data
  - a. Concrete Mix Design; G
3. Test Reports
  - a. Field Testing of Concrete
4. Certificates
  - a. Concrete Batch Tickets

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Cementitious Materials



1. Maintain Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:
  - a. Portland Cement
    - 1) ASTM C150/C150M, Type V

#### B. Aggregates

1. Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better. Maintain certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

#### C. Admixtures

1. Admixtures to be used, when required or approved, shall comply with an appropriate specification. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.
  - a. Air-Entraining Admixture
    - 1) Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.
  - b. Water-Reducing or Retarding Admixture
    - 1) Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

#### D. Water

1. Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

#### E. Reinforcing Steel

1. Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A185/A185M. Details of reinforcement not shown shall be in accordance with ACI MCP SET Part 3, Chapters 7 and 12.

#### F. Expansion Joint Filler Strips, Premolded

1. Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D1752, Type I.

#### G. Joint Sealants - Field Molded Sealants

1. Joint sealants - field molded sealants shall conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

#### H. Formwork

1. The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor.

I. Form Coatings

1. Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

## **2.2 READY-MIX CONCRETE**

A. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP SET Part 2. Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C94/C94M.

B. Non-exposed concrete elements

1. 3000 psi minimum compressive strength.

C. Direct-exposed concrete elements (including air-conditioned rooms)

1. 5000 psi minimum compressive strength as determined in 28 calendar days.

D. Slump

1. 1 to 4 inch according to ASTM C143/C143M and ACI MCP SET Part 1.

E. Portland Cement conforming to ASTM C150/C150M, Type 5.

F. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

G. Air-Entraining Admixtures conforming to ASTM C260/C260M. Exterior concrete exposed to freezing needs to be air-entrained 5 to 6 percent by volume.

H. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C494/C494M.

I. Fly Ash used as a supplementary cementitious material shall conform to ASTM C618, Class C or F with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight.

J. Ground granulated blast furnace slag used as a supplementary cementitious material shall conform to ASTM C989/C989M, Grade 120 with between 25 to 50 percent maximum cement replacement by weight.

## **2.3 STEEL REINFORCEMENT**

A. Deformed Steel Bars

1. Provide steel bars conforming to ASTM A615/A615M, Grade 60 ksi ACI MCP SET Parts 2 and 3.

B. FORMS

1. Forms shall be of wood, steel, or other approved material and conform to ACI MCP SET, Parts 2 and 3. Provide form release conforming to ACI MCP SET, Part 4.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

A. Prepare construction joints to expose coarse aggregate. The surface shall be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available.

B. Embedded Items

1. Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

#### C. Formwork Installation

1. Forms shall be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

#### D. Production of Concrete

1. Ready-Mixed Concrete
  - a. Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.
2. Concrete Made by Volumetric Batching and Continuous Mixing
  - a. Concrete made by volumetric batching and continuous mixing shall conform to ASTM C685/C685M.

### 3.2 CONVEYING AND PLACING CONCRETE

A. Concrete placement is not permitted when weather conditions prevent proper placement and consolidation. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours or 45 minutes when the placing temperature is 86 degrees F or greater unless a retarding admixture is used. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented. Submit Methods and equipment for transporting, handling, depositing, and consolidating the concrete prior to the first concrete placement. Perform conveying and placing concrete in conformance with the following:

#### B. Consolidation

1. Consolidate each layer of concrete by rodding, spading, or internal vibrating equipment. External vibrating equipment may be used when authorized. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

#### C. Cold-Weather Requirements

1. No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

#### D. Hot-Weather Requirements

1. When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP SET Part 2, is expected to exceed 0.2 psf per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

#### E. Lifts in Concrete

1. Deposit concrete in horizontal layers not to exceed 24 inches in thickness. Carry on placement at a rate that prevents the formation of cold joints. Place slabs in one lift.

### 3.3 FORM REMOVAL

- A. Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

### 3.4 FINISHING

#### A. Temperature Requirement

1. Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

#### B. Finishing Formed Surfaces

1. Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

#### C. Finishing Unformed Surfaces

1. Float finish all unformed surfaces that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish and 5/16 inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

#### D. Float Finish

1. Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

#### E. Flat Floor Finishes

#### F. Expansion and Contraction Joints

1. Make expansion and contraction joints in accordance with the details shown or as otherwise specified. Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Cut contraction joints at a minimum of 1 inch deep with a jointing tool after the surface has been finished.

### **3.5 CURING AND PROTECTION**

A. Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

1. Continuous sprinkling or ponding.
2. Application of absorptive mats or fabrics kept continuously wet.
3. Application of sand kept continuously wet.
4. Application of impervious sheet material conforming to ASTM C171.
5. Application of membrane-forming curing compound conforming to ASTM C309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

B. Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

### **3.6 TESTS AND INSPECTIONS**

A. Field Testing Technicians

1. The individuals who sample and test concrete, as required in this specification, shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

B. Inspection Details and Frequency of Testing

1. Preparations for Placing
  - a. Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.
2. Air Content
  - a. Check air content at least once during each shift that concrete is placed for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C231/C231M.
3. Slump
  - a. Check slump at least once during each shift that concrete is produced. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C143/C143M.
4. Consolidation and Protection
  - a. Ensure that the concrete is properly consolidated, finished, protected, and cured.

C. Action Required

1. Placing
  - a. Do not permit placing to begin until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified.
2. Air Content

- a. Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.
- 3. Slump
  - a. Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the concrete mixture proportion.

### 3.7 FORM WORK

A. Form work shall conform to ACI MCP SET Parts 2 through 5.

B. Preparation of Form Surfaces

- 1. Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

C. Form Coating

- 1. Coat forms, for exposed surfaces, with a nonstaining form release coating applied shortly before concrete is placed. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

D. Removal of Forms

- 1. Remove forms carefully to prevent damage to the concrete. Do not remove forms before the expiration of the minimum time indicated below:

Arches, beams and deck-type slabs	144 hours
Columns and walls (lifts 15 feet and under)	24 hours
Columns and walls (lifts over 15 feet)	48 hours

### 3.8 STEEL REINFORCING

A. Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

B. Fabrication

- 1. Shop fabricate steel reinforcement in accordance with ACI MCP SET Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP SET Parts 2 and 3.

C. Splicing

- 1. Perform splices in accordance with ACI MCP SET Parts 2 and 3.

D. Supports

- 1. Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

### 3.9 EMBEDDED ITEMS

A. Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

### **3.10 FIELD TESTING**

- A. Provide samples and test concrete for quality control during placement. Sampling of fresh concrete for testing shall be in accordance with ASTM C172/C172M.
- B. Test concrete for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform to ASTM C31/C31M. Perform Compressive strength testing conforming to ASTM C39/C39M.
- C. Test Slump at the site of discharge for each design mix in accordance with ASTM C143/C143M.
- D. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M.
- E. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M.

**-- END OF SECTION --**

## SECTION 22 00 00

### PLUMBING

#### PART 1 - GENERAL

##### 1.1 REFERENCES

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

A. American Society of Sanitary Engineering (ASSE)

ASSE 1013 .....(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)

B. American Water Works Association (AWWA)

AWWA 10084 .....(2005) Standard Methods for the Examination of Water and Wastewater

AWWA B300 .....(2010; Addenda 2011) Hypochlorites

AWWA B301 .....(2010) Liquid Chlorine

AWWA C509 .....(2009) Resilient-Seated Gate Valves for Water Supply Service

AWWA C515 .....(2009) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

AWWA C600 .....(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C651 .....(2005; Errata 2005) Standard for Disinfecting Water Mains

C. ASME International (ASME)

ASME B16.34 .....(2013) Valves - Flanged, Threaded and Welding End

D. ASTM International (ASTM)

ASTM A536 .....(1984; R 2009) Standard Specification for Ductile Iron Castings

E. International Association of Plumbing and Mechanical Officials (IAPMO)

IAPMO UPC .....(2003) Uniform Plumbing Code

F. International Code Council (ICC)

ICC IPC .....(2012) International Plumbing Code

G. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

MSS SP-110 .....(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MSS SP-25 .....(2013) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 .....(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation



- MSS SP-72 .....(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
- MSS SP-78 .....(2011) Cast Iron Plug Valves, Flanged and Threaded Ends
- MSS SP-136 .....(2014) Ductile Iron Swing Check Valves

H. NACE International (NACE)

- NACE SP0169 .....(2013) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

I. National Electrical Manufacturers Association (NEMA)

- NEMA 250.....(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA MG 1 .....(2011; Errata 2012) Motors and Generators
- NEMA MG 11 .....(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

J. Society of Automotive Engineers International (SAE)

- SAE J1508 .....(2009) Hose Clamp Specifications

## 1.2 SUBMITTALS

The following shall be submitted:

A. Product Data

- 1. Product Data for each plumbing fixture (faucet, valve, etc.) to be installed. Product Data shall include installation instructions and performance data.

B. Test Reports

- 1. Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

C. Operation and Maintenance Data

## 1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

A. Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

B. Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### C. Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### D. Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

##### 1. Definitions

For the International Code Council (ICC) 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" shall be interpreted to mean the "Contracting Officer." References to the "permit holder" shall be interpreted to mean the "Contractor."

##### 2. Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Contractor to replace damaged or defective items at no additional cost.

### 1.5 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 – SI (ASHRAE 90.1 - IP)

### 1.6 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

### 1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

## **1.8 ACCESSIBILITY OF EQUIPMENT**

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

## **PART 2 - PRODUCTS**

All products shall conform to the Buy American Act.

### **2.1 PIPE MATERIALS**

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F2389. Grooved pipe couplings and fittings shall be from the same manufacturer. 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/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors.

#### **A. Pipe Joint Materials**

Grooved pipe and hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

1. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310
2. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).
3. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self-centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
4. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 110 degrees C (230 degrees F).
5. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

6. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

**B. Miscellaneous Materials**

Miscellaneous materials shall conform to the following:

1. Hose Clamps: SAE J1508.
2. Hypochlorites: AWWA B300.
3. Liquid Chlorine: AWWA B301.
4. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

**C. Pipe Hangers, Inserts, and Supports**

Pipe hangers, inserts, and supports shall conform to MSS SP-58.

## **2.2 VALVES**

Valves shall be provided on supplies to equipment and fixtures. Valves 80 mm (3 inches) and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Table I – Valve Standards

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Ductile Iron Swing Check Valves	MSS SP-136
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34

Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

## 2.3 BATHTUB & SHOWER FIXTURES

Valve bodies shall be cast brass construction.

### A. Bathtub Spouts

1. Metal bath and shower trim set (FIXTURE CODE "A")
  - a. 2.5 gpm flow rate.
  - b. Metal lever handle.
  - c. Optional 4-7/8" diverter bath spout with NTP or slip-fit connection.
  - d. Manufacturer: Kohler Faucets "Coralais" model K-T15601, or Engineer approved equal.

### B. Shower Head

1. Industrial ball-joint shower head (FIXTURE CODE "B")
  - a. 1.6 gpm flow rate.
  - b. Manufacturer: Kohler Faucets "Mastershower" model K-8510, or Engineer approved equal.
2. Hand shower (FIXTURE CODE "C")
  - a. 2.0 gpm flow rate.
  - b. Check valve to prevent backflow.
  - c. Thumb tab for single-hand operation.
  - d. 3-function/spray patterns.
  - e. 60" long metal shower hose.
  - f. Manufacturer: Kohler Faucets "Awaken B90" model K-7240, or Engineer approved equal.
3. Hand shower wall-mounted slide bar (FIXTURE CODE "D")
  - a. 36" long wall-mounted slide bar with adjustable mounting positions.
  - b. Manufacturer: Kohler Faucets "Awaken" model K-98343, or Engineer approved equal.

### C. Valves & Devices

1. Pressure-Balancing Valve (FIXTURE CODE "AA")
  - a. Brass valve body.
  - b. Thermostatic mixing valve with high temperature limit setting and screwdriver stops.

- c. Pressure-balancing diaphragm.
- d. Manufacturer: Kohler Faucets "Rite-Temp" model K-304-KS, or Engineer approved equal.

## 2.4 LAVATORY FIXTURES

Faucets shall be cast or forged brass construction. Valve bodies shall be cast brass construction. Finish shall be chrome.

### A. Deck-Mounted, 3-Hole

1. Single-lever control, 4" center set (FIXTURE CODE "E")
  - a. 2.2 gpm flow rate.
  - b. Laminar flow aerator.
  - c. 5" integral spout with ADA compliant lever handle.
  - d. Ceramic disc cartridge.
  - e. Eighteen (18)" long 3/8" stainless steel flexible hose with 3/8" female compression fitting.
  - f. Temperature limit stop.
  - g. Grid strainer drain.
  - h. Manufacturer: Zurn "Sierra" model Z7443-XL, or Engineer approved equal.
2. Dual-blade control (FIXTURE CODE "F")
  - a. 1.5 gpm flow rate.
  - b. Quarter (1/4)-turn washerless ceramic disc valve cartridges.
  - c. Vandal-resistant wrist blade handles.
  - d. Vandal resistant non-aerated laminar flow outlet.
  - e. One-half (1/2)" male threaded inlet shanks with brass shank nut and coupling nuts.
  - f. Grid strainer drain.
  - g. Manufacturer: American Standard "Monterrey" model 5502.170 (4" center set), or model 6502.170 (8" center set), as required, or Engineer approved equal.

### B. Backsplash-Mounted, 8" Center Set, 2-Hole

1. Backsplash-mounted (FIXTURE CODE "G")
  - a. 2.2 gpm flow rate.
  - b. S-Type swing spout.
  - c. Rebuildable compression cartridge that opens and closes 90° and closes with water pressure, square tapered stem.
  - d. Three-eighths (3/8)" offset inlet supply arm with 1/2" NPT female thread inlet, and 2-5/16" diameter slip flange.
  - e. Vandal-resistant wrist blade handles.
  - f. Manufacturer: Chicago Faucets "Mechanical Faucets" model 540-LD317ABCP, or Engineer approved equal

### C. Valves & Devices

1. Thermostatic Mixing Valve (FIXTURE CODE "BB")
  - a. Adjustable temperature control cartridge. Adjustable from 95° to 120° F with ± 3.5° F temperature accuracy.
  - b. Paraffin based thermostatic engine.
  - c. One-half (1/2)" FNPT connections with 3/8" compression adapter.
  - d. Vandal-resistant cap.
  - e. Hot and cold check valve to prevent backflow on water supply inlets.
  - f. Cold water supply: 39° to 80°F. Hot water supply: 120° to 180°F.
  - g. 14.8 gpm maximum flow rate.
  - h. Working pressure: 20 psi minimum to 125 psi maximum.
  - i. Stainless steel internal strainer.
  - j. Manufacturer: Moen model 104465, or Engineer approved equal.

2. Anti-Scald Device (FIXTURE CODE "CC")
  - a. 2.1" long screw-in adaptor, fits all U.S. sinks.
  - b. Male/female adaptors.
  - c. Reduces flow to 0.25 gpm in response to outlet temperatures above preset limit (120° F, maximum).
  - d. Automatic or manual reset after actuation.
  - e. Manufacturer: AntiScald Inc. "ScaldShield Products" model 14108, or Engineer approved equal.
3. Laminar Control Device (FIXTURE CODE "DD")
  - a. Vandal-resistant aerator key.
  - b. Female aerator thread.
  - c. Screenless construction.
  - d. Pressure compensating for 2.2 gpm flow rate from 20 to 80 psi.
  - e. Manufacturer: T&S Brass and Bronze Works model B-0199-21-VRF, or Engineer approved equal.

## 2.5 KITCHEN SINK FIXTURES

Faucets shall be cast or forged brass construction. Valve bodies shall be cast brass construction. Finish shall be chrome.

### A. Deck-Mounted, 8" Center Set, 3-Hole

1. Single-lever control (FIXTURE CODE "H")
  - a. Spout: 9" reach minimum, 6-5/8" high minimum, swings 360°.
  - b. All operating parts replaceable from the top.
  - c. One-half (1/2)" – 14 NPSM threaded male inlet adapters.
  - d. Single lever control handle, stainless steel ball type with replaceable non-metallic seats. Control handle shall return to neutral position when valve is off.
  - e. Optional spray attachment shall have anti-siphon device as integral part of valve body (4-hole).
  - f. Manufacturer: Delta model B4410LF, or Engineer approved equal.
2. Dual-blade control with optional sprayer (FIXTURE CODE "I")
  - a. 1.5 gpm Vandal-resistant non-aerated laminar flow outlet.
  - b. Quarter (1/4)-turn ceramic disc valve cartridges.
  - c. One-half (1/2)" male threaded inlet shanks with brass shank nuts and couplings.
  - d. Vandal-resistant wrist blade handles with color indexes.
  - e. 8" reach tubular brass swivel spout, 5" height to outlet.
  - f. Manufacturer: American Standard "Monterrey" model 6408.171, or Engineer approved equal.

## 2.6 GOOSENECK FAUCETS

Faucets shall be cast or forged brass construction. Valve bodies shall be cast brass construction. Finish shall be chrome.

### A. Deck-Mounted, 3-Hole

1. Wrist blade control (FIXTURE CODE "J")
  - a. 1.5 gpm flow rate.
  - b. Swivel spout, 3-5/8" reach, 6" height to outlet, with spout swing restriction pin.
  - c. Quarter (1/4)-turn ceramic disc valve cartridges.
  - d. Wrist blade handles.
  - e. Manufacturer: Elkay model LK406GN04T6 (4" center set), model LK810GN05T6 (8" center set), as required, or Engineer approved equal.

## B. Deck-Mounted, Single Hole

1. Side lever handles (FIXTURE CODE "K")
  - a. 1.5 gpm flow rate.
  - b. Swivel spout, 8" reach, 9.25" height to outlet, with spout swing restriction pin.
  - c. Quarter (1/4)-turn ceramic disc valve cartridges.
  - d. Wrist blade handles.
  - e. Manufacturer: Elkay model LK500GN08T6, or Engineer approved equal.
2. Foot pedal control (FIXTURE CODE "L")
  - a. 1.5 gpm vandal-resistant laminar control outlet.
  - b. Swivel spout, 4.5" reach, 6.5" to 7" height to outlet.
  - c. Double wall-mounted foot pedal valve, 14.5" to 15.375" from wall, 2" from floor at off position.
  - d. Manufacturer: Delta "Teck Commercial" model 54T5432A, or Engineer approved equal.

## 2.7 UTILITY FAUCETS

### A. Valves & Devices

1. Anti-Scald Device (FIXTURE CODE "EE")
  - a. 4 gpm flow rate at 40 psi.
  - b. Approximately 2" long screw-in adaptor, fits 1/2" threaded outlet.
  - c. Reduces flow to 0.25 gpm in response to outlet temperatures above preset limit (120° F, maximum).
  - d. Device will reset within 20-60 seconds of lowering water temperature.
  - e. Contractor shall supply male/female adaptors to connect device to faucet and to provide 3/4" threaded outlet for hose connection.
  - f. Manufacturer: AntiScald Inc. "ScaldShield Products" model 14110, or Engineer approved equal.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 900 mm (36 inches) below the finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

#### A. Water Pipe, Fittings, and Connections

##### 1. Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

##### 2. Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.



### 3. Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings.

### 4. Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m (50 feet) in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

## B. Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

### 1. Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm (2-1/2 inches) and smaller; flanges shall be used on pipe sizes 80 mm (3 inches) and larger.

### 2. Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

### 3. Other Joint Methods

## C. Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal

connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

#### D. Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

#### E. Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

##### 1. Sleeve and Casing Spacer Requirements:

- a. Unless indicated otherwise, provide pipe sleeves meeting the following requirements:
- b. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors, as indicated on drawings.
- c. A casing spacer shall be installed in the annular space between pipe and sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Fill annular space between steel sleeve and casing spacer with 2-Hour rated fire insulating foam.
- d. Except as otherwise specified, the annular space between wall and sleeve shall be sealed as indicated with structural non-shrink grout.

#### F. Supports

##### 1. General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided.

##### 2. Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-58 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
  - 1) Be used on insulated pipe less than 100 mm (4 inches).
  - 2) Be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or less.
  - 3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter (8 pcf) or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-58 and a support shall be installed not over 300 mm (1 foot) from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m (5 feet) apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C (120 degrees F) for PVC and 82 degrees C (180 degrees F) for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m (15 feet) nor more than 2 m (8 feet) from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
  - 1) On pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
  - 2) On pipe less than 100 mm (4 inches) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

- 3) On pipe 100 mm (4 inches) and larger carrying medium less than 15 degrees C (60 degrees F) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

### 3. Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

## 3.2 FIXTURES AND FIXTURE TRIMMINGS

### A. Faucets, Bathtub Spouts, Shower Heads and Trim

All existing faucets, bathtub spouts, shower heads and fixture trim shall be removed and disposed of by Contractor. Faucets, bathtub spouts, shower heads and fixture trim shall be installed per manufacturer's instructions and in the locations as indicated on the plans. Walls, countertops and all affected surfaces shall be patched and repaired to match existing adjacent finishes.

## 3.3 IDENTIFICATION SYSTEMS

### A. Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves at well house. Tags shall be 35 mm (1-3/8 inch) minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

## 3.4 TESTS, FLUSHING AND DISINFECTION

### A. Plumbing System

The water supply system tests shall be performed on the plumbing system in accordance with IAPMO UPC, AWWA C651-05 and AWWA C652-11.

### B. Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

### C. Disinfection Procedures When Cutting Into or Repairing Existing Mains

1. The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to the completion of bacteriological testing in order to minimize the time customers are without water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor.
  - a. *Swabbing with hypochlorite solution.* The interior of pipe and fittings (particularly couplings and sleeves) shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed.

- b. *Flushing.* Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second (4 fps) through all portions of the piping system. In the event that this is impossible due to size of system, the COR shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. In addition, the section of pipe installation or repair shall be isolated, all service connections shut off, and the section shall be flushed and chlorinated utilizing the slug method. This method consists of placing calcium hypochlorite granules in the main during construction; completely filling the main to eliminate air pockets; flushing the main to remove particulates; and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 300 mg/L for a period of not less than 15 minutes.
  - c. *Sampling Procedure.* After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate, as required by *Standard Methods for the Examination of Water and Wastewater*. The sampling pipe must be clean and disinfected and flushed prior to sampling.
  - d. *Bacteriological samples.* Bacteriological samples shall be taken after installations and repairs are completed to provide a record for determining the procedure's effectiveness.
  - e. *Tapping sleeves.* Before a tapping sleeve is installed, the exterior of the pipe to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.
2. *Re-disinfection.* If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main may be re-flushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be re-chlorinated by the continuous-feed or slug method until satisfactory results are obtained—that being two consecutive sets of acceptable samples taken 24 hours apart.

#### D. Operational Test

When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 – SI (ASHRAE 90.1 - IP) for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

### 3.5 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

### 3.6 PIPE AND FITTING MATERIALS

Table II – Pipe and Fittings Standards

**SERVICE:**

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- \* - Hard Temper

**PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS**

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				
	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X

11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X
15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F441/F441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F442/F442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F439 for use with Items 20, 21, and 22	X	X		X
25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X

26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F877	X	X		X
38	Press Fittings: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 82 degrees C (180 degrees F) Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Below Ground Indicated types are minimum wall thicknesses. ** Type L - Hard *** Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** In or under slab floors only brazed joints				

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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.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 03 30 00, CAST-IN-PLACE CONCRETE: CONCRETE AND GROUT.
- D. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL

**1.3 QUALITY ASSURANCE**

- A. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 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 three years.
  - 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, 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 Officer's 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.
- 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 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 Contracting Officer's Representative 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 drawings and specifications shall be referred to the COR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the COR at least two weeks prior to commencing installation of any item.
  2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code.

#### **1.4 SUBMITTALS**

- A. Submittals 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.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- 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. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. 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. Fire stopping materials.
  - 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 5. Wall, floor, and ceiling plates.
- H. 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 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, 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 until 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.
- I. 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.
  - 2. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
  - 3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

## **1.5 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 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.
- B. 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), latest edition. 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.

## 1.6 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):

Boiler and Pressure Vessel Code (BPVC):

SEC IX-2007 ..... Boiler and Pressure Vessel Code; Section IX, Welding and  
Brazing Qualifications.

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

A36/A36M-2008 ..... Standard Specification for Carbon Structural Steel

A575-96 (R 2007)..... Standard Specification for Steel Bars, Carbon, Merchant Quality,  
M-Grades R (2002)

E84-2005..... Standard Test Method for Surface Burning Characteristics of  
Building Materials

E119-2008a..... Standard Test Methods for Fire Tests of Building Construction  
and Materials

- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-02 ..... Pipe Hangers and Supports-Materials, Design and Manufacture

SP 69-2003 (R 2004) ..... Pipe Hangers and Supports-Selection and Application

- E. National Electrical Manufacturers Association (NEMA):

MG1-2003, Rev. 1-2007..... Motors and Generators

- F. International Code Council, (ICC):

IBC-06, (R 2007) ..... International Building Code

IPC-06, (R 2007) ..... International Plumbing Code

## PART 2 - PRODUCTS

### 2.1 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.
  - 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.
- 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

## **2.2 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.

## **2.3 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 6 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.

## **2.4 LIFTING ATTACHMENTS**

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.

## **2.5 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals.
- B. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. 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.
- C. B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- D. C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

- E. D. 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.
- F. 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 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage, 38 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 216 mm (8-1/2 inches) by 280 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. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
  - 4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

## **2.6 FIRE STOPPING**

- A. Provide an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

## **2.7 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint.

## **2.8 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), latest edition. Submittals based on the International Building Code (IBC), latest edition, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Contracting Officer's Representative in all cases. See these specifications for lateral force design requirements.
- B. Type Numbers Specified: MSS SP-58.
- 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 102 mm (4 inches) thick when approved by the Contracting Officer's Representative for each job condition.
  - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the Contracting Officer's Representative 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. Attachment to Metal Pan or Deck: As required for materials and in accordance with manufacturer's recommendations.

- F. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A36 or 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 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 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. Trapeze hangers are not permitted for steam supply and condensate piping.
  - 1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
  - 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.
- I. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. 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, plastic coated or taped with isolation tape to prevent electrolysis.
      - 2) For vertical runs use epoxy painted 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.
    - j. Spring hangers are required on all plumbing system pumps one horsepower and greater.
  - 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.
- J. Pre-insulated Calcium Silicate Shields:
  - 1. Provide 360 degree water resistant high density 965 kPa (140 psi) 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 one 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 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

## **2.9 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 fire stopping 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. Any deviation from these requirements must receive prior approval of Contracting Officer's Representative.
- 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.
- 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 fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

## **2.10 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Contracting Officer's Representative, 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 Contracting Officer's Representative.
- 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.

## **2.11 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.
- 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 80 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.

## **2.12 ASBESTOS**

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. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.
- B. 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 and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, 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.
- C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
  - 1. 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.
  - 2. 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.
  - 3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service 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 Contracting Officer's Representative. Damaged or defective items in the opinion of the Contracting Officer's Representative, shall be replaced.
  - 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. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE shall be used for all pad or floor mounted equipment. 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.
- 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, 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 electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- 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 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.

### **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 Para. 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. 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.

### **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 Contracting Officer's Representative.

- 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), latest edition, 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.
  - 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 0.5 kg (one 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 accordance with recognized fire protection standards. 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. 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.

### 3.7 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.
- B. 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.
    - 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 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 color as utilized by the pump manufacturer.
- 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
- 6. 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.

### **3.8 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 5 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, performance 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.

### **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 Contracting Officer's Representative.
- 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 system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests such systems respectively during first actual seasonal use of respective systems following completion of work.

### **3.11 OPERATION AND MAINTENANCE MANUALS**

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to COR not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. 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.

- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.
- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

### **3.12 INSTRUCTIONS TO VA PERSONNEL**

Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 22 05 20**  
**CHEMICAL MONITORING OF WATER SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirements for water quality and pressure monitoring.

**1.2 RELATED WORK**

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Chlorine Analyzer.
  2. Water Quality Monitor.
  3. Pressure Gages.
  4. BACnet communication protocol
  5. Product certificates for each type of water quality monitor and gauge
- C. Operations and Maintenance manual shall include:
1. System Description
  2. Major assembly block diagrams
  3. Troubleshooting and preventive maintenance guidelines
  4. Spare parts information.
- D. Shop Drawings shall include the following:
1. One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

**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. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

B40.1-05 ..... Gauges-Pressure Indicating Dial Type-Elastic

- C. American Water Works Association (AWWA):

AWWA C670-09..... Online Chlorine Analyzer Operation and Maintenance

C700-07 (R 2003) ..... Standard for Cold Water Meters, Displacement Type, Bronze  
Main Case

C701-07 ..... Cold Water Meters-Turbine Type, for Customer Service AWWA/  
ANSI

C702-01 ..... Cold water meters – Compound Type

D. International Code Council (ICC):

IPC-06..... (2007 Supplement) International Plumbing Code

## 1.5 AS-BUILT DOCUMENTATION

- A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended."
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of 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 CHEMICAL MONITORING

- A. Free Chlorine Process Analyzer
  - 1. The analyzer must be housed in a NEMA 4 or NEMA 12 enclosure rated for wall or panel mounting.
  - 2. Measurements must be continuously monitored, with results displayed in the range of 0 to 5 mg/L.
  - 3. The analyzer must operate using 115V or 230V selectable AC power.
  - 4. The analyzer must perform a self-test and auto-blanking between analysis points to compensate for sample color, turbidity, and changes in light intensity due to voltage fluctuations or light source aging.
  - 5. The analyzer must be able to operate unattended for 30 days between chemical reagent changes and measurement cell cleaning.
  - 6. The analyzer has two feed control (relay) operation modes to operate chemical feed pumps. Available control options are:
    - a. On/off control where the concentration alarm outputs activate or deactivate a pump when chlorine levels fall below or exceed acceptable levels.
    - b. Proportional control where the 4-20mA output current is scaled to pace a feed pump proportional to output.
  - 7. The analyzer has standard optically isolated analog outputs, selectable as 0/4 to 20mA, field programmable over any portion of the analyzer range.
  - 8. The analyzer has two standard SPDT relay alarms, with contacts rated for 5 amp resistive loads at 230V AC power. Alarm options include concentration set point, analyzer system warning, and analyzer system shut down.
  - 9. Manufacturer:

- a. Hach CL17 Colorimetric Chlorine Analyzer
  - b. Engineer Approved equal.
- B. Universal Controller
  - 1. Use a menu-driven operating system.
  - 2. Equipped with a data logger with RS-232 compatibility.
  - 3. Equipped with an SD card reader for data download and controller software upload.
  - 4. Equipped with sufficient amount of 4-20 mA outputs for monitoring connections.
  - 5. Manufacturer:
    - a. Hach sc200
    - b. Engineer Approved equal
- C. pH Sensor
  - 1. Sensor to continuously measure pH in aqueous solution.
  - 2. Must be able to communicate with digital controller.
  - 3. Performance requirements:
    - a. Measurement range: 0 to 14 pH
    - b. Sensitivity: 0.01 pH
    - c. Stability: 0.03 pH per 24 hours, non-cumulative
  - 4. Operating criteria:
    - a. Temperature range (min): 23°F to 158°F
    - b. Sample flow rate: 10 feet per second (max)
    - c. Pressure: 100 psi at 158°F
    - d. Transmission distance: 1,000 ft
  - 5. Manufacturer:
    - a. Hach model pHD-SC pH Sensor
    - b. Engineer Approved equal.
- D. Dissolved Solids Sensor
  - 1. Sensor that continuously measures conductivity and/or resistivity in aqueous solutions.
  - 2. Must be able to communicate with digital controller.
  - 3. Performance requirements:
    - a. Measurement range: 0.057 to 200,000  $\mu\text{S}/\text{cm}$
    - b. Accuracy:  $\pm 0.01\%$  of reading, all ranges
  - 4. Operational criteria:
    - a. Sample flow rate: 10 feet per second, maximum, fully immersed
    - b. Operating temperature: dependent on probe selection
    - c. Insertion depth: 4 inches
  - 5. Manufacturer:
    - a. Hach 3400-SC Contacting Conductivity Sensor
    - b. Engineer Approved equal
- E. Pressure Transducer
  - 1. Measurements must be continuously monitored, with results displayed in psi.
  - 2. Measure pressures up to 400 psi
  - 3. Burst pressure: 5x rated pressure or 45,000 psi, whichever is less
  - 4. Must display temperature at source location
  - 5. Must be able to communicate with SCADA system
  - 6. Manufacturers:
    - a. American Sensor Technologies model AST46DS
    - b. Engineer Approved equal
- F. Temperature Monitoring
  - 1. Measurements must be continuously monitored, with results displayed in Fahrenheit.
  - 2. Operating temperature: 20°F to 140°F
  - 3. Must be able to communicate with SCADA system
  - 4. Manufacturers:

- a. Monnit Industrial Water Temperature Sensor with Monnit Serial MODBUS Gateway
  - b. Engineer Approved equal
- G. Temperature Gauge
  - 1. Temperature range measurements of at least 30°F minimum to 180°F maximum.
  - 2. Accuracy to be within 1% of actual temperature.
  - 3. Conform to ASSE 1061/NSF61.
- H. Data Logger
  - 1. Must be compatible with Free Chlorine Process Analyzer.
  - 2. PC Hardware shall be capable of storing a minimum of 30 days of data.
  - 3. The system shall include a backup drive to ensure data is not lost if a malfunction occurs.
  - 4. The data shall be exportable to a .csv file and downloadable onto a flash drive or DVD for data transfer.
  - 5. Manufacturers:
    - a. HOBO model UX120 and U-Shuttle (U-DT-x)
    - b. Engineer Approved equal

## **2.2 MONITORING COMMUNICATION PROTOCOL**

- A. The monitoring system shall use a native BACnet Ethernet communication protocol supporting HTTP. The communications shall be protected against surges induced on its communications channels.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Free Chlorine Process Analyzer
  - 1. Contractor will install the analyzer in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.
  - 2. The waste drain line shall be installed with International Plumbing Code and Pennsylvania Code compliant backflow prevention.
- B. Universal Controller
  - 1. Contractor will install the controller in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.
- C. pH Sensor
  - 1. Contractor will install the sensor in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.
  - 2. The sensor must be mounted to an acceptable mounting assembly directly in the solution to be measured.
  - 3. Mount sensor vertically with electrode pointing down. A minimum of 15 degrees above horizontal is allowed.
- D. Dissolved Solids Sensor
  - 1. Contractor will install the sensor in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.
  - 2. The sensor must be mounted to an acceptable mounting assembly directly in the solution to be measured.
- E. Pressure Transducer
  - 1. Contractor will install the transducer in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.
- F. Temperature Monitoring
  - 1. Contractor will install the monitor in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.

- G. Temperature Gauge
  - 1. Direct mounted temperature gauges shall be installed in piping tees with pressure gauge located on pipe at the most readable position.
- H. Data Logger
  - 1. Contractor will install the data logger in strict accordance with the manufacturer's instructions and recommendations, and the contract documents.

### **3.2 FIELD QUALITY CONTROL**

- A. The monitoring and sensor assemblies shall be visually inspected and operationally tested.

### **3.3 TRAINING**

- A. A training course shall be provided to the medical center on monitor and sensor configuration and maintenance. Training manuals shall be supplied for all attendee with four additional copies supplied. The training course shall cover monitor and sensor configuration, troubleshooting, and diagnostic procedures.

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## **SECTION 260010**

### **GENERAL ELECTRICAL REQUIREMENTS**

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

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and to all following sections within Division 26.

##### **1.2 SUMMARY**

- A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.
- B. Division 26 of these Specifications, and Drawings numbered with prefixes E generally describe these systems, but the scope of the electrical Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.
- C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets and circuits without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

##### **1.3 QUALITY ASSURANCE**

- A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the Work specified.
- B. Install all Work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.
- C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.
- D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

##### **1.4 CODES, REFERENCES AND STANDARDS**

- A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between



various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Architect's and Engineer's attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

- B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.
- C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.
- D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:

BOCA	Building Officials Code Administration
CBC	California Building Code
FBC	Florida Building Code
IBC	International Building Code
NBC	National Building Code
SBC	Standard Southern Building Code
UBC	Uniform Building Code
ADA	Americans with Disabilities Act
Delete the "AIA" line below if Project is not medical related	
[AIA	Guidelines for Design and Construction of Hospital and Healthcare
Facilities]	
AEIC	Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CSA/USA	Canadian Standards Association/USA
ICEA	Insulated Conductors Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code, NFPA 70
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers' Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
UL	Underwriter's Laboratories

- E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.
- F. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the electrical work shall be provided by the Contractor.
- G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

## 1.5 DEFINITIONS

- A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:
1. Furnish: "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
  2. Install: "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
  3. Provide: "To furnish and install complete, and ready for the intended use."
  4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division."
  5. Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the "Architect".
  6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
  7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
- C. Manufacturers: The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- D. The following definitions apply to excavation operations:
1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
  2. Sub-base: as used in this Section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.
  3. Sub-grade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
  4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Architect.

## 1.6 COORDINATION

- A. Coordinate with other Divisions for electrical work included in them but not listed in Division 26 or indicated on electrical Drawings.
- B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

- C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.
- D. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes actually installed.
- E. Maintain an electrical foreman on the jobsite at all times to coordinate this Work with other trades so that various components of the electrical systems is installed at the proper time, fits the available space, and allows proper service access to all equipment. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.
- F. Work of this Division shall progress according to the "Construction Schedule" as described in Division 01 and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.

### **1.7 MEASUREMENTS AND LAYOUTS**

- A. The Drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

### **1.8 SUBMITTALS**

- A. Refer to Division 01 and General Conditions for submittal requirements.
- B. Submittals and shop drawings shall not contain HEI's firm name or logo, nor shall it contain the HEI's engineers' seal and signature. They shall not be copies of HEI's work product. If the contractor desires to use elements of such product, the license agreement for transfer of information at the end of this section must be used.
- C. Assemble and submit for review, manufacturers product literature for material and equipment to be furnished, installed, or both, under this Division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this Division. Provide the number of submittals required by Division 01; however, at a minimum, submit seven (7) sets.
- D. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed.
- E. Refer to individual Sections for additional submittal requirements.
- F. Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.
- G. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- H. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:
  - 1. The project name.
  - 2. The applicable Specification Section and paragraph.
  - 3. The submittal date.

4. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
- I. Refer to Division 1 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representatives. Contractor shall allow the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- J. The Engineer's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Engineer's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve him from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

#### **1.9 ELECTRONIC DRAWING FILES**

- A. In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of \$200 for a drawing set up to 12 sheets and \$15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall complete and send the form attached at the end of this section along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

#### **1.10 SUBSTITUTIONS**

- A. Refer to Bid documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions.
- B. Materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.
- C. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's or Engineer's decision to approve or disapprove a substitution in a Bid is final.
- D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.
- E. No substitutions will be considered after receipt of Bids and before award of the Contract.
- F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

#### **1.11 OPERATION AND MAINTENANCE DATA**

- A. Refer to Division 01 and General Conditions for Operation and Maintenance Data.
- B. Submit data prior to requesting the final punch list and before all requests for Substantial Completion.

- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Prior to Substantial Completion of the project, furnish to the Architect, for Engineer's review, and for the Owner's use, four (4) copies of brochures in three-ring, loose-leaf, hard-back notebook form, divided and tabbed, containing equipment data, approved submittals, shop drawings, diagrams, capacities, spare part numbers, manufacturer's service and maintenance data, warranties, guarantees, etc. Include local contacts complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

#### **1.12 RECORD DRAWINGS**

- A. Keep a set of jobsite work prints of the Issued for Construction Drawings on the jobsite during construction, for the purpose of annotating changes. During the course of construction, indicate on these Documents, changes made from the Conformed Contract Documents. Pay particular attention to those items that require locating for servicing.
- B. Refer to Division 01 and General Conditions for Record Drawings
- C. At the completion of the project, obtain reproducible vellum copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these vellums. These changes shall be done by a skilled drafter. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect.

#### **1.13 DELIVERY, STORAGE AND HANDLING**

- A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling.
- B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Engineer.
- D. Be responsible for the safe storage of tools, material and equipment.

#### **1.14 WARRANTIES**

- A. Refer to Division 01 and General Conditions for Warranties.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.
- D. Also warrant the following additional items:
  - 1. All raceways are free from obstructions, holes, crushing, or breaks of any nature.
  - 2. All raceway seals are effective.
  - 3. The entire electrical system is free from all short circuits and unwanted open circuits and grounds.
- E. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.

- F. Perform the remedial work promptly, upon written notice from the Architect or Owner.
- G. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

#### **1.15 TEMPORARY FACILITIES**

- A. Refer to Division 01 and General Conditions for Temporary Facilities requirements.
- B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
- C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.
  - 1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
  - 2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

#### **1.16 PROJECT CONDITIONS**

- A. Conditions Affecting Work In Existing Buildings: The following project conditions apply:
  - 1. The Drawings describe the general nature of remodeling to the existing building; however, visit the Site prior to submitting bid to determine the nature and extent of work involved.
  - 2. Schedule Work in the existing building with the Owner.
  - 3. Perform certain demolition work prior to the remodeling. Perform the demolition that involves electrical systems, Light fixtures, equipment, raceways, equipment supports or foundations and materials.
  - 4. Remove articles that are not required for the new Work. Unless otherwise indicated, remove each item removed during this demolition from the premises and dispose in accordance with applicable federal, state and local regulations.
  - 5. Relocate and reconnect electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where electrical equipment or materials are removed, cap unused raceways below the floor line or behind the wall line to facilitate restoration of finish.
  - 6. Finish material will be installed under other Divisions.
  - 7. Obtain permission from the Architect for channeling of floors or walls not specifically noted on the Drawings.
  - 8. Protect adjacent materials indicated to remain. For Work specific to this Division, install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 9. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, provide temporary services for affected areas.
- B. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not

intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

- C. Use of explosives is not permitted.
- D. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

## **PART 2 - EXECUTION**

### **2.1 PERMITS**

- A. Secure and pay for all permits required in connection with the installation of the Electrical Work. Arrange with the various utility companies for the installation and connection of all required utilities for this facility and pay all charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others.

### **2.2 TEMPORARY ELECTRICAL SERVICE AND WIRING**

- A. Provide 208Y/120 volt, three-phase, four-wire, temporary electrical service and temporary lighting system to facilitate construction.
- B. In existing facilities, with Owner's approval, Contractor may utilize the existing electrical system as the source of temporary power. Coordinate the point of connection and method of connection to the existing system with the Owner's Representative.
- C. Work for the temporary power shall consist of all labor and materials, including, but not limited to conduit, wiring, panelboards, fuse blocks, fused disconnecting switches, fuses, pigtails, receptacles, wood panel switch supports, and other miscellaneous materials required to complete the power system.
- D. Install all temporary wiring in accordance with applicable codes, and maintain in an OSHA-approved manner.
- E. When the permanent wiring for lighting and power is installed, with approval of the Architect and Owner, the permanent system may be used, provided the Contractor assumes full responsibility for all electrical material, equipment, and devices contained in the systems and provided that roof drainage system and roofing are complete.
- F. When directed by the Architect, remove all temporary services, lighting, wiring and devices from the property.

### **2.3 SELECTIVE DEMOLITION**

- A. Refer to Division 01, Division 02, and General Conditions for Selective Demolition requirements.
- B. General: Demolish, remove, demount, and disconnect abandoned electrical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- C. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- D. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- E. Electrical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
  - 1. Inactive and obsolete raceways, fittings, supports and specialties, equipment, wiring, controls, fixtures, and insulation:
    - a. Raceways and outlets embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Cut embedded raceways to below finished surfaces, seal, and refinish surfaces as specified or as indicated on the Architectural finish Drawings. Remove materials above accessible ceilings. Cap raceways allowed to remain.
    - b. Perform cutting and patching required for demolition in accordance with Division 01, General Conditions and "Cutting and Patching" portion of this Section in Division 26.

## 2.4 EXISTING CONDITIONS

- A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and, they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new Work.
- B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

## 2.5 EXCAVATION AND BACKFILLING

- A. Refer to Division 01, Division 02 and General Conditions for Excavation and Backfilling.
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this Division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.
- C. Restore roads, alleys, streets and sidewalks damaged during this Work to the satisfaction of Authorities Having Jurisdiction.
- D. Do not excavate trenches close to walks or columns without prior consultation with the Architect.
- E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep them burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.
- F. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
  - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.
- I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
  - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
  - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
  - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- K. Excavation for Underground Tanks and Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
  - 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of one inch in diameter and larger with emulsified asphalt tree paint.
  - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- L. Trenching: Excavate trenches for electrical installations as follows:
  - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.



2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
  3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
  4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.
  5. Excavate trenches for raceway and cables and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.
- M. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- N. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
  2. Under building slabs, use drainage fill materials.
  3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
  4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
  5. Other areas use excavated or borrowed materials.
- O. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
  2. Removal of concrete formwork.
  3. Removal of shoring and bracing, and backfilling of voids.
  4. Removal of trash and debris.
- P. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less than 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.
- Q. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- R. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- S. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

- a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
  - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
  - c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
- 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- T. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

## **2.6 WORK IN EXISTING FACILITIES**

- A. The Drawings describe the general nature of remodeling to the existing facilities; however, visit the Site prior to submitting a Bid, to determine the nature and extent of Work involved.
- B. Schedule Work in the existing facility with the Owner.
- C. Certain demolition work shall be performed prior to the remodeling. Perform the demolition that involves electrical systems, fixtures, conduit, wiring, equipment, equipment supports or foundations and materials.
- D. Remove all of these articles that are not required for the new Work. Unless otherwise indicated, each item removed during this demolition shall be removed from the premises and disposed of in accordance with all state and local regulations.
- E. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify **Owner** days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Architect's/Owner's written permission.
- F. Relocate and reconnect all electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where electrical fixtures or equipment are removed, cap all unused raceways behind the floor line or wall line to facilitate restoration of finish, and, remove all existing wiring from abandoned raceways.
- G. Finish materials are specified in other Divisions.
- H. Where removal of existing wiring interrupts electrical continuity of circuits that are to remain in use, provide necessary wiring, raceways, junction boxes, etc., to ensure continued electrical continuity.
- I. Channel walls and floors as required to produce the desired result; however, obtain permission from the Architect or Owner for all channeling not specifically noted on the Drawings.

## **2.7 ACCESS TO EQUIPMENT**

- A. Locate all pull boxes, junction boxes and controls so as to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings. Refer to Division 26 Section "Common Work Results for Electrical".
- B. Maintain all code required clearances and clearances required by manufacturers.

## **2.8 PENETRATIONS**

- A. Unless otherwise noted as being provided under other Divisions, provide sleeves, box frames, or both, for openings in floors, walls, partitions and ceilings for all electrical work that passes through construction. Refer to Division 26 Section "Common Work Results for Electrical".
- B. Provide sleeves, box frames, or both, for all conduit, cable, and busways that pass through masonry, concrete or block walls.
- C. The cutting of new and/or existing construction will not be permitted except by written approval of the Architect.

## **2.9 CUTTING AND PATCHING**

- A. Provide all necessary cutting of walls, floors, ceilings and roofs for work under this Division.
- B. Cut no structural member without permission from Architect.
- C. Patch around all openings to match adjacent construction.
- D. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

## **2.10 SEISMIC REQUIREMENTS: THE PROJECT IS LOCATED IN SEISMIC ZONE 2B AS DEFINED IN IBC.**

## **2.11 CLEANING**

- A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.
- B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises broom clean. Clean all material and equipment installed under this Division.
- C. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.
- D. Touch up and restore damaged finishes to their original condition.

## **2.12 ADJUSTING, ALIGNING AND TESTING**

- A. Adjust, align and test all electrical equipment furnished and/or installed under this Division.
- B. Check motors for alignment with drive and proper rotation, and adjust as required.
- C. Check and test protective devices for specified and required application, and adjust as required.
- D. Check, test and adjust adjustable parts of all light fixtures and electrical equipment as required to produce the intended performance.
- E. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.
- F. After completion, perform tests for continuity, unwanted grounds, and insulation resistance in accordance with the requirements of NFPA 70 and NETA.
- G. Be responsible for the operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Owner of the complete project under this Contract. Maintain all electrical equipment in the best operating condition including proper lubrication.
- H. Notify the Architect immediately of all operational failures caused by defective material, labor or both.
- I. Maintain service and equipment for all testing of electrical equipment and systems until all Work is approved and accepted by the Owner.
- J. Keep a calibrated voltmeter and ammeter (true RMS type) available at all times. Provide service for test readings when and as required.
- K. Refer to individual Sections for additional and specific requirements.

## **2.13 START-UP OF SYSTEMS**

- A. Prior to start-up of electrical systems, check all components and devices, lubricate items appropriately, and tighten all screwed and bolted connections to manufacturers' recommended torque values using appropriate torque tools.

- B. Each power, lighting and control circuit shall be energized, tested and proved free of breaks, short-circuits and unwanted grounds.
- C. Adjust taps on each transformer for rated secondary voltages.
- D. Balance all single phase loads at each panelboard, redistributing branch circuit connections until balance is achieved to plus or minus 10 percent.
- E. Replace all burned-out lamps. Replace the lamps of all light fixtures that use incandescent, halogen or quartz lamp sources that are installed as part of the finished building, but are used by the Contractor during construction, with new lamps of appropriate type and wattage prior to turning the facility over to the Owner or Tenant.
- F. After all systems have been inspected and adjusted, confirm all operating features required by the Drawings and Specifications and make final adjustments as necessary.
- G. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.
- H. At the time of final review and tests of the power and lighting systems, all equipment and system components shall be in place and all connections at panelboards, switches, circuit breakers, and the like, shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connections to all switches, receptacles, outlets, and the like.

## **2.14 TEST REPORTS**

- A. Perform tests as required by these Specifications and submit the results in the operations and maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each electrical system installed. Notify the Architect and Engineer two working days prior to each test.
- B. For specific testing requirements of special systems, refer to the Specification section that describes that system.
- C. Upon completing each test, record the results, date and time of each test and the conditions under which the test was conducted. Submit to the Architect, for Engineer's review, in duplicate, the test results for the following electrical items:
  - 1. Building service entrance voltage and amperes at each phase.
  - 2. Electrical service grounding conditions and grounding resistance.
  - 3. Proper phasing throughout the entire system.
  - 4. Voltages (phase-to-phase and phase-to-neutral) and amperes at each phase for each panelboard, switchboard, and the like.
  - 5. Phase voltages and amperes at each three-phase motor.
  - 6. Test all wiring devices for electrical continuity and proper polarity of connections.
- D. Promptly correct all failures or deficiencies revealed by these tests as determined by the Engineer.

## **2.15 SUBSTANTIAL COMPLETION REVIEW**

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:
  - 1. Submit complete Operation and Maintenance Data.
  - 2. Submit complete Record Drawings.
  - 3. Perform all required training of Owner's personnel.
  - 4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
  - 5. Perform start-up tests of all systems.
  - 6. Remove all temporary facilities from the site.
  - 7. Comply with all requirements for Substantial Completion in the Division 01 and General Conditions.
- B. Request in writing a review for Substantial Completion. Give the Architect at least seven (7) days notice prior to the review.

- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, he shall reimburse the Architect and Engineer for time and expenses incurred for the visit.
- F. Upon completion of the review, the Architect and Engineer will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

**END OF SECTION 260010**

## SECTION 260500

### COMMON WORK RESULTS FOR ELECTRICAL

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

##### **1.1 SUMMARY**

- A. This Section includes limited scope general construction materials and methods, electrical equipment coordination, and common electrical installation requirements as follows:
  - 1. Access doors in walls, ceilings, and floors for access to electrical materials and equipment.
  - 2. Electrical equipment nameplate data.
  - 3. Sleeves and seals for electrical penetrations.
  - 4. Joint sealers for sealing around electrical materials and equipment, and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
  - 5. Sealing penetrations through noise critical spaces.

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 07 Section "Penetration Firestopping" for fire stopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
- B. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- C. Division 26 Section "Equipment Wiring Systems" for electrical connections to equipment specified under other Sections, Divisions, or furnished by the Owner.

##### **1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements":
  - 1. Product data for the following products:
    - a. Sleeve seals.
    - b. Through and membrane penetration firestopping systems.
    - c. Joint Sealers
    - d. Acoustical sealers
  - 2. Shop drawings for:
    - a. Detailed fabrication drawings of access panels and doors.
  - 3. Detailed list of proposed nameplates for Owner/Engineer review and acceptance before fabrication and attachment.
  - 4. Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.
    - a. Where Project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
    - b. Qualifications Data for testing agency.
  - 5. Record Drawings: Submit Record Drawings as required by Division 1 and Division 26
    - a. Accurately record actual locations of firestopped penetrations and access panel/door locations. Indicate dimensions from fixed structural elements.

##### **1.4 DEFINITIONS**

- A. The following abbreviations apply to this and other Sections of these Specifications:
  - 1. AFF: Above Finished Floor

2. AHJ: Authority(ies) having Jurisdiction
  3. ATS: Acceptance Testing Specifications
  4. EMT: Electrical Metallic Tubing
  5. EPDM: Ethylene-propylene-diene terpolymer rubber
  6. FMC: Flexible Metal Conduit
  7. GRS: Galvanized Rigid Steel Conduit
  8. IMC: Intermediate Metal Conduit
  9. LFMC: Liquidtight Flexible Metal Conduit
  10. LFNC: Liquidtight Flexible Nonmetallic Conduit
  11. MC: Metal Clad
  12. MFR: Manufacturer
  13. N/A: Not Available or Not Applicable
  14. NBR: Acrylonitrile-butadiene rubber
  15. NRTL: Nationally Recognized Testing Laboratory
  16. PCF: Pounds per Cubic Foot
  17. RAC: Rigid Aluminum Conduit
  18. RMC: Rigid Metal Conduit
  19. RNC: Rigid Nonmetallic Conduit
- B. The following definitions apply to this and other Sections of these Specifications:
1. HOMERUN: That portion of an electrical circuit originating at a junction box, termination box, receptacle or switch with termination at an electrical panelboard. Note: Where MC Cable is utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box in an accessible ceiling space immediately above the first load.

## **1.5 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.
  4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

## **2.2 ACCESS PANELS**

- A. Manufacturers:
1. Bar-Co., Inc.
  2. J.L Industries.
  3. Karp Associates, Inc.
  4. Milcor
  5. Nystrom Building Products
  6. Wade
  7. Zurn
- B. Access Doors:
1. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
  2. Joints and seams: continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
  3. Frames: 16-gauge steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling:
    - a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
    - b. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
    - c. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
  4. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
    - a. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
  5. Locking Devices: Flush, screwdriver-operated cam locks.
  6. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide 2 keys.

## **2.3 NAMEPLATES**

- A. Engraved, contrasting color, three-layer, laminated plastic indicating the name of the equipment, load, or circuit as designated on the Drawings and in the Specifications.
- B. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.
- C. Color: blackbackground with white] letters for Normal Power; Letter height: 1/2-inch minimum .

## **2.4 STEEL SLEEVES FOR RACEWAYS AND CABLES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends and drip rings.

## **2.5 CAST IRON WALL PIPE SLEEVES FOR RACEWAYS AND CABLES**

- A. Manufacturers
1. Josam Mfg. Co.
  2. Smith (Jay R) Mfg. Co.



3. Tyler Pipe/Wade Div.; Subs of Tyler Corp.
4. Watts Industries, Inc.
5. Zurn Industries, Inc.; Hydromechanics Div.
- B. Cast-iron sleeve with integral clamping flange with clamping ring, and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with setscrews.
- C. Sleeves for rectangular Openings: Galvanized sheet steel with minimum 0.052-] [or] [0.138-] inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

## 2.6 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. O-Z/Gedney
    - e. Pipeline Seal and Insulator, Inc.
  2. Sealing Elements: EPDM interlocking or solid sealing links shaped or pre-drilled to fit surface of cable or raceway. Include type and number required for material and size of raceway or cable.
  3. Pressure Plates: Plastic Include two for each sealing element. For multi-phase circuits, use slotted pressure plates if metal.
  4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
  1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
  2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
  3. Products: Subject to compliance with requirements, provide one of the following:
    - a. One-Part, Nonacid-Curing, Silicone Sealant:
      - 1) "Dow Corning 790," Dow Corning Corp.
      - 2) "Dow Corning 795," Dow Corning Corp.
      - 3) "Silglaze N SCS 2801," General Electric Co.
      - 4) "Silpruf SCS 2000," General Electric Co.
      - 5) "864," Pecora Corp.
      - 6) ".Omniseal," Sonneborn Building Products Div
      - 7) "Spectrem 1," Tremco, Inc.
      - 8) "Spectrem 2," Tremco, Inc.
    - b. One-Part, Mildew-Resistant, Silicone Sealant:

- 1) "Dow Corning 786," Dow Corning Corp.
  - 2) "Sanitary 1700," General Electric Co.
  - 3) "898 Silicone Sanitary Sealant," Pecora Corp.
  - 4) "OmniPlus," Sonneborn Building Products Div.
  - 5) "Tremsil 600 White," Tremco Corp.
- D. Acrylic-Emulsion Sealants: One-part, non-sagging, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Chem-Calk 600," Bostik
    - b. "AC-20," Pecora Corp.
    - c. "Sonolac," Sonneborn Building Products Div.
    - d. "Tremflex 834," Tremco, Inc.

## **2.8 FIRESTOPPING**

- A. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, by Underwriters' Laboratories, Inc., or other NRTL acceptable to AHJ.
1. Manufacturers:
    - a. Hilti, Inc.
    - b. RectorSeal.
    - c. Specified Technologies Inc.
    - d. 3M Corp.
    - e. United States Gypsum Company.

## **2.9 ACOUSTICAL SEALANTS**

- A. Foam Backer Rod: Closed cell polyethylene suitable for use as a backing for non-hardening sealant.
- B. Non-Hardening Penetration Sealant: Non-hardening polysulphide type. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise critical walls that are also fire rated.
- C. Packing Material: Mineral fiber; non-combustible; resistant to water, mildew and vermin. Expanding resilient foams manufactured for this purpose are an acceptable alternative only if the material density is at least 15 PCF (40 kg/m<sup>3</sup>).

## **PART 3 - EXECUTION**

### **3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless indicated otherwise.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

### **3.2 ACCESS DOORS**

- A. Furnish adequately sized access doors for the devices served, with a minimum size of 18 inches x 18 inches, for installation under Division 09 "Finishes".

- B. Furnish access doors of the proper construction for type of ceiling or wall construction where installed.
- C. Verify the exact location, sizes, and types of all access doors with the Architect prior to purchase.
- D. Provide access doors for all concealed electrical equipment, except where above lay-in ceilings.
- E. Coordinate with architectural finishes to set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- F. Adjust hardware and panels after installation for proper operation.
- G. Label all access doors per Division 26 Section "Identification for Electrical Systems".

### **3.3 NAMEPLATES**

- A. Provide nameplates for the following items:
  - 1. Panelboards
  - 2. Disconnect switches
  - 3. Enclosed circuit breakers
- B. Attach nameplates securely and permanently to the equipment, and in a manner acceptable to the equipment manufacturer.

### **3.4 SLEEVES AND SLEEVE SEALS**

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Provide all sleeves for required openings in all concrete and masonry construction and fire, smoke, or both, partitions, for all electrical Work that passes through such construction. Coordinate with all other trades and Divisions to dimension and lay out all such openings.
- C. Only those openings specifically indicated on the Architectural or Structural Drawings will be provided under other Divisions.
- D. New Construction:
  - 1. Coordinate with Divisions 03 and 04 for installation of sleeves and sleeve seals integrally in cast-in-place, precast, and masonry walls and horizontal slabs where indicated on the Drawings or as required to support raceway penetrations.
- E. Construction in Existing Facilities:
  - 1. Saw cut or core drill existing walls and slabs to install sleeves and sleeve seals in existing facilities. Do not cut or drill any walls or slabs without first coordinating with, and receiving approval from, the Architect, Owner, or both. Seal sleeves and sleeve seals into concrete walls or slabs with a waterproof non-shrink grout acceptable to the Architect.
- F. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".
- G. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Do not cut or core drill new construction without written approval from the Architect and Structural Engineer.
- H. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- I. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- J. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- K. Install pipe and rectangular sleeves in above-grade walls and slabs, where penetrations are not subject to hydrostatic water pressures. Ensure that drip ring is fully encased and sealed within the wall or slab.
- L. Cut sleeves to length for mounting flush with both surfaces of walls.

- M. Extend sleeves installed in floors 2 inches above finished floor level.
- N. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- O. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- P. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (or larger, if required by the seal manufacturer) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- Q. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (or larger, if required by the sleeve manufacturer) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
- R. Above Grade Concrete or Masonry Penetrations
  - 1. Provide sleeves for cables or raceways passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide sleeves as follows:
    - a. Install schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.
    - b. Install galvanized sheet metal for sleeves 6 inches in diameter and larger, thickness shall be 0.138 inches.
    - c. Install galvanized sheet metal for rectangular sleeves with the following minimum metal thickness:
      - 1) For sleeve cross-section rectangle perimeter 50 inches and no side greater than 16 inches, thickness shall be 0.52 inches.
      - 2) For sleeve cross-section rectangular perimeter equal to, or greater than, 50 inches and one (1) or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inches.
    - d. Schedule 40 PVC pipe sleeves are acceptable for use in areas without return air plenums.
  - 2. Seal elevated floor, exterior wall and roof penetrations watertight and weather tight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of ½" of sealant.
- S. Underground, Exterior-Wall Penetrations: Install cast-iron wall pipes for sleeves. Size sleeves to allow for 1-inch (or larger, if required by the mechanical sleeve manufacturer) annular clear space between sleeve and cable or raceway. Provide mechanical sleeve seal.
  - 1. Use type and number of sealing elements recommended by manufacturer for pipe material and size. Position pipe in center of sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
  - 2. Inspect installed sleeve and sleeve-seal installation for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade to seal against hydrostatic pressure.
- T. Elevated Floor Penetrations of waterproof Membrane:
  - 1. Provide cast-iron wall pipes for sleeves, extend top of wall pipe minimum 1" above finish floor. Size wall pipe for minimum ½" annular space between wall pipe and cable or raceway.
  - 2. Pack with mineral wool and seal both ends with minimum of ½" of waterproof sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.
  - 3. Secure waterproof membrane flashing between clamping flange and clamping ring. Comply with requirements for flashing specified in Division 7 Section "Sheet Metal Flashing and Trim"
  - 4. Extend bottom of wall pipe below floor slab as required and secure underdeck clamp to hold wall pipe rigidly in place.
- U. Interior Foundation Penetration: Provide sleeves for horizontal raceway passing through or under foundation. Sleeves shall be cast iron soil pipe two normal pipe sizes larger than the pipe served.

- V. Concrete Slab on Grade Penetrations:
  - 1. Provide ½" thick cellular foam insulation around perimeter of raceway passing through concrete foundation. Installation shall extend to 2" above and below the concrete slab.
- W. Interior Penetrations of Non-Fire-Rated Walls: Seal annular space between sleeve and cable or raceway, using joint sealant appropriate for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of ½" of sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- X. Exterior Wall Penetrations: Seal annular space between sleeve and raceway or duct, using joint sealant for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of ½" of waterproof sealant. Refer to Division 07 Section "Joint Sealants" for material and installation.
- Y. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- Z. Sleeve-Seal Installation
  - 1. Install sleeve seals for all underground raceway penetrations through walls at elevations below finished grade. Additionally, install seals inside raceways, after conductors or cables have been installed, in all raceway penetrations through walls at elevations below finished grade.
  - 2. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- AA. Inspect installed sleeve and sleeve-seal installations for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade and above grade where installed to seal against hydrostatic pressure.

### **3.5 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire/smoke-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### **3.6 JOINT SEALERS**

- A. Preparation for Joint Sealers
  - 1. Clean surfaces of penetrations, sleeves, or both, immediately before applying joint sealers, to comply with recommendations of joint sealer manufacturer.
  - 2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.
- B. Application of Joint Sealers
  - 1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
    - a. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
    - b. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.
  - 2. Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical raceways penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which

penetration occurs. Comply with installation requirements established by testing and inspecting agency.

### **3.7 ACOUSTICAL PENETRATIONS**

- A. Do not allow direct contact of raceways with shaft walls, floor slabs and/or partitions. Sleeve, pack and seal airtight with foam rod, non-hardening sealant and/or packing material, as described herein, for all penetrations by raceway, through surfaces that encompass or are between noise critical spaces. Seal and pack with caulking for the full depth of the penetration all openings around raceways in the structure surrounding the electrical equipment and surrounding noise-critical spaces. This includes all slab penetrations and penetrations of noise critical walls.
- B. Where a raceway passes through a wall, ceiling or floor slab of a noise critical space, cast or grout a metal sleeve into the structure. The internal diameter or dimensions of the sleeve shall be 2 inches larger than the external diameter or dimensions of the raceway passing through it. After all of the raceways are installed in that area, check the clearances and correct, if necessary, to within 1/2-inch. Pack the voids full depth with packing material sealed at both ends, 1-inch deep, with non-hardening sealant backed by foam rod.

**END OF SECTION 260500**

## **SECTION 260502**

### **EQUIPMENT WIRING SYSTEMS**

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

##### **1.1 SUMMARY**

- A. This Section includes limited scope for electrical connections to equipment specified under other Sections or Divisions, or furnished under separate contracts or by the Owner.
- B. Related Sections include the following:
  - 1. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
  - 2. Division 26 Section "Raceway and Boxes for Electrical Systems" for raceways.
  - 3. Division 26 "Low-voltage Electrical Power Conductors and Cables" for conductors, cables, and cords.
  - 4. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

##### **1.2 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories:
  - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 2. Marked for intended use.
- B. Comply with NFPA 70.

##### **1.3 COORDINATION**

- A. Unless otherwise noted, perform all electrical Work required for the proper installation and operation of equipment, furnishings, devices and systems specified in other Divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this Contract.
- B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and rough-in requirements based on Shop Drawings.
- D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- E. Sequence electrical connections to coordinate with start-up schedule for equipment.

#### **PART 2 - PRODUCTS AND MATERIALS**

##### **2.1 CORDS AND CAPS**

- A. Attachment Plugs: Conform to NEMA WD 1.
- B. Cord: See Paragraph "Flexible Cords" in Division 26 Section "Low-voltage Electrical Power Conductors and Cables".
- C. Provide cord size suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

#### **PART 3 - EXECUTION**

##### **3.1 EXAMINATION**

- A. Verify conditions of equipment and installation prior to beginning work.
- B. Verify that equipment is ready for connecting, wiring, and energizing.

### **3.2 ELECTRICAL DEVICES**

- A. Install disconnect switches, controllers, control stations, and control devices (other than temperature control devices) as indicated.
- B. Install disconnect switches, controllers, control stations, and control devices (other than temperature control devices) specified in other Divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this Contract.

### **3.3 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturers' instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.
- C. Make wiring connections using conductors and cable with insulation suitable for temperatures encountered in heat producing equipment.
- D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated on the Drawings.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Provide interconnecting conduit and wiring between devices and equipment where indicated on the Drawings.

**END OF SECTION 260502**



## SECTION 260526

### GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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

##### **1.1 SUMMARY:**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. This Section includes:
  - 1. Grounding Conductors
  - 2. Connector Products
  - 3. Grounding Electrodes
  - 4. Miscellaneous Grounding Materials and Products

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this section.
- B. Division 26 Section "Low-voltage Electrical Power Conductors and Cables" for insulated conductors.
- C. Division 26 Section "Raceway and Boxes for Electrical Systems" for raceways.

##### **1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements":
  - 1. Product data for the following products:
- B. Electrodes, mechanical and compression connectors, and exothermic connectors. Qualification Data: For a qualified testing and inspecting agency engaged by Contractor.
- C. Field Quality-Control Test Reports: From Contractor.
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section "General Electrical Requirements":
  - 1. Accurately record actual locations of all exterior buried electrodes and all buried ground rings. Indicate dimensions from fixed structural elements.

##### **1.4 DEFINITIONS**

- A. The following apply to this and other Sections of these Specifications:
  - 1. EMT: Electrical metallic tubing.
  - 2. ENT: Electrical nonmetallic tubing.
  - 3. FMC: Flexible metal conduit.
  - 4. IMC: Intermediate metal conduit.
  - 5. LFMC: Liquidtight flexible metal conduit.
  - 6. LFNC: Liquidtight flexible nonmetallic conduit.
  - 7. RMC: Rigid Metal Conduit
  - 8. GRS: Galvanized Rigid Steel Conduit
  - 9. RAC: Rigid Aluminum Conduit
  - 10. RNC: Rigid nonmetallic conduit.

11. PSF: Pounds per Square Foot

## **1.5 QUALITY ASSURANCE**

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Test Equipment Suitability and Calibration: Comply with NETA ATS (current version), "Suitability of Test Equipment" and "Test Instrument Calibration."
- C. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Electrical Components, Devices, and Accessories:
  - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 2. Marked for intended use.
  - 3. Comply with UL 467.
- E. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- F. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- G. Comply with NFPA 70.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

### **2.2 GROUNDING CONDUCTORS, CONNECTORS, AND ELECTRODES:**

- A. Manufacturers:
  - 1. Apache Grounding/Erco Inc.
  - 2. Boggs, Inc.
  - 3. Chance/Hubbell.
  - 4. Copperweld Corp.
  - 5. Dossert Corp.
  - 6. Erco Inc.; Electrical Products Group.
  - 7. FCI/Burndy Electrical.
  - 8. Galvan Industries, Inc.
  - 9. Hastings Fiber Glass Products, Inc.
  - 10. Ideal Industries, Inc.
  - 11. ILSCO.
  - 12. Kearney/Cooper Power Systems.
  - 13. Korn's: C. C. Korn's Co.; Division of Robroy Industries.
  - 14. Lyncole XIT Grounding.

15. O-Z/Gedney Co.; a business of the EGS Electrical Group.
16. Panduit, Inc
17. Raco, Inc.; Division of Hubbell.
18. Salisbury: W. H. Salisbury & Co.
19. Superior Grounding Systems, Inc.
20. Thomas & Betts, Electrical.

## 2.3 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Common Work Results for Electrical."
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Bare, stranded, unless otherwise indicated.
- F. Underground Conductors: Tinned-Bare-copper conductor, No. 2/0AWG minimum stranded unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
  1. Solid Conductors: ASTM B 3.
  2. Assembly of Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows:
  1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
  2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
  3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (wide and 1/16 inch thick.
- I. Aluminum Bonding Conductors: As follows:
  1. Bonding Cable: 10 strands of No. 14 AWG aluminum conductor, 1/4 inch in diameter.
  2. Bonding Conductor: No. 4 or No. 6 AWG, stranded aluminum conductor.
  3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; 1-5/8 inches wide and 1/16 inch thick.
- J. Ground Conductor and Conductor Protector for Wood Poles: As follows:
  1. No. 4 AWG minimum, soft-drawn copper conductor.
  2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

## 2.4 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors
  1. Compression Connectors: Burndy Hyground, or equal, permanent, pure, wrought copper, meeting ASTM 8 1 87, essentially the same as the conductors being connected; clearly and permanently marked with the information listed below:
    - a. Company symbol and/or logo.
    - b. Catalog number.
    - c. Conductors accommodated.
    - d. Installation die index number or die catalog number is required.

- e. Underwriters Laboratories "Listing Mark".
- f. The words "Suitable for Direct Burial" or, where space is limited, "Direct Burial" or "Burial" per UL Standard ANSI/UL467 (latest revision).
- 2. Cast connectors: copper base alloy according to ASTM B 30 (latest revision).
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## **2.5 GROUNDING ELECTRODES**

- A. Ground Rods: UL-listed:
  - 1. Copper-clad steel; bonded copper electrolytically-applied to minimum thickness of 10mils.
  - 2. Hot-dip galvanized steel; minimum zinc thickness specified per ASTM A-123
  - 3. Stainless steel; Type 304
  - 4. Size: 3/4 inch by 10 feet. Provide sectional types when longer rods are indicated.
- B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a bare conductor sized, at a minimum, for the size of the connecting grounding electrode conductor.
- C. Ground Plates: UL-listed, rectangular, bare solid copper plate; minimum 0.032-inch thick.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Examine areas and conditions under which electrical grounding connections are to be made and notify the Architect/Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with Work until unsatisfactory conditions have been corrected.
- B. Provide all materials, labor and equipment for an electrical grounding system in accordance with applicable portions of the NEC and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.
- C. Accomplish grounding and bonding of electrical installations and specific requirements for systems, circuits and equipment required to be grounded for both temporary and permanent construction.

### **3.2 APPLICATION**

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In branch circuit and feeder raceways, use insulated equipment grounding conductors.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated on the Drawings.
  - 1. Use insulated spacers and mounting brackets, and support from wall 8feet above finished floor, unless otherwise indicated.
  - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- D. Underground Grounding Conductors: Bury at least 24inches below grade, or 6 inches below the official frost line, whichever is greater, or when crossing a duct bank, bury 12inches above duct bank.

### **3.3 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and branch circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.

2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Flexible raceway runs.
  6. Armored and metal-clad cable runs.
  7. Feeders and branch circuits installed in non-metallic raceways.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panelboards or power-distribution units. If connections specified in paragraph below circumvent dielectric fittings intended to isolate interior piping systems from ground, other action may be necessary to prevent electrolytic corrosion. Delete if lightning protection is not specified.

### 3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible. Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by the manufacturers for indicated applications. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended by the manufacturers for types of service indicated.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Replace welds that are puffed up or that show convex surfaces indicating improper cleaning. Use exothermic welded connections for the following:
1. Connecting conductors together.
  2. Connecting conductors to ground rods, except at test wells.
  3. Connecting conductors to building steel.
  4. Connecting conductors to plates.
- C. Compression Fittings: Permanent compression-type fittings may be used for the following rather than exothermic connections:
1. Connecting conductors together.
  2. Connecting conductors to building steel.
  3. Connecting conductors to ground rods, except at test wells.
- D. Mechanical Pressure Fittings: Use bolted mechanical (removable) pressure-type clamps for the following:
1. Connecting conductors to ground rods at test wells.
  2. Connecting conductors to pipes.
- E. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- F. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or

terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- G. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- H. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- I. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- J. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### **3.5 GRADING AND PLANTING**

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 31 and 32. Maintain restored surfaces. Restore disturbed paving as indicated.

**END OF SECTION 260526**

## SECTION 260529

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- B. Division 26 Section "Common Work Results for Electrical" for concrete pads for pad-mounted service transformers.

##### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

##### **1.4 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of fivetimes the applied force.

##### **1.5 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.
- B. Shop Drawings; Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Nonmetallic slotted channel systems. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

##### **1.6 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

##### **1.7 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## **PART 2 - PRODUCTS**

### **2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
  - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.



- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Hilti Inc.
  - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
  - 3) MKT Fastening, LLC.
  - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
- 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
  - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
    - 2) Empire Tool and Manufacturing Co., Inc.
    - 3) Hilti Inc.
    - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
    - 5) MKT Fastening, LLC.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

## **2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements.
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### **3.5 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 260529**

## SECTION 260533

### RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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

##### **1.1 SUMMARY**

- A. This Section includes:
  - 1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- B. Division 26 Section "Common Work Results for Electrical" for limited scope general construction materials and methods.
- C. Division 26 Section "Equipment Wiring Systems" for electrical connections to equipment specified under other Sections, Divisions, or furnished by the Owner.
- D. Division 26 Section "Grounding and Bonding".
- E. Division 26 Section "Hangers and Supports for Electrical Systems".
- F. Division 26 Section "Identification for Electrical Systems".
- G. Division 26 Section "Wiring Devices" for devices installed in boxes, power poles, and multi-outlet assemblies.
- H. Division 26/27 Section "Common Work Results for Communications".

##### **1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements":
  - 1. Product data for the following products:
  - 2. Shop drawings
- B. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section "General Electrical Requirements":
  - 1. Accurately record actual routing of all exterior buried raceway and all interior raceways three inches and larger. Indicate dimensions from fixed structural elements.

##### **1.4 DEFINITIONS**

- A. Terminology used in this specification is as defined below:
  - 1. EMT: Electrical Metallic Tubing
  - 2. FMC: Flexible Metal Conduit
  - 3. GRS: Galvanized Rigid Steel Conduit
  - 4. IMC: Intermediate Metal Conduit
  - 5. LFMC: Liquidtight Flexible Metal Conduit
  - 6. LFNC: Liquidtight Flexible Nonmetallic Conduit
  - 7. RAC: Rigid Aluminum Conduit
  - 8. RMC: Rigid Metal Conduit
  - 9. RNC: Rigid Nonmetallic Conduit

##### **1.5 QUALITY ASSURANCE**

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Electrical Components, Devices, and Accessories:
  - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to AHJ.

- 2. Marked for intended use.
- C. Comply with NFPA 70.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

### **2.2 CONDUITS, SURFACE MOUNTED RACEWAYS AND ACCESSORIES**

- A. Metal Conduit And Tubing
  - 1. Manufacturers:
    - a. AFC Cable Systems, Inc.
    - b. Alflec Corporation, a Southwire Company
    - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
    - d. Electri-Flex Co.
    - e. Indalex
    - f. Manhattan/CDT/Cole-Flex
    - g. O-Z/Gedney; Unit of General Signal (Fittings)
    - h. Republic Raceway
    - i. Tyco International; Allied Tube & Conduit Div.
    - j. Western Tube and Conduit Corporation
    - k. Wheatland Tube Co.
  - 2. RMC:
    - a. GRS: Hot-dip galvanized: ANSI C80.1, UL 6.
    - b. RAC: ANSI C80.5, UL6A.
  - 3. IMC: ANSI C80.6, UL 1242.
  - 4. Plastic-Coated GRS and Fittings: NEMA RN 1, UL-listed. Coating thickness of 0.04 inches (1mm), minimum.
  - 5. Plastic-Coated IMC and Fittings: NEMA RN 1, UL-listed.
  - 6. EMT and Fittings: ANSI C80.3, UL 797.
    - a. Fittings: Set-screw or compression type.
  - 7. FMC: Aluminum UL 1.
  - 8. LFMC: Flexible steel raceway with PVC jacket: UL 360.
    - a. Fittings: NEMA FB 1; compatible with raceway and tubing materials.
- B. Nonmetallic Raceway And Tubing
  - 1. Manufacturers:
    - a. AFC Cable Systems, Inc. (Tubing)
    - b. American International.
    - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
    - d. Arnco Corp.
    - e. Cantex Inc.
    - f. Certainteed Corp.; Pipe & Plastics Group.

- g. Condux International.
  - h. ElecSYS, Inc.
  - i. Electri-Flex Co.
  - j. Lamson & Sessions; Carlon Electrical Products.
  - k. Manhattan/CDT/Cole-Flex.
  - l. Prime Conduit (formerly Carlon)
  - m. RACO; Division of Hubbell, Inc.
  - n. Spiralduct, Inc./AFC Cable Systems, Inc.
  - o. Superflex Ltd.
  - p. Thomas & Betts Corporation.
2. RNC: Schedule 40 and 80 PVC: NEMA TC 2, UL 651.
- a. Fittings: match to raceway type and material: NEMA TC 3, NEMA TC 6, UL 651, as applicable.
  - b. Fittings: match to tubing type and material: NEMA TC 3, NEMA TC 6, UL 651, as applicable.

## **2.3 BOXES, ENCLOSURES AND CABINETS**

### **A. General**

1. Manufacturers:
- a. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - b. Emerson/General Signal; Appleton Electric Company.
  - c. Erickson Electrical Equipment Co.
  - d. Hoffman.
  - e. Hubbell, Inc.
  - f. Killark Electric Manufacturing Co.
  - g. O-Z/Gedney; Unit of General Signal.
  - h. RACO; Division of Hubbell, Inc.
  - i. Robroy Industries, Inc.; Enclosure Division.
  - j. Scott Fetzer Co.; Adalet-PLM Division.
  - k. Spring City Electrical Manufacturing Co.
  - l. Thomas & Betts Corporation.
  - m. Walker Systems, Inc.; Wiremold Company (The).
  - n. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

### **B. Outlet Boxes**

- 1. Sheet Metal Outlet and Device Boxes: NEMA OS 1; UL514A.
- 2. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- 3. Nonmetallic Outlet and Device Boxes: NEMA OS 2
- 4. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified in the following paragraphs. Manufacturers and model numbers listed are used only to represent the characteristics required and are not intended to restrict the use of other Manufacturers listed above and models that meet the specified criteria.
  - a. Boxes for exposed work: deep drawn type with raised covers:
    - 1) Appleton 4S 1/2-DR; 8300 series cover.
    - 2) RACO 190 series; 800 series cover.
    - 3) Steel City 52150 series; RS series cover.
  - b. Concealed and exposed boxes for lighting:
    - 1) Appleton 40-3/4.

- 2) RACO 160 series.
- 3) Steel City 54170 series.
- c. Boxes imbedded in concrete for lighting:
  - 1) Appleton OCR
  - 2) RACO 270 or 280 series.
  - 3) Steel City 54500 series.
- d. Boxes for flush switches, receptacles, telephone, data or other general devices:
  - 1) Appleton 4SVB series; 8400 series cover.
  - 2) RACO 198 series; 770 series cover.
  - 3) Steel City CWV series; 52-C-00 series cover.
- e. Boxes for flush switches, receptacles, telephone, data or other general devices installed in masonry construction:
  - 1) Appleton MI-250 series or MI-350 series.
  - 2) RACO 690 series or 960 series.
  - 3) Steel City GW series.
- f. Exposed weatherproof boxes for general devices: cast aluminum with mounting lugs and neoprene gasket:
  - 1) Appleton FDB series.
  - 2) RACO 5300 series.
  - 3) Steel City T100L or LT100L series.
- g. Exposed weatherproof boxes for general devices: cast aluminum with neoprene gasket:
  - 1) Appleton FS series.
  - 2) RACO 5300 series.
  - 3) Steel City T100 or LT100 series.
- C. Junction and Pull Boxes
  - 1. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
  - 2. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast iron with gasketed cover. Select all floor boxes applicable to the project. Identify them in the Specifications and on the Drawings as "TYPE A", "TYPE B", etc. delete all non-applicable boxes before finalizing the Specifications. WARNING! Some of these boxes might not be listed for or physically capable of supporting a GFCI or transient suppression receptacle! Double-check with the box manufacturers if you have such a need!

## **2.4 FACTORY FINISHES**

- A. Finish: For metal wireway and surface raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: For metal wireway and surface raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled metal wireway and surface raceways, enclosures, and cabinets before shipping.

## **PART 3 - EXECUTION**

### **3.1 RACEWAYS**

- A. General
  - 1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on drawings or in this article are stricter.
  - 2. Provide sizes and types of raceways as indicated on the Drawings. Sizes are based on THWN insulated copper conductors, except where noted otherwise. Where sizes are not

shown on the Drawings or in the Specifications, size raceways in accordance with NFPA 70 requirements for the number, size and type of conductors installed. Minimum raceway size: 1/2 inch (concealed and exposed); 1 inch (underground and under slab).

3. Provide all raceways, fittings, supports, and miscellaneous hardware required for a complete electrical system as described by the Drawings and Specifications.
4. Install a green-insulated, equipment-grounding conductor, which is bonded to the electrical system ground, in all raceways, with the exception of Service Entrance raceways.
5. Install grounding bushings on all conduit terminations and bond to the enclosure, equipment grounding conductor, and electrical system ground.
6. Install raceways concealed in walls or above suspended ceilings in finished areas. When approved by the Architect, raceways may be installed concealed in elevated floor slabs. Do not install raceways horizontally within slabs on grade.
7. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
8. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
9. Make bends and offsets so inside diameters are not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
10. Install raceways:
  - a. To meet the requirements of the structure and the requirements of all other Work on the Project.
  - b. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.
  - c. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.
  - d. Parallel or perpendicular to building lines or column lines.
  - e. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
11. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
  - a. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - b. Space raceways laterally to prevent voids in concrete.
  - c. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - d. Change from RNC to coated GRS or IMC before rising above the floor.
12. Where masonry walls are left unfinished, coordinate raceway installations with other trades so that the raceways and boxes are concealed and the wall will have a neat and smooth appearance.
13. Provide support spacing in accordance with NFPA 70 requirements, and at a minimum in accordance with NEMA standards. Support by the following methods:
  - a. Attach single raceway directly to structural steel with beam clamps.
  - b. Attach single raceway directly to concrete with one-hole clamps or clips and anchors. Outdoors and wherever subject to dampness or moisture, offset raceways from the surface by using galvanized clamps and clamp backs, to mitigate moisture entrapment between raceways and surfaces.
  - c. Attach groups of raceway to structural steel with slotted support system attached with beam clamps. Attach raceway to slotted channel with approved raceway clamps.



- d. Attach groups of raceway to concrete with cast-in-place steel slotted channel fabricated specifically for concrete embedment. Attach raceway to steel slotted channel with approved raceway clamps.
  - e. Hang plumb horizontally suspended single raceway using a threaded rod. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to threaded rod with approved raceway clamps.
  - f. Hang horizontally suspended groups of raceway using steel slotted support system suspended from threaded rods. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to steel slotted channel with approved raceway clamps.
  - g. Support conductors in vertical raceway in accordance with NFPA 70 requirements.
  - h. Cross-brace suspended raceway to prevent lateral movement during seismic activity.
  - i. Use pre-fabricated non-metallic spacers for parallel runs of underground or under-slab conduits, either direct buried or encased in concrete.
14. Install electrically- and physically-continuous raceways between connections to outlets, boxes, panelboards, cabinets, and other electrical equipment with a minimum possible number of bends and not more than the equivalent of four 90-degree bends between boxes. Make bends smooth and even, without flattening raceway or flaking the finish.
  15. Protect all electrical Work against damage during construction. Repair all Work damaged or moved out of line after rough-in, to meet the Architect's approval, without additional cost to the Owner. Cover or temporarily plug openings in boxes or raceways to keep raceways clean during construction. Clean all raceways prior to pulling conductors or cables.
  16. Align and install raceway terminations true and plumb.
  17. Complete raceway installation before starting conductor installation.
  18. Install a pull cord in each empty raceway that is left empty for installation of wires or cables by other trades or under separate contracts. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull cord.
  19. Install approved expansion/deflection fittings where raceways pass through or over building expansion joints.
  20. Route raceway through roof openings for piping and ductwork or through roof seals approved by the Architect, the roofing contractor, or both. Obtain approval for all roof penetrations and seal types from the Architect, Owner, roofing contractor, or all three as required to maintain new or existing roofing warranties.
  21. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from building exterior to building interior.
    - b. Where otherwise required by NFPA 70.
  22. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with GRS] : FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

#### B. RMC

1. Use GRS in the following areas:
  - a. Where indicated.
  - b. Exterior applications where above grade and exposed.
  - c. Below grade when concrete-encased, plastic-coated, or provided with a corrosion resistant approved mastic coating.

- d. All raceways penetrating slabs on grade (use plastic-coated raceway or provide with a corrosion resistant approved mastic coating). This shall include the 90-degree elbow below grade and the entire vertical transition to above grade.
- C. EMT
- 1. Use EMT in the following areas:
    - a. Where indicated.
    - b. Interior concealed locations for:
      - 1) Branch circuits.
  - 2. Do not use EMT:
    - a. Below grade.
    - b. In exterior applications when exposed.
- D. FMC and LFMC
- 1. Use FMC or LFMC:
    - a. For the final 24 inches of raceway to all motors, transformers, and other equipment subject to vibration or movement.
    - b. From outlet boxes (attached to building structure) to recessed light fixtures. Install sufficient length to allow for relocating each light fixture within a 5-foot radius of its installed location.
  - 2. Do not use FMC or LFMC:
    - a. For branch circuits, homeruns or feeders.
    - b. In lengths exceeding 6 feet.
  - 3. Use FMC only in dry locations; use LFMC in damp, wet, corrosive, and outdoor locations
- E. RNC
- 1. Solvent-weld RNC fittings and raceway couplings per the manufacturer's instructions and make all connections watertight. Use solvent of the same manufacturer as the raceway.
  - 2. Where installed exposed outdoors or other areas subject to temperature variations, install expansion fittings per Article 352.44 of NFPA 70, to accommodate thermal expansion in straight runs.
  - 3. Use RNC in the following locations:
    - a. Only where specifically indicated, and then only as specified below.
    - b. Underground, single and grouped, in lieu of GRS or IMC, when indicated.
      - 1) Direct buried
      - 2) Concrete-encased (use approved rigid PVC interlocking spacers, selected to provide minimum duct spacing and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts).Keep the following sub-paragraph only if the Project includes a parking garage. (Recommended in northern climates due to heavy salt use, but not in Kansas City and more southern climates. HEI may consider this for the southern climates as a VE item, but always check with you PM, PIC and the electrical department director before allowing this concept. Remember, PVC has a high amount of thermal expansion.)
    - c. Schedule 80: vertical risers below 7 feet AFF and not subject to vehicular traffic.
  - 4. Do not use RNC:
    - a. Exposed indoors
    - b. In occupied spaces.
    - c. In return air plenums.
    - d. Where subject to physical damage.
    - e. Where not permitted by codes.
- F. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. RMC and IMC: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings and installation tools approved by the manufacturer for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits. Replace all fittings and conduits that have any portion of the coating scraped off to bare metal, at no additional cost to the Owner.
3. Join raceways with fittings designed and approved for that purpose and make joints tight.
4. Use insulating bushings to protect conductors at raceway terminations:
  - a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
  - b. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- G. Telephone and Signal/Data System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- H. Wireways
  1. Use flat head screws, clips and straps to fasten wireways to surfaces. Mount plumb and level.
  2. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
  3. Close ends of wireway and unused raceway openings.
- I. Surface Raceways
  1. Use flat head screws, clips and straps to fasten surface raceways to surfaces. Mount plumb and level.
  2. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
  3. Close ends of surface raceway.

### **3.2 BOXES**

- A. General
  1. Verify locations of device boxes prior to rough in.
  2. Set boxes at elevations to accommodate mounting heights as specified or indicated on the Drawings.
  3. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box locations to accommodate intended purpose.
  4. Install boxes to preserve fire ratings of walls, floors, and ceilings.
  5. Install flush wall-mounted boxes without damaging wall insulation or reducing its effectiveness.
  6. Support boxes independently of raceway.
  7. Clean the interior of boxes to remove dust, debris, and other material. Clean exposed surfaces and restore finish.
  8. Adjust flush-mounted boxes to make front edges flush with finished wall material.
  9. Provide boxes of the depth required for the service, device and the application, and with raised covers set flush with the finished wall surface for boxes concealed in plaster finishes. Select covers with the proper openings for the devices being installed in the boxes. Install boxes flush unless otherwise indicated.
  10. Install outlet boxes in firewalls complying with UL requirements, with box surface area not exceeding 16 square inches; and, when installed on opposite sides of the wall, separate by a distance of at least 24 inches.
- B. Outlet Boxes

1. Install all electrical devices, such as plug receptacles, lamp receptacles, light switches, and light fixtures in or on outlet boxes.
  2. Locations of outlets on Drawings are approximate; and, except where dimensions are shown, determine exact dimensions for locations of outlets from plans, details, sections, or elevations on Drawings, or as directed by Architect. Locate outlets generally from column centers and finish wall lines or to centers or joints of wall or ceiling panels.
  3. Locate outlet boxes so they are not placed back-to-back in the same wall, and in metal stud walls, so they are separated by at least one stud space, to limit sound transmission from room to room. Install outlet boxes in accessible locations and do not install outlets above ducts or behind furring.
  4. Install extension and plaster rings as required by NFPA 70.
  5. Carefully set outlet boxes concealed in non-plastered block walls so as to line up with wall joints. Coordinate the box and raceway installation with the wall construction as required for a flush and neat appearing installation. Outlet box extensions may be used where necessary.
  6. Do not exceed allowable fill per NFPA 70.
  7. Where multiple devices are shown grouped together, gang mount with a common cover plate.
- C. Junction and Pull Boxes
1. Install junction and pull boxes above accessible ceilings and in unfinished areas.
  2. Provide boxes set flush in painted walls or ceilings with primer coated cover.
  3. Where junction and pull boxes are installed above an inaccessible ceiling, locate so as to be easily accessible from a ceiling access panel.
  4. Boxes for exterior use shall be:
    - a. PVC with a UV-stabilized PVC cover sealed and gasketed watertight.
    - b. Cast aluminum with a cast aluminum cover sealed and gasketed watertight.
    - c. Cast iron with cast iron cover sealed and gasketed watertight in vehicular traffic areas. Provide box and cover UL listed for use in vehicular traffic areas.
    - d. Install buried boxes so that box covers are flush with grade, unless indicated otherwise.

**END OF SECTION 260533**

## **SECTION 260553**

### **IDENTIFICATION FOR ELECTRICAL SYSTEMS**

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

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for raceways and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.

##### **1.3 SUBMITTALS**

- A. Product Data: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements" for each electrical identification product indicated:
  - 1. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
  - 2. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

##### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories:
  - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that are acceptable to authorities having jurisdiction.
  - 2. Marked for intended use.
- B. Comply with ANSI A13.1 and ANSI C2.
- C. Comply with NFPA 70.
- D. Comply with 29 CFR 1910.145.

##### **1.5 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

### **2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Self-laminating Computer Printable Labels: Clear over-laminate to protect legend for permanent, clean identification. Self-laminating Polyester material with white print-on area.
- D. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.
- F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

### **2.3 UNDERGROUND-LINE WARNING TAPE**

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.

### **2.4 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied and shall not compromise any NRTL listing or labeling criteria.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

## 2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied and shall not compromise any NRTL listing or labeling criteria.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- D. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- E. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be (25 mm)

## 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
  - 1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
    - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
      - 1) Primer: Exterior concrete and masonry primer.
      - 2) Finish Coats: Exterior semigloss acrylic enamel.
  - 2. Exterior Concrete Unit Masonry:
    - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.
      - 1) Block Filler: Concrete unit masonry block filler.
      - 2) Finish Coats: Exterior semigloss acrylic enamel.
  - 3. Exterior Ferrous Metal:
    - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
      - 1) Primer: Exterior ferrous-metal primer.
      - 2) Finish Coats: Exterior semigloss alkyd enamel.
  - 4. Exterior Zinc-Coated Metal (except Raceways):
    - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

- 1) Primer: Exterior zinc-coated metal primer.
- 2) Finish Coats: Exterior semigloss alkyd enamel.
5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
  - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
    - 1) Primer: Interior concrete and masonry primer.
    - 2) Finish Coats: Interior semigloss alkyd enamel.
6. Interior Concrete Unit Masonry:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.
    - 1) Block Filler: Concrete unit masonry block filler.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
7. Interior Gypsum Board:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
    - 1) Primer: Interior gypsum board primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
8. Interior Ferrous Metal:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
    - 1) Primer: Interior ferrous-metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
9. Interior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
    - 1) Primer: Interior zinc-coated metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:
  1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to raceways concealed within wall.
  3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches (50 mm) high, with self-adhesive vinyl labels Repeat legend at 10-foot (3-m) maximum intervals.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands snap-around, color-coding bands:
  1. Fire Alarm System: Red.
  2. Fire-Suppression Supervisory and Control System: Red and yellow.
  3. Combined Fire Alarm and Security System: Red and blue.



4. Security System: Blue and yellow.
  5. Mechanical and Electrical Supervisory System: Green and blue.
  6. Telecommunication System: Green and yellow.
  7. Control Wiring: Green and red.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in the same junction or pull box, use color-coding conductor tape Identify each ungrounded conductor according to source and circuit number.
  - E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Limit use of underground-line warning tape to direct-buried cables
  - F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
    1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      - a. Power transfer switches.
      - b. Controls with external control power connections.
    2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
  - G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
    1. Labeling Instructions:
      - a. Indoor Equipment: Adhesive film label Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
      - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label
    2. Label the following equipment:
      - a. Panelboards, electrical cabinets, and enclosures.
      - b. Disconnect switches.
      - c. Enclosed circuit breakers.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for branch-circuit conductors.
1. Color shall be factory applied
  2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue
    - d. Neutral: White
    - e. Ground: Green
    - f. Isolated Ground: Green, with Yellow stripe
  3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility. DO NOT install metal tags, or tags with metal edges, or tags with metal tie-wraps in any enclosure with exposed energized terminals, busses, or similar parts, where the tags could come into accidental contact with the exposed parts.
- I. Non-metallic Marker Tags and Tape: Secure tight to surface of conductor or cable with non-metallic tie wraps or adhesive, as specified, at a location with high visibility and accessibility; and, in all enclosures with exposed energized parts.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

**END OF SECTION 260553**

## **SECTION 262726**

### **WIRING DEVICES**

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

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles: Single, duplex, quad/4-plex, twist-lock, ground-fault circuit interrupters (GFCI), surge protective device (SPD), and isolated ground (IG).
  - 2. Device Wall Plates.

##### **1.2 RELATED SECTIONS INCLUDE THE FOLLOWING:**

- A. Division 26 Section "General Electrical Requirements" for general requirements and related documents that apply to this Section.
- B. Division 26 Section "Common Work Results for Electrical Systems" for cords, caps, outlet boxes, floor service outlets, and poke-through assemblies used to support wiring devices.
- C. Division 26 Section "Identification for Electrical Systems" for device and circuit labels.

##### **1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.
- B. IG: Isolated Ground

##### **1.4 SUBMITTALS**

- A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements".
- B. Product data for the following products:
- C. Shop drawings for:
  - 1. List of legends and description of materials and process used for pre-marking wall plates.
- D. Samples:
  - 1. One for each type of device and wall plate specified, in each color specified.
  - 2. Samples will be returned after review, and, if accepted by the Architect and Engineer, may be installed on the Project.
- E. Field quality-control test reports.
- F. Warranty: Special warranties specified in this Section.

##### **1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device and associated cover plate from a single manufacturer and through one source. Where practical and possible, obtain all wiring devices and associated cover plates from a single manufacturer and one source.
- B. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 10 years.
- C. Electrical Components, Devices, and Accessories:
  - 1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that are acceptable to authorities having jurisdiction.
  - 2. Marked for intended use.

##### **1.6 COORDINATION**

- A. Receptacles for Equipment Furnished by Owner or Under Other Divisions or Contracts: Match plug configurations.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.1 GENERAL**

- A. Wiring devices are defined as single discrete units of electrical distribution systems, such as convenience receptacles, switches, special purpose receptacles, and similar, which are intended to carry, but not use electrical energy. Install wiring devices as required by the Specifications and where indicated on the Drawings.

### **2.2 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Receptacles and Switches:
    - a. Cooper Wiring Devices.
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Mfg. Company Inc.
    - d. Pass & Seymour/Legrand; Wiring Devices Div.
  2. Multioutlet Assemblies:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Wiremold Company (The).
  3. Service/Power Poles:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Pass & Seymour/Legrand; Wiring Devices Div.
    - c. Square D/Groupe Schneider NA.
    - d. Thomas & Betts Corporation.
    - e. Wiremold Company (The).
- C. In other Part 2 articles below, where lists of manufacturers and device catalog numbers are included, the following additional requirements apply to product selection:
1. Additional Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers listed in individual articles below, in addition to those listed in Paragraph Manufacturers above.

### **2.3 FINISHES**

- A. Color:
1. Wiring devices connected to normal power systems: Match existing devices, unless otherwise indicated or required by NFPA 70. Cover plates: Match existing cover plates.
- B. Manufacturer's model numbers listed are to establish the quality of the wiring devices. Coordinate the proper suffixes in order to provide the correct color as specified above.

### **2.4 CONVENIENCE RECEPTACLE:**

- A. The catalog numbers listed below are generally for 20A rated devices. Where 15A rated devices are indicated on the Drawings or required for circuit rating limitations, provide receptacles equivalent to those specified for 20A, but rated for 15A.
- B. Duplex convenience receptacles: Heavy Duty Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>	<u>Single</u>
Cooper	5362	5351
Hubbell	5352A	HBL5361

Leviton	5352	5261
Pass & Seymour	5362	5361

- C. Duplex convenience receptacles: Commercial Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>
Cooper	CR20
Hubbell	BR20
Leviton	CR20
Pass & Seymour	CR20

- D. Duplex tamper resistant convenience receptacles: Heavy Duty Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>
Cooper	TR5362
Hubbell	HBL8300SGA
Leviton	8300-SGG
Pass & Seymour	TR5362

- E. Duplex tamper resistant convenience receptacles: Commercial Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>
Cooper	TRCR20
Hubbell	BR20TR
Leviton	TBR20
Pass & Seymour	TR20

- F. Duplex weather resistant convenience receptacles: Heavy Duty Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>
Cooper	TWR270
Hubbell	5362WR
Leviton	WBR20
Pass & Seymour	WR5862

- G. Duplex weather resistant convenience receptacles: Commercial Specification grade, NEMA 5-20R, 125V, 20A, grounding type, UL listed and labeled, smooth nylon face, side and back wired, self-grounding.

<u>Manufacturer</u>	<u>Duplex</u>
Cooper	WRBR20
Hubbell	5362WR
Leviton	WBR20
Pass & Seymour	WR20TRW

## 2.5 GFCI RECEPTACLES

- A. Ground fault circuit interrupter type receptacles: Specification Grade UL listed and labeled complying with UL 943, Class A and NEMA WD-1-1.10, 125V, 20A, trip at 4-6mA within 0.025 second, and feed-thru type with integral heavy duty NEMA 5-20R receptacle arranged to protect receptacles down stream on the same circuit.

<u>Manufacturer</u>	<u>Specification Grade</u>
Cooper	VGf20
Hubbell	GF20LA
Leviton	T7899-H
Pass & Seymour	2095

- B. Ground fault circuit interrupter type weather-resistant receptacles: Specification Grade UL listed and labeled complying with UL 943, Class A and NEMA WD-1-1.10, 125V, 20A, trip at 4-6mA within 0.025 second, and feed-thru type with integral heavy duty NEMA 5-20R receptacle arranged to protect receptacles down stream on the same circuit.

<u>Manufacturer</u>	<u>Specification Grade</u>
Cooper	WRVGf20
Hubbell	GFTR20
Leviton	W7899
Pass & Seymour	2095TRWR

- C. Ground fault circuit interrupter type tamper and weather-resistant receptacles: Specification Grade UL listed and labeled complying with UL 943, Class A and NEMA WD-1-1.10, 125V, 20A, trip at 4-6mA within 0.025 second, and feed-thru type with integral heavy duty NEMA 5-20R receptacle arranged to protect receptacles down stream on the same circuit.

<u>Manufacturer</u>	<u>Specification Grade</u>
Cooper	TWRVGf20
Hubbell	GFTR20
Leviton	W7889-T
Pass & Seymour	2095TRWR

## 2.6 COVER PLATES

- A. Single and combination types to match corresponding wiring devices and manufacturer of wiring devices specified herein.
1. Plate securing screws: Metal with head color to match finish plate.
  2. Material for Finished Spaces: Refer to "Finishes" above for color.
  3. Material for Unfinished Spaces and surface mounted wiring devices: Galvanized steel.
  4. Masonry walls and oversized wall openings: Jumbo size plates with same material as indicated above.
- B. Damp Location Weatherproof Receptacle Cover Plates: UL-listed Wet Location (cover closed, not in use); die-cast, gasketed (factory-installed) self-closing covers, for vertical mounting

<u>Manufacturer</u>	<u>Vertical</u>
Cooper	966
Hubbell	RW51040
Leviton	4978
Pass & Seymour	4512

- C. Wet Location Weatherproof Receptacle Cover Plates: NEMA 3R weather resistant recessed or flush mount, lockable cover. Configure cover for vertical mounting of receptacle as indicated., Back box must be suitable for conduit connections. Coordinate back box with wall depth.

<u>Manufacturer</u>	<u>Vertical</u>
Intermatic	WP1000RC
Cooper	
Hubbell	RW57500
Leviton	
Pass & Seymour	

- D. Weatherproof switch cover plates: Fabricated of cast aluminum or cast zinc, sealed water-tight and UL listed for wet locations.

<u>Manufacturer</u>	<u>1 Gang</u>	<u>2 Gang</u>
Appleton	FSK	
Raco	5100 Series	
Steel City	SW Series	

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Outlets are only approximately located on the small scale Drawings. Use great care in the actual location by consulting the various large scale detailed Drawings used by other Division trades, and by securing definite locations from the Engineer.

- B. Do not use multi-conductor circuits, with a shared neutral, for any GFCI receptacle circuit. Provide a separate neutral conductor with all GFCI receptacle circuits.

### **3.2 EXAMINATION**

- A. Verify existing conditions prior to beginning work.
- B. Verify that outlet boxes are installed at proper height and are flush with the finished surface.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### **3.3 PREPARATION**

- A. If required, provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from in and around outlet boxes.

### **3.4 INSTALLATION**

- A. Install all wiring devices plumb, level, and square with building lines. Wiring device bodies shall extend to the finished surface of the walls, ceiling or floor, as applicable, without projecting beyond them.
- B. Connect wiring devices by wrapping conductors around screw terminals. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. Connect wiring device grounding terminal to branch circuit equipment grounding conductor and bond to metal outlet box. Exception: Do not bond grounding terminals of isolated ground receptacles to the outlet box.
- D. Install devices shown on wood trim, cases or other fixtures symmetrically and, where necessary, set with the long dimensions of the plate horizontal, or ganged in tandem.
- E. Unless dimensioned otherwise, install wiring devices a minimum of 24 inches from the closest edge of any sink.
- F. Install switches with OFF position down.
- G. Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- H. Where dimmer switches are shown adjacent to standard switches, install both in separate back boxes with adequate space between so that neither cover plate requires cutting. Dimmers shall not require de-rating. Do not remove fins.
- I. Provide a separate grounded conductor (neutral) for each circuit controlled by a dimmer. Do not share neutral conductor on load side of dimmers.
- J. Install cover plates on all switches, receptacles, and blank outlets.
- K. Locate wiring devices so that the cover plate does not have to be cut to be installed.
- L. Where devices are shown near wall openings, coordinate location if corner guards are to be installed so that cover plates do not require cutting.
- M. Install cover plates after the wall has been finished (painted, wall paper, etc).
- N. Install device boxes in brick or block walls such that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

### **3.5 MOUNTING HEIGHTS**

- A. Coordinate locations of outlet boxes provided under Division 26 Section "Common Work Results for Electrical".
- B. Unless noted otherwise, install wiring devices as indicated below (NOTE: All dimensions are to the BOTTOM of the outlet box unless noted otherwise):
  - 1. Receptacles:
    - a. General:
      - 1) Vertically with the ground slot mounted at the bottom: 16 inches above finished floor.



- 2) Horizontally, with neutral slot mounted at the bottom: 16 inches above finished floor.

### **3.6 IDENTIFICATION**

- A. Label all devices fed down stream of GFCI protected receptacles as "GFCI PROTECTED".
- B. Comply with Division 26 Section "Identification for Electrical Systems."
  1. Receptacles and Switches: Identify panelboard and circuit number from which served, using:
    - a. Durable wire markers or tags inside outlet boxes.
    - b. Permanent-ink marker, hand-printed legibly, inside outlet boxes.
    - c. Adhesive film label, but with letter/number height of 1/4 inch, on face of plate.
    - d. Adhesive Film Label with Clear Protective Overlay, but with letter/number height of 1/4 inch, on face of plate, for exterior and damp/wet locations.

### **3.7 FIELD QUALITY CONTROL**

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
- D. Test all wiring devices for electrical continuity and proper polarity of connections.
- E. Test each GFCI receptacle device for proper operation.
- F. Correct wiring devices incorrectly installed.
- G. Repair or replace all damaged items or damaged finishes at no expense to the Owner.

### **3.8 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.

### **3.9 CLEANING**

- A. Clean exposed surfaces to remove splatters and restore finish.

**END OF SECTION 262726**

## SECTION 262816

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Molded-case circuit breakers (MCCBs).
  - 2. Molded-case switches.

##### **1.2 DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

##### **1.3 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

##### **1.4 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control reports.

1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Manufacturer's field service report.
- G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device

### **1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NFPA 70.

### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  2. Altitude: Not exceeding 6600 feet (2010 m).
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
  2. Indicate method of providing temporary electric service.
  3. Comply with NFPA 70E.

### **1.7 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## **PART 2 - PRODUCTS**

## 2.1 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- K. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered] type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
  - 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 7. Under voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

## **2.2 MOLDED-CASE SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Features and Accessories:
  - 1. Standard frame sizes and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 5. Under voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
  - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
  - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
  - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
  - 10. Electrical Operator: Provide remote control for on, off, and reset operations.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

### **3.3 IDENTIFICATION**

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- E. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.5 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

**END OF SECTION 262816**

## **SECTION 27 53 19**

### **DISTRIBUTED ANTENNA AND DATA AQUISITION SYSTEM**

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

##### **1.1 DESCRIPTION**

- A. This Section describes the interfacing, technical and performance requirements for a fully installed, functioning and operating Distributed Antenna System and Equipment. The system is based upon outside antennas, inside I/O module(s), inside network controller(s), active amplification functions and architecture to support water system chemical monitoring and scald protection located within 11 buildings and 2 water towers located on the Veterans Affairs Medical Center Campus.

##### **1.2 SUMMARY**

- A. Minimum Composition Requirements and/or installation methods for following materials and work are included in this section:
  - 1. Head-End Components required for the conditioning, amplifying, combining and distributing wireless signals as part of multi-services Distributed Antenna System.
  - 2. Network Control Components required for amplifying and distribution of signals as part of a multi-services Distributed Antenna System.
  - 3. I/O Unit Components required for gathering plumbing point data for repository in the server.
- B. Minimum Composition Requirements and Installation Methods for following:
  - 1. Head-End Components
  - 2. Network Control Components
  - 3. I/O Unit Control Components
  - 4. Antennas
- C. Related Requirements: Comply with Following:
  - 1. Grounding and Bonding for all Communication Systems Installed within and outside of all buildings.

##### **1.3 REFERENCES**

- A. Reference Standards: General Requirements – Division 01 and Common Work Results for Communications – Division 27.

##### **1.4 SUBMITTALS**

- A. The BMS and Antenna Contractor shall submit a list of all shop drawings along with all outside and inside locations of components with submittals dates within 30 days of contract award. Submittals shall be defined packages.
- B. At a minimum, submit the following:
  - 1. BMS network architecture diagrams, System Schematics, Sequences and Flow diagrams.
  - 2. Colors and Finishes, submitted and approved by Architect prior to order.
  - 3. Provide details of all BMS and Antenna connections, interfaces, Bill of Materials and software.
  - 4. If providing pre-standards manufacturer system solution, submit installer/contractor certification documentation and channel certification information and requirements from manufacturer.
  - 5. Contractor shall provide the latest and most current equipment and materials available on the market for installation. All system submittals shall include the latest technology equipment and materials available on the data of installation.

#### **PART 2 - PRODUCTS**

##### **2.1 GENERAL DESCRIPTIONS**

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third party devices and

applications. The system shall be designed for use on the internet industry standard technology compatible with other owner provided networks.

- B. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of controllers and operator devices while re-using existing controllers.
- C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
  - 1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
  - 2. The system shall maintain all settings and overrides through system reboot.
- D. Acceptable Manufactures
  - 1. Johnson Controls, Inc.
  - 2. Honeywell
  - 3. Siemens Building Systems

## **2.2 BMS ARCHITECTURE**

- A. Automation Network
  - 1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP.
  - 2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and server(s) as required for systems operation.
  - 3. All BMS devices on the network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
  - 4. Network Controllers shall reside on the automation network.
- B. Control Network
  - 1. Control networks shall operate at a minimum communication speed of 9600 baud.
  - 2. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
- C. Integration
  - 1. Analog and digital signal values shall be passed from one system to another via hardwired connections or through wireless communication.
  - 2. There will be one separate physical point on each system for each point to be integrated between systems.
- D. Direct Protocol
  - 1. The BMS system shall include appropriate hardwire equipment and software to allow bi-directional data communications between the BMS system and 3<sup>rd</sup> party manufactures' communication. The BMS shall receive and react to the multiple building water system chemical monitoring and scald protection.

## **2.3 RF ANTENNA**

- A. System shall be implemented based on proven state-of-the-art technology that can seamlessly integrate with the wireless technologies and BMS systems.
- B. The system shall include a head-end system. The BMS/DAS head end shall be located in the Maintenance room in building 59.
- C. DAS antenna coverage shall be depicted on the Contractor's Required Survey(s) and additionally shown on the contract drawings.
- D. The Contractor shall provide coverage antennas and/or wireless communication to meet the operational requirements.
- E. The Contractor shall provide plans indicating equipment, antenna and/or component location(s), cable route(s) and other installation information.



- F. Each DAS connection should be brought in through separate paths that provide two distinct DAS connections to the head end, giving each building a redundant connectivity in the case of a cable damage or system failure.
- G. Acceptable Manufactures:
  - 1. Firetide
  - 2. Accepted Substitute in accordance with Substitution Procedures: Division 01.

## **2.4 ANTENNA EQUIPMENT**

- A. Furnish and install a complete and fully functional DAS System.
- B. List specific location for each antenna and indicate each location in/at the required location on the contract drawings.
- C. The system shall include, but not be limited to:
  - 1. Directional, Omi-Directional outdoor antennas
  - 2. Mesh network Communication
  - 3. Antenna masts, antenna multi-couplers
  - 4. Lightning protection

## **2.5 HEAD-END COMPONENTS, REMOTE UNIT COMPONENTS**

- A. Dedicated Web Based User Interface
  - 1. Where indicated on plans, the BMS contractor shall provide and install a personal computer for command entry, information management and water system monitoring functions. All real-time controls functions, including scheduling and history collection shall be resident in the BMS network controller unit to facilitate greater fault tolerance and reliability.
- B. Installation shall include:
  - 1. Delivery, unloading and setting in place of equipment.
  - 2. Install on rack or wall as indicated by contract documents
  - 3. Interconnecting wiring of the system components.
  - 4. Extended building power from available locations.
  - 5. Equipment alignment and adjustment.
  - 6. Other work required to result in complete and operational system.
- C. Shall be installed as per manufacturer's instructions and recommendations.
- D. Provide access to equipment and components requiring operation, service or maintenance within the life of the system.
- E. The user interface software shall provide help menus and instructions for each operation and/or application. The system shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
- F. Head-end components and remote unit components shall be of the same manufacturer and system solution.
- G. Coordinate ordering and installation of equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- H. The Contractor shall be responsible for damage to surface or work disrupted as a result of Contractors work.

## **2.6 NETWORK UNIT COMPONENTS/ I/O UNIT COMPONENTS**

- A. Installation shall include:
  - 1. Delivery, unloading and setting in place of equipment.
  - 2. Install on rack or wall as indicated by contract documents
  - 3. Interconnecting wiring of the system components.
  - 4. Extended building power from available locations.
  - 5. Equipment alignment and adjustment.
  - 6. Other work required to result in complete and operational system.
- B. Shall be installed as per manufacturer's instructions and recommendations.

- C. Provide access to equipment and components requiring operation, service or maintenance within the life of the system.
- D. Head-end components and remote unit components shall be of the same manufacturer and system solution.
- E. Coordinate ordering and installation of equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- F. The Contractor shall be responsible for damage to surface or work disrupted as a result of Contractors work
- G. Contractor coordination with Water System Chemical Monitoring and Scald Protection should be stated on drawing which system points are being integrated, location of unit components and which floor per building all components are being located.

## **2.7 ANTENNA**

- A. Attach to roof surface or as indicated by contractor documents
- B. Shall be installed as per manufacturer's recommendations
- C. All applicable coring, grounding, lightning protection and roof work shall be by Contractor.

## **2.8 TESTING**

- A. The VA representative(s) and the contractor will tour all major areas where the systems are completely and properly installed to insure they are operationally ready for proof of performance testing. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- B. After the Physical and Mechanical Inspection of each DAS location, terminating, mounting and interface equipment, the DAS cable distribution system shall be checked at each interface, junction and distribution point to insure all meets the standards outlined herein.
- C. Testing all RF environments as required by service providers.
- D. Contractor representative will prove DAS proof of performance testing until 100% of the system has been tested and found to meet the contents of this specification. Each DAS item shall meet or exceed the minimum requirements of this document.
- E. If the system is declared unacceptable without conditions, all rescheduled testing expense will be borne by the contractor.

## **2.9 CONNECTING TO THE DAS SYSTEM**

- A. The contractor shall manage and collect all license/listings and provide them to the VAMC chief when VA's accepts the system.
- B. The Contractor shall represent the VAMC during construction with each Wireless Service Provider to insure all VA Conditional Use Permits / Agreements are completed and approved. Coordination connection of each Wireless Service provider to the system.
- C. The contractor shall coordinate site preparation and assist with approved DAS system.

## **2.10 IDENTIFICATION**

- A. Permanently label the front and rear of devices mounted in equipment rack to coordinate with the nomenclature used on the contract documents.
- B. Label each component to indicate the corresponding service provider being supported.

## **2.11 BONDING AND GROUNDING**

- A. Provide in accordance with TIA-J-STD-607-A and NFPA 70.
- B. The Contractor shall be responsible for bonding of all telecommunications equipment cabinets, racks, enclosures, tray systems and cables within each technology space.

## **2.12 VERIFICATION TESTS**

### **A. Pre-install site survey:**

1. Perform analysis of site for optimal antenna placement. Site visit is to be arranged 15 days prior to bid date.

--- E N D ---

**SECTION 33 11 00**  
**WATER DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 REFERENCES**

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2013) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
AWWA C200	(2012) Steel Water Pipe - 6 In. (150 mm) and Larger
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C205	(2012) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied
AWWA C206	(2011) Field Welding of Steel Water Pipe
AWWA C207	(2013) Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm through 3600 mm 4 in. through 144 in.
AWWA C208	(2012) Standard for Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	(2013) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipelines
AWWA C210	(2007) Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(2009; Addenda A 2011) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(2009) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2009) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C700	(2009) Standard for Cold Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(2012) Standard for Cold-Water Meters - Turbine Type for Customer Service
AWWA C702	(2010) Cold-Water Meters - Compound Type
AWWA C703	(2011) Cold-Water Meters - Fire Service Type
AWWA C704	(2012) Propeller-Type Meters for Waterworks Applications
AWWA C706	(2010) Direct-Reading, Remote-Registration Systems for Cold-Water Meters
AWWA C707	(2010) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA M11	(2004; 4th Ed) Manual: Steel Water Pipe: A Guide for Design and Installation
ASME INTERNATIONAL (ASME)	
ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.15	(2013) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B18.2.2	(2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASTM INTERNATIONAL (ASTM)	
ASTM A307	(2012) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A746	(2009) Standard Specification for Ductile Iron Gravity Sewer Pipe

ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B61	(2008; R 2013) Standard Specification for Steam or Valve Bronze Castings
ASTM B62	(2009) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C94/C94M	(2014) Standard Specification for Ready-Mixed Concrete
ASTM D1599	(1999; R 2011) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D2657	(2007) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 1961	(2013) Standard on Fire Hose
NFPA 24	(2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 704	(2012) Standard System for the Identification of the Hazards of Materials for Emergency Response
UNDERWRITERS LABORATORIES (UL)	
UL 246	(2011; Reprint Feb 2013) Hydrants for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 312	(2010) Check Valves for Fire-Protection Service
UL 789	(2004; Reprint Feb 2013) Standard for Indicator Posts for Fire-Protection Service

## 1.2 DESIGN REQUIREMENTS

- A. Water Distribution Main: Provide water distribution mains indicated as 4 through 12 inch diameter pipe sizes of ductile-iron, cast iron or steel pipe. Also provide water main accessories, gate valves and check valves as specified and where indicated.

## 1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product Data
  - 1. Piping Materials
  - 2. Water distribution main piping, fittings, joints, valves, and coupling
- B. Test Reports

1. Bacteriological Disinfection
2. Test results from commercial laboratory verifying disinfection

C. Certificates

1. Water distribution main piping, fittings, joints, valves, and coupling
2. Shop-applied lining [and coating]
3. Lining
4. Fire hydrants
5. Displacement Type Meters
6. Compound Type Meters

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

D. Manufacturer's Instructions

1. Delivery, storage, and handling installation procedures for water piping.

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

- A. Delivery and Storage: Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store [plastic piping, jointing materials and] rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, and valves free of dirt and debris.
- B. Handling: Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

#### **1.5 PERFORMANCE REQUIREMENTS**

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

### **PART 2 - PRODUCTS**

All products shall conform to Buy American Act.

#### **2.1 WATER DISTRIBUTION MAIN MATERIALS**

A. Piping materials

1. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F2389. Grooved pipe couplings and fittings shall be from the

same manufacturer. 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/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors.

**B. Joints and Jointing Material:**

1. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:
  - a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310
  - b. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).
  - c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
  - d. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 110 degrees C (230 degrees F).
  - e. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.
  - f. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

**C. Steel Piping**

1. Pipe and Fittings: Pipe, AWWA C200. Fittings, AWWA C208 and to AWWA C200, with reference to the requirements specified therein for "Special Sections." Ends of pipe and fittings shall be suitable for the joints and jointing materials used.
  - a. Pipe shall be welded or seamless with plain or shouldered and grooved ends in accordance with AWWA C606 for use with mechanical couplings or bell-and-spigot ends with rubber gaskets. Bell-and-spigot ends for sizes less than 6 inches diameter shall be as required by AWWA C200.
  - b. Fittings and specials shall be made of the same material as the pipe. Specials and fittings may be made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. The thickness rating of pipe fittings and specials shall be not less than the thickness specified and the pressure rating calculated for the pipe with which they are used. Protective materials for fittings and specials shall be as specified for the pipe. Specials and fittings that cannot be mechanically lined, coated, and wrapped shall be lined, coated, and wrapped by hand, using the same material used for the pipe with the same number of applications of each material, smoothly applied.

## **2.2 VALVES**

**A. Gate Valves**

1. Valves shall be provided on supplies to equipment and fixtures. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Steel valves shall conform to ASME B16.34.



B. Check Valves

1. Swing-check type, AWWA C508 or UL 312. Valves conforming to: (1) AWWA C508 shall have iron or steel body and cover and flanged ends, and (2) UL 312 shall have cast iron or steel body and cover, flanged ends. Materials for UL 312 valves shall conform to the reference standards specified in AWWA C508. Valves shall have clear port opening. Valves shall be weight-loaded where indicated. Flanges shall be Class 125 conforming to ASME B16.1. In lieu of flanged ends, valves may have grooved or shouldered ends suitable for grooved or shouldered type joints. Valves shall be of one manufacturer.

C. Propeller Type Meters

1. Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall open and shall read in cubic feet. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder-type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C703.

## 2.3 WATER SERVICE LINE MATERIALS

A. Piping Materials

1. Steel Piping and Associated Fittings
  - a. Pipe, ASTM A53/A53M, Standard Weight, zinc-coated. Fittings, ASME B16.4, Class 125, zinc coated; or ASME B16.3, Class 150, zinc coated, threaded.
  - b. Protective materials for steel pipe less than 3 inches, except as otherwise specified, shall be mechanically applied in a factory or plant especially equipped for the purpose. The materials shall, unless otherwise indicated on the drawings, consist of [one of the following] [the following] for the indicated pipe material and size:
  - c. Pipe and fittings less than 3 inches in diameter shall be thoroughly cleaned of foreign material by wire brushing and solvent cleaning, and then given 1 coat of coal-tar primer and 2 coats of coal-tar enamel conforming to AWWA C203; threaded ends of pipe and fittings shall be adequately protected prior to coating.
2. Cast-Iron Piping and Associated Fittings
  - a. Pipe, ASTM A74-13a, Standard Weight, zinc-coated. Fittings, ASME B16.1, Class 125, zinc coated; or ASME B16.3, Class 150, zinc coated, threaded.

B. Insulating Joints

1. Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

C. Water Service Line Appurtenances

1. Corporation Stops: Ground key type; bronze, ASTM B61 or ASTM B62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.
2. Curb or Service Stops: Ground key, round way, inverted key type; made of bronze, ASTM B61 or ASTM B62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.
3. Service Clamps: Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

4. Dielectric Fittings: Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.
5. Check Valves: Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.
6. Gate Valve 3 Inch Size and Larger: Gate valves 3 inch size and larger in aboveground locations, AWWA C500 or UL 262 and of one make. Valves conforming to: (1) AWWA C500 shall be outside-screw-and-yoke rising-stem type with flanged ends and double-disc gates. Valves, UL 262, shall be outside-screw-and-yoke type, shall be designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Provide valves with handwheels that open by a counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.
7. Displacement Type Meter: Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in cubic feet. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C700.
8. Disinfection
  - a. Chlorinating materials shall conform to the following:
    - 1) Chlorine, Liquid: AWWA B301.
    - 2) Hypochlorite, Calcium and Sodium: AWWA B300.

## 2.4 CHEMICAL MONITORING ENCLOSURE

- A. Chemical monitoring enclosure shall be insulated and completely removable and lockable, with access panel doors and built-in heater. Enclosure shall be certified ASSE 1060. Enclosure shall be designed to support a minimum vertical load of 100psf and withstand wind gusts up to 140mph.
- B. Enclosure Box
  1. Enclosure skin shall be of minimum 18 gauge reinforced aluminum sheeting meeting ASTM B209, with bracing of 6063-T52 aluminum meeting ASTM B221. No wood or particle board shall be used in the construction of the enclosure box.
  2. Four (4) drains shall be provided, sized for full port backflow discharge and designed for one-way exit, inhibiting intrusion of debris and/or vermin.
  3. Enclosure shall be anchored to concrete pad from within the enclosure with steel anchors. Anchor pads shall be galvanized steel.
  4. Color to be Federal Brown.
- C. Insulation
  1. Insulation shall be minimum 1-1/2" thick unicellular, non-wicking insulation and shall form a monolithic bond with metal frame and skin. The following values shall be met:
    - a. R-Value 10
    - b. Compressive strength 51 psi
    - c. Flame point 325°F
    - d. Water absorption 0.037 psf
    - e. Porosity 91%
- D. Keys
  1. Contractor shall provide two (2) keys to Contracting Officer Representative upon substantial completion. Each key shall be capable of opening all panel door locks.
- E. Approved Manufacturers:

1. HotBox Enclosures
2. WattsBox
3. Engineer Approved equal

## **2.5 ELECTRICAL WORK**

### **A. NEMA Heater**

1. Chemical monitoring enclosure shall be provided with two (2) heaters to protect equipment from exterior temperatures to -30°F and be thermostatically controlled. UL or ETL listed self-regulating cable or wall mounted air heater(s) will be sized to maintain the equipment at +40°F, in accordance with NFPA 3-3.1.8 and 3-6.1.3.2. Heat source shall be mounted a minimum of 7" above the slab unless it is UL or ETL certified and NEC approved for submersion. Power sources shall be protected with a ground fault interrupting receptacle, UL 943, NEMA 3R, inside the enclosure. Provide separate 20 amp circuits for each heater.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF PIPELINES**

#### **A. General Requirements for Installation of Pipelines**

1. These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

#### **B. Location of Water Lines**

1. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line.

#### **C. Pipe Laying and Jointing**

1. Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines.
2. Connections to Existing Water Lines
  - a. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
3. Flanged Pipe: Flanged pipe shall only be installed above ground or with the flanges in valve pits.

#### **D. Special Requirements for Installation of Water Mains**

1. Installation of Steel Piping
  - a. Unless otherwise specified, install pipe and fittings in accordance with AWWA M11, Chapter 12, "Transportation, Installation, and Testing." Apply protective coating for aboveground piping as specified in Section [\_\_\_\_\_].

- b. Jointing: Make rubber-gasketed bell-and-spigot joints with the gaskets previously specified for this type joint, using an approved lubricant recommended by the pipe manufacturer; assemble in accordance with the recommendations of the pipe manufacturer. Make welded joints in accordance with AWWA C206 and with the recommendations given for installation of pipe in AWWA M11, Chapter 12, "Transportation, Installation, and Testing." Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full-size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without straining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Make grooved type joints with the couplings specified for this type joint connecting pipe with roll-grooved ends or pipe with welded-on cut-grooved adapters, each with dimensions as previously specified for this type joint. Groove pipe ends in the field only with approved groove rolling equipment and groove adapters in the field only with approved groove cutting equipment; groove rolling and groove cutting equipment shall be designed especially for the purpose and produced by a manufacturer of grooved joint couplings. Obtain approval for field-cut grooves before assembling the joint. Make shouldered type joints with the couplings specified for this type joint connecting pipe with the shouldered ends specified for this type joint. Assemble grooved and shouldered type joints in accordance with the recommendations of the coupling manufacturer.] [Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled. Finish joints on piping with cement-mortar lining as specified in Appendix on Field Joints in AWWA C205. Finish joints on piping with coal-tar enamel or coal-tar epoxy coating by cleaning, priming, coating, and wrapping with a cold-applied tape coating conforming to and applied in accordance with AWWA C209.
- c. Allowable Offsets: For pipe with bell-and-spigot rubber-gasket joints, maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets shall be 5 degrees unless a lesser amount is recommended by the manufacturer. Short-radius curves and closures shall be formed by short lengths of pipe or fabricated specials specified.
- 2. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. [Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation ], except as otherwise indicated. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.
- 3. Location of Meters: Meters shall be installed at the locations shown on the drawings. The meters shall be positioned to allow for reading and ease of removal or maintenance.
- E. Disinfection: Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water

until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

### **3.2 FIELD QUALITY CONTROL**

- A. Field Tests and Inspections: Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.
- B. Testing Procedure
  - 1. Hydrostatic Testing: Test water mains and water service lines in accordance with the applicable specified standard. Where water mains and water service lines provide fire service, test in accordance with the special testing requirements given in paragraph entitled "Special Testing Requirements for Fire Service." Test PVC plastic water mains and water service lines made with PVC plastic water main pipe in accordance with the requirements of AWWA C605 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in AWWA C605, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing.
  - 2. Leakage Testing: For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

### **3.3 CLEANUP**

- A. Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

**-- END OF SECTION --**