

VA PALO ALTO  
Building 520 - Pod A Courtyard

BID SET

**VA – Palo Alto Health Care System**

Palo Alto, California

**DVA PROJECT NO. 640-13-132P**

May 2, 2014



01-01-14

**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS**

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**SECTION 00 01 15  
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The drawings listed below accompanying this specification form a part of the contract.

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C0.1	General Notes
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**ARCHITECTURAL**

AS0-1	Overall Site Plan
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**ELECTRICAL**

ES0-1	Symbol Legend, Abbreviations, General Notes and Fixture Schedule
ES1-1	Overall Site Plan
ES1-2	Site Plan – Electrical
ES2-1	Details

**ARTWORK**

ART 1	Site Plan / Renders
ART 2	Plan, Elevation, Details
ART 3	Structural

--- END ---

SECTION 01 00 00  
GENERAL REQUIREMENTS

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**1.01 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 new site work to include demolition of hardscape, planting, lighting and utilities as indicated on the drawings and include new hardscape, planting, lighting, drainage and power plus addition of new courtyard canopy and new public artwork as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer..
- C. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Contracting Officer's Representative (COR) in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than five work days unless otherwise designated by the COR.
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b) (2) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training:
  - 1. All management employees of general contractor or subcontractors shall have the 30-hour and all other employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 2. Submit training records of all such employees for approval before the start of work.

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

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, walks, grading, drainage, and electrical work, and utility systems, necessary removal of existing site elements and construction and certain other items. The scope of work includes coordination with other on-going projects adjacent to the area of work and existing below grade utilities within the area of work.
- B. This scope of work includes demolition of existing site elements such as paving, planting and lighting and provides for new paving, planting, lighting, seating areas, low concrete walls, and new canopy with a painted steel frame cast in concrete footings.



- C. BID ALTERNATE NO.1: Delete canopy in its entirety, labeled as "New Canopy" on Drawing AS2-1, and all canopy associated lights, footings, and finishes.

### 1.03 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. After award of contract, specifications and drawings will be available for download from a link provided by the Contracting Officer's Representative
- B. The Contractor shall maintain on the job site one (1) printed set of specifications, one (1) printed set of drawings, one (1) printed copy of all RFI's and any documents that modify the original specifications and drawings.

### 1.4 ACCIDENT PREVENTION

- A. Refer to 01 35 26 Safety Requirements Section 1.04
- B. Whenever the Contracting Officer becomes aware of any noncompliance with safety requirements or any condition which poses a serious or imminent danger to the health or safety of personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.
- C. The Contractor shall insert the above clause with appropriate changes in the designation of the parties in subcontracts.

### 1.5 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan:
  - 1. **The Security Plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project. for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted Security Plan.**
  - 2. The Contractor is responsible for assuring that all sub-Contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
  - 1. Contractor and subcontractor employees shall not enter the project site without an appropriate badge. They will be subject to inspection of their personal effects when entering or leaving the project site.

2. The Contractor shall create an Employee Daily Log of all personnel working on the site. The Employee Daily Log shall contain the employee's (a) Full Name, (b) Employer/Company Name and (c) Occupation/Trade. The Employee Daily Log shall be submitted with the Contractor's Daily Work Report.
3. All work on the contract shall be performed between 7:00 am and 5:00 pm Monday through Friday, excluding National Holidays, unless approved in writing by the Contracting Officer. For working outside the these hours, the Contractor shall give two weeks' notice to the Contracting Officer's Representative so that oversight, security and escort arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this specification.
4. No photography of VA premises is allowed without written permission of the VA Public Affairs Officer. Submit request to the Contracting Officer's Representative.
5. The VA Police are Federal Police Officers with full authority to make arrests, investigate crimes and issue traffic citations. Citations issued require an appearance in the Federal District Court and/or payment of a fine. Speed limits and other driving and parking codes are strictly enforced. Any vehicle left unattended for more than a few minutes may be cited by the VA Police.
6. Sexual harassment is strictly prohibited. This includes deliberate or unsolicited verbal comments or gestures of a sexual nature, unwelcome sexual advances, requests for sexual favors and/or other unwelcome verbal or physical conduct of a sexual nature.
7. Possession or use of non-prescription drugs or alcohol, including beer and wine, on the Health Care System grounds is strictly prohibited. Possession of firearms, knives with blades over 4", ammunition, explosive devices and any item that may be considered an offensive weapon is strictly prohibited. This includes carrying such items in vehicles.
8. The Health Care System does not have the equipment, facilities, or personnel trained to handle serious injuries. Call 911 for emergency medical assistance and notify the Contracting Officer's Representative and the VA Police.
9. Vehicle authorization requests shall be required for any vehicle entering the site and such requests shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies. Separate permits shall be issued for Contractor and subcontractor employees for parking in designated areas only.
10. VA reserves the right to shut down the project site and order Contractor's employees and subcontractors off the premises in the event of a national emergency or local disaster. The Contractor may return to the site only with the written approval of the Contracting Officer's Representative.

C. Guards: NOT USED

D. Key Control:

1. NOT USED

E. Document Control:

1. NOT USED

## 1.6 FIRE SAFETY

A. Refer to 01 35 26 Safety Requirements Section 1.13

B. When work requires removal of any ceiling tiles for more than 4 hours in a 24-hour period in areas protected by a fire sprinkler system where the sprinkler heads are made less effective by space above the ceiling exceeding 18 inches, temporary provision shall be made for supplemental heat detectors with annunciation capability to the building/campus fire alarm system. Programmed wireless heat detector sensors (Honeywell #5809 or equal) with associated receiver (Honeywell #5881 or equal) and control panel (Honeywell Vista-20P or equal) are acceptable. Tie-in of the control panel to the building/campus fire alarm system will be made by the VA. Fifteen (15) days advance notice shall be given to the VA for scheduling the tie-in.

C. Hot Work: Any welding, cutting metal or other burning or spark producing operations will require a hot work permit. Welding and/or burning operations are allowed only during normal working hours. Coordinate with Contracting Officer's Representative to obtain permits from the Facility Safety Officer at least 24 hours in advance. **Evidence of training of all personnel assigned to be a fire watch shall be provided before Hot Work Permits will be issued.** A fire watch is required for all hot work unless specified differently on the permit. The fire watch shall have fire extinguishing equipment readily available and be trained in its use and be familiar with facilities for sounding an alarm in the event of a fire. They shall watch for fires in all exposed areas, try to extinguish then otherwise sound the alarm. A fire watch shall be maintained for at least 30 minutes after completion of hot work.

D. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily. Waste and debris will not be disposed of on station or in VA trash containers or dumpsters. The Contractor shall provide their own bin or dumpster, however, the use and location of such must be approved in writing by the Contracting Officer's Representative. Construction waste and debris will not be accumulated in corridors or other building areas where it might cause a fire or safety hazard.

E. Smoke/fire Barrier Penetrations: Any penetrations to smoke or fire barrier walls, ceilings or floor slabs shall be properly sealed immediately with Hilti Fire Stop 601 or 635 for walls and ceilings and Hilti Fire Stop 657 for floor penetrations or approved equal.

## 1.7 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer's Representative. The

Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer's Representative and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at their expense upon completion of the work. With the written consent of the Contracting Officer's Representative, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, as prescribed by the Contracting Officer's Representative, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer's Representative. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law, code or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the Contracting Officer's Representative.
- E. Workmen are subject to rules of the VA Campus applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of the VA Campus as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by the VA in quantities sufficient for not more than two work days. Provide unobstructed access to VA Campus areas required to remain in operation.
- G. Utilities Services: Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems, they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Contracting Officer's Representative. All such actions shall be coordinated with any Utility Company involved:
- H. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, six-foot minimum height, around the construction area, material storage areas and dumpsters/waste locations. Contractor shall provide and maintain visual screening fabric for

all fencing. Contractor shall provide gates as required for access with necessary hardware including hasps and locks. All gates shall be locked when no workers are present. Contractor shall coordinate with the VA to assure VA access at any time. Contractor shall remove the fence when directed by Contracting Officer's Representative.

- I. Work areas will be vacated by Government and turned over to Contractor after date of Notice to Proceed and after all pre-construction activities have been completed and pre-construction submittals have been approved by the Contracting Officer's Representative.
- J. When a building is turned over to Contractor, Contractor shall accept entire responsibility therefore.
  1. Contractor shall make arrangements for pre-inspection of site with Fire Department (VA or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.
- K. Utilities Services: Maintain existing utility services for the VA Campus at all times.
  1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Contracting Officer's Representative. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Contracting Officer's Representative prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
  2. Contractor shall submit a request to interrupt any such services or systems to Contracting Officer's Representative, **in writing, four (4) weeks in advance of proposed interruption.** Request shall state reason, date, exact time of, and approximate duration of such interruption. Approved outage dates are not guaranteed and are subject to VA operational requirements.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of the VA. Interruption time approved by Contracting Officer's Representative may occur at other than Contractor's normal working hours.
  4. In case of a contract construction emergency, service will be interrupted on approval of Contracting Officer's Representative. Such approval will be confirmed in writing as soon as practical.
  5. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service connection to the construction project, for such items as water, sewer,

- electricity or gas, payment of such fee shall be paid by the Contractor unless specifically relieved in writing by the Government.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- M. To minimize interference of construction activities with flow of VA Campus traffic, comply with the following:
1. The Contractor shall not block any road or street, walkway or building egress without requesting approval from the Contracting Officer's Representative. Submit written request five workdays prior to proposed blockage. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new work crosses existing roads, at least one lane must be open to traffic at all times.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Contracting Officer's Representative.
- N. Coordinate this contract with other construction operations as directed by Contracting Officer's Representative. This includes the scheduling of traffic and the use of roadways.

## **1.8 ALTERATIONS**

- A. NOT USED

## **1.9 INFECTION PREVENTION MEASURES**

- A. Refer to 01 35 26 Safety Requirements Section 1.12 & 1.13
- B. Implement the requirements of VA's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Contracting Officer's Representative and Facility ICRA team for review for compliance with contract requirements.

## **1.10 DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be

- removed from present locations in such a manner as to prevent damage. Store such items where directed by Contracting Officer's Representative.
2. Items not reserved shall become property of the Contractor and be removed by Contractor.
  3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the VA during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
  4. The Contractor is required to alert the VA immediately in the event any known or suspected hazardous materials are disturbed or will need to be disturbed before proceeding with work. Hazardous materials, such as PCB's, asbestos, lead paint, cleaning solutions and other harmful chemicals shall be disposed of in accordance with federal, state and local laws and regulations. In case of an accidental spill of hazardous materials, the Contractor shall take immediate action to contain the spill and notify the Contracting Officer's Representative. Washing cement, plaster, paint, oil or grease, solvents, etc. into any drains is strictly prohibited. **REPORT ANY ACCIDENTAL SPILLS THAT MAY RUN INTO STORM DRAINS IMMEDIATELY TO ENGINEERING SERVICE AT EXTENSION 62468.**
  5. Contractor shall provide a monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling per SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

#### **1.11 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's Representative.
- 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's Representative may have the necessary work performed and charge the cost to the Contractor.

#### **1.12 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the Contracting Officer's Representative. Existing work to be altered or extended and that which is found to be defective in any way, shall be reported to the Contracting Officer's Representative before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in 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, computer network, etc.) which are indicated on drawings or reasonably discovered during execution of the work and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings for which locations are unknown and not reasonably discovered will be considered for adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.13 PHYSICAL DATA**

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

#### **1.14 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the COR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the COR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the



COR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

**(FAR 52.236-17)**

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

Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.

- E. 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**

- F. 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.
- G. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- H. Contractor shall deliver two approved completed sets of as-built drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.

- I. 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 the VA Campus and, when authorized by the Contracting Officer's Representative, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed transitions.

### **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's Representative. If the equipment is not installed and maintained in accordance with the following provisions, the Contracting Officer's Representative will withdraw permission for use of the equipment.
  2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before use and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.

- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

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

A. NOT USED

#### **1.19 TEMPORARY TOILETS**

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

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

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. If applicable, the amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer's Representative, shall install and maintain all necessary temporary connections and distribution lines, 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 equipment.
- C. Contractor shall install meters at Contractor's expense and furnish the Contracting Officer's Representative a monthly record of the Contractor's usage of electricity as required.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the VA Campus electrical distribution system. 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.
- F. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the VA Campus water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
  2. Maintain connections, pipe, fittings and fixtures and conserve water use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Contracting Officer's Representative's discretion) of use of water from VA Campus system at no cost.
- G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished or reimbursed by the Contractor at Contractor's expense.

#### **1.21 NEW TELEPHONE EQUIPMENT**

- A. NOT USED

#### **1.22 TESTS**

- A. CONDUCT TESTS REQUIRED IN VARIOUS SECTIONS OF SPECIFICATIONS IN PRESENCE OF THE CONTRACTING OFFICER'S REPRESENTATIVE. CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, INSTRUMENTS, AND FORMS, TO CONDUCT AND RECORD SUCH TESTS. SUBMIT ALL TEST RESULTS IN ACCORDANCE WITH SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

#### **1.23 INSTRUCTIONS**

- A. NOT USED

#### **1.24 GOVERNMENT-FURNISHED PROPERTY**

- A. Not Used

#### **1.25 RELOCATED EQUIPMENT ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Contracting Officer's Representative.
- C. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.

#### **1.26 CONSTRUCTION SIGN**

- A. Not Used.

### **1.27 SAFETY SIGN**

- A. Provide a Safety Sign where directed by Contracting Officer's Representative. Face of sign shall be 3/4 inch thick exterior grade plywood. Provide two four by four inch posts extending full height of sign and three feet into ground. Set bottom of sign level at four feet above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted and approved by Contracting Officer's Representative.
- C. Maintain sign and remove it when directed by Contracting Officer's Representative.
- D. Detailed drawing of a safety sign showing required legend and other characteristics of sign will be available from the Contracting Officer's Representative.
- E. Post the number of accident free days on a daily basis.

### **1.28 PHOTOGRAPHIC DOCUMENTATION – NOT USED**

### **1.29 FINAL ELEVATION DIGITAL IMAGES – NOT USED**

### **1.30 HISTORIC PRESERVATION**

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

### **1.31 VA TRIRIGA CPMS**

- J. VA contractors, selected by award to perform work, are required to get access to the VA TRIRIGA CPMS. The TRIRIGA CPMS is the management and collaborative environment that the VA uses for all Major, Minor and Non-Recurring Maintenance (NRM) projects within the Office of Construction & Facilities Management (CFM), Veterans Health Administration (VHA), National Cemetery Administration (NCA), and the Veterans Benefits Administration (VBA).

The contractor is solely responsible for acquiring access to the VA TRIRIGA CPMS. To gain access to the VA TRIRIGA CPMS the contractor is encouraged to follow the licensing process outline as specified below:

- K. Requirement: TRIRIGA is the management and collaborative environment that VA uses for all construction projects. VA requires its contractors to procure TRIRIGA access as part of the cost of performance for a VA construction related contract.

- L. Access Request and Payment can be made through the following URL:

<https://valicensing.oncfi.com/>

Inquiries or to request additional services, contact the following:

Craig Alsheimer, Federal Account Manager  
Computerized Facility Integrations, LLC  
18000 West Nine Mile Road  
Suite 700  
Southfield, MI 48075  
Email: calsheimer@gocfi.com

Phone: 248-557-4234 Extension 6010; 410-292-7006

- M. Process:
1. Once the contractor has been notified by VA of the award and a unique contract number, the contractor can enter a request for access to TRIRIGA at URL <https://valicensing.oncfi.com/>
  2. CFI will process the request for access and payment. CFI will create the USER ID and a password. Security provisions required to align the contractor to the Contract Number will be entered and an email will be generated and submitted to the requestor.
  3. CFI will also provide standard terms and conditions related to the transaction and use agreement.

- - - E N D OF SECTION - - -

**SECTION 01 32 16.15  
PROJECT SCHEDULES**

**PART 1- GENERAL**

**1.01 DESCRIPTION:**

A. THE CONTRACTOR SHALL DEVELOP A PLAN AND SCHEDULE DEMONSTRATING FULFILLMENT OF THE CONTRACT REQUIREMENTS (PROJECT SCHEDULE). THE CONTRACTOR SHALL KEEP THE PROJECT SCHEDULE UP-TO-DATE AND SHALL UTILIZE IT FOR SCHEDULING, COORDINATING AND MONITORING WORK UNDER THIS CONTRACT (INCLUDING ALL ACTIVITIES OF SUBCONTRACTORS, EQUIPMENT VENDORS AND SUPPLIERS).

**1.2 CONTRACTOR'S REPRESENTATIVE**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative.
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this contract.

**1.3 SCHEDULES AND UPDATES**

- A. The contractor shall provide monthly, to the Contracting Officer's Representative an updated Project Schedule.
- B. The contractor shall be responsible for the correctness and timeliness of any updated Project Schedule and payment requests.

**1.4 PROJECT SCHEDULE SUBMITTAL**

- A. **The Project Schedule shall be submitted for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted Project Schedule.** The submittal shall include project duration, phase completion dates, activities/events duration and activities/event allocated/loaded cost. Each activity/event on the schedule shall contain a name/number ID, description, duration, allocated cost, early start date, early finish date, late start date, late finish date and total float. The Project Schedule shall reflect the entire contract duration as defined in the contract.

Changes/delays shall be entered at the first update after receipt of approval. The Contractor shall provide written requests for time extensions as a result of contract changes/delays.

C. The Project Schedule shall constitute the approved Baseline Schedule until subsequently revised.

D. The Project Schedule shall include all major work.

#### **1.5 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 shall equal the total 90% contract price. The remaining 10% will be held until all requirements of the contract have been completed. The Contractor shall prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cost curves indicating graphically the total percentage of work activity/event dollar value scheduled versus actual.

D. The Contractor shall cost load activities/events for all work. Periodic payments shall be approved only for work activities that have been 100% completed and for equipment and material that has been delivered to the work site.

#### **1.6 PROJECT SCHEDULE REQUIREMENTS**

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

1. Show activities/events such as:

- a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
- b. Contracting Officer's Representative's and Architect/Engineer's review and approval of shop drawings, equipment schedules, samples, templates, or similar items.
- c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.



- d. Test, balance and adjustment of various systems and pieces of equipment, delivery of maintenance and operation manuals, instructions and maintenance tasks.
  - e. VA inspection and acceptance with a minimum duration of five work days at the end of each phase and immediately preceding any VA move required by the contract phasing for that phase.
3. Break up the work into activities/events with a duration no longer than one reporting period, except as to non-construction activities/events and any activities/events for which the Contracting Officer's Representative 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 14 work days.
  4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer's Representative. 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 Contracting Officer's Representative's approval of the Project Schedule.

**1.7 PAYMENT TO THE CONTRACTOR:**

- A. The Contractor shall be entitled to a monthly progress payment upon approval of costs as determined from the currently approved updated Project Schedule. Monthly payment requests/invoices shall include: a listing of all agreed upon project schedule changes and associated data and an updated Project Schedule.
- B. Approval of the Contractor's invoice shall be contingent on, among other factors, the submittal of a satisfactory monthly update of the Project Schedule.

### **1.8 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the Contracting Officer's Representative 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 Contracting Officer's Representative three work days in advance of the scheduled update meeting.

### **1.9 RESPONSIBILITY FOR COMPLETION**

- A. If it becomes apparent from the current revised monthly Project 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 Contracting Officer's Representative 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.

### **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, data and supporting evidence 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 required for 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 Representative's determination as to the total number of days of contract extension will be based upon the current Project Schedule for the time period in question and any other relevant information.

- B. Actual delays in activities/events which, according to the schedule, do not affect the extended and predicted contract completion date shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer's Representative will, within a reasonable time after receipt of a request with justification and supporting information, review the facts and advise the Contractor in writing of the Contracting Officer's Representative's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer's Representative 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 request, a sketch showing all schedule logic revisions, duration changes, and cost changes for work in question and its relationship to other activities on the approved Project Schedule.

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples (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 Resident Engineer on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, the Contracting Officers Representative 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 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 E Mail, 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, 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 approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both Resident Engineer and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to Resident Engineer 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 Resident Engineer 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 (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to the Contracting Officers representative via E Mail.

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

**1.01 APPLICABLE PUBLICATIONS**

- A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
- B. American Society of Safety Engineers (ASSE):
  - A10.1-2011.....Pre-Project & Pre-Task Safety and Health Planning
  - A10.34-2012.....Protection of the Public on or Adjacent to Construction Sites
  - A10.38-2013.....Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations
- C. American Society for Testing and Materials (ASTM):
  - E84-2014.....Surface Burning Characteristics of Building Materials
- D. The Facilities Guidelines Institute (FGI):
  - FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities
- E. National Fire Protection Association (NFPA):
  - 10-2013.....Standard for Portable Fire Extinguishers
  - 30-2012.....Flammable and Combustible Liquids Code
  - 51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
  - 70-2014.....National Electrical Code
  - 70B-2013.....Recommended Practice for Electrical Equipment Maintenance
  - 70E-2012.....Standard for Electrical Safety in the Workplace
  - 99-2012.....Health Care Facilities Code
  - 241-2013.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
- F. The Joint Commission (TJC)
  - TJC Manual .....Comprehensive Accreditation and Certification Manual
- G. U.S. Nuclear Regulatory Commission
  - 10 CFR 20.....Standards for Protection Against Radiation
- H. U.S. Occupational Safety and Health Administration (OSHA):
  - 29 CFR 1904 ...Reporting and Recording Injuries & Illnesses
  - 29 CFR 1910 ...Safety and Health Regulations for General Industry
  - 29 CFR 1926 ...Safety and Health Regulations for Construction Industry
  - CPL 2-0.124.....Multi-Employer Citation Policy
- I. VHA Directive 2005-007

**1.02 DEFINITIONS**

- A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.

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

### 1.03 REGULATORY REQUIREMENTS

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

### 1.04 ACCIDENT PREVENTION PLAN (APP)

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



- iii. Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
- b. **BACKGROUND INFORMATION.** List the following:
  - i. Contractor;
  - ii. Contract number;
  - iii. Project name;
  - iv. Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
- c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
- d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
  - i. A statement of the employer's ultimate responsibility for the implementation of his SOH program;
  - ii. Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
  - iii. The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached;
  - iv. Requirements that no work shall be performed unless a designated competent person is present on the job site;
  - v. Requirements for pre-task Activity Hazard Analysis (AHAs);
  - vi. Lines of authority;
  - vii. Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;
- e. **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
  - i. Identification of subcontractors and suppliers (if known);
  - ii. Safety responsibilities of subcontractors and suppliers.
- f. **TRAINING.**
  - i. Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
  - ii. Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
  - iii. Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
  - iv. OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)
- g. **SAFETY AND HEALTH INSPECTIONS.**

- i. Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
    - ii. Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)
  - h. **ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative:
    - i. Exposure data (man-hours worked);
    - ii. Accident investigations, reports, and logs.
  - i. **PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:
    - i. Emergency response ;
    - ii. Contingency for severe weather;
    - iii. Fire Prevention ;
    - iv. Medical Support;
    - v. Posting of emergency telephone numbers;
    - vi. Prevention of alcohol and drug abuse;
    - vii. Site sanitation (housekeeping, drinking water, toilets);
    - viii. Night operations and lighting ;
    - ix. Hazard communication program;
    - x. Welding/Cutting "Hot" work ;
    - xi. Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
    - xii. General Electrical Safety
    - xiii. Hazardous energy control (Machine LOTO);
    - xiv. Site-Specific Fall Protection & Prevention;
    - xv. Excavation/trenching;
    - xvi. Asbestos abatement;
    - xvii. Lead abatement;
    - xviii. Crane Critical lift;
    - xix. Respiratory protection;
    - xx. Health hazard control program;
    - xxi. Radiation Safety Program;
    - xxii. Abrasive blasting;
    - xxiii. Heat/Cold Stress Monitoring;
    - xxiv. Crystalline Silica Monitoring (Assessment);
    - xxv. Demolition plan (to include engineering survey);
    - xxvi. Formwork and shoring erection and removal;
    - xxvii. PreCast Concrete.

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

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

#### 1.05 ACTIVITY HAZARD ANALYSES (AHAS)

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
  - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
  - 2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
    - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
    - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
  - 3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 [ ] calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to Contracting Officer Representative.

#### **1.06 PRECONSTRUCTION CONFERENCE**

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

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

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

removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

## 1.08 TRAINING

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

## 1.09 INSPECTIONS

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

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

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

- A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.
- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

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

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

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

## 1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Contracting Officer's Representative. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class II**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:
  1. Class I requirements:
    - a. During Construction Work:
      - i. Notify the Contracting Officer Representative.
      - ii. Execute work by methods to minimize raising dust from construction operations.
      - iii. Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
    - b. Upon Completion:
      - i. Clean work area upon completion of task
      - ii. Notify the Contracting Officer Representative.
  2. Class II requirements:
    - a. During Construction Work:
      - i. Notify the Contracting Officer Representative.
      - ii. Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
      - iii. Water mist work surfaces to control dust while cutting.
      - iv. Seal unused doors with duct tape.
      - v. Block off and seal air vents.
      - vi. Remove or isolate HVAC system in areas where work is being performed.
    - b. Upon Completion:
      - i. Wipe work surfaces with cleaner/disinfectant.
      - ii. Contain construction waste before transport in tightly covered containers.
      - iii. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.

- iv. Upon completion, restore HVAC system where work was performed
      - v. Notify the Contracting Officer Representative.
  - 3. Class III requirements:
    - a. During Construction Work:
      - i. Obtain permit from the Contracting Officer Representative.
      - ii. Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
      - iii. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
      - iv. Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
      - v. Contain construction waste before transport in tightly covered containers.
      - vi. Cover transport receptacles or carts. Tape covering unless solid lid.
    - b. Upon Completion:
      - i. Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
      - ii. Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
      - iii. Vacuum work area with HEPA filtered vacuums.
      - iv. Wet mop area with cleaner/disinfectant.
      - v. Upon completion, restore HVAC system where work was performed.
      - vi. Return permit to the Contracting Officer Representative.
- 4. Class IV requirements:
  - a. During Construction Work:
    - i. Obtain permit from Contracting Officer Representative // or Government Designated Authority.
    - ii. Isolate HVAC system in area where work is being done to prevent contamination of duct system.
    - iii. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
    - iv. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
    - v. Seal holes, pipes, conduits, and punctures.
    - vi. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.



- vii. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.
        - b. Upon Completion:
          - i. Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
          - ii. Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
          - iii. Contain construction waste before transport in tightly covered containers.
          - iv. Cover transport receptacles or carts. Tape covering unless solid lid.
          - v. Vacuum work area with HEPA filtered vacuums.
          - vi. Wet mop area with cleaner/disinfectant.
          - vii. Upon completion, restore HVAC system where work was performed.
          - viii. Return permit to the Contracting Officer Representative.
- C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:
  - 1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
  - 2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
    - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with Contracting Officer Representative and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
    - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
    - c. Class III & IV - Seal all penetrations in existing barrier airtight
    - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
    - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
    - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
  - 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
  - 2. Barrier Doors: Self Closing One-hour fire-rated solid core wood in steel frame, painted
  - 3. Dust proof one-hour fire-rated.
  - 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
  - 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
  - 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
  - 7. Disinfectant: Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. **The Dust Control Program shall be submitted for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 Calendar days Prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted Dust Control Program**
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
  3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
  5. The contractor shall not haul debris through patient-care areas without prior approval of the Contracting Officer Representative and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
  6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
  7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- I. Final Cleanup:
1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.

2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

### 1.13 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and **submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted FIRE SAFETY PLAN** This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  2. Install one-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
  3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

- J. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- K. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.
- L. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.
- M. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative to obtain permits from Facility Safety Officer at least twenty four (24) hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- N. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.
- O. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- P. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

#### **1.14 ELECTRICAL**

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.
  - 1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-

- energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
  2. Verification of the absence of voltage after de-energization and lockout/tagout is considered “energized electrical work” (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
  3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.
- D.** Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
- E.** Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. “Assured Equipment Grounding Conductor Program” only is not allowed.

#### **1.15 FALL PROTECTION**

- A.** The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
  2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
  3. Fall protection while using a ladder will be governed by the OSHA requirements.

#### **1.16 SCAFFOLDS AND OTHER WORK PLATFORMS**

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

inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person's name and signature;
2. Dates of initial and last inspections.

#### **1.17 CRANES**

- A. All crane work shall comply with 29 CFR 1926 Subpart CC.
- B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date of November 10, 2014.
- C. A detailed lift permit shall be submitted 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing. The lift will not be allowed without approval of this document.
- D. Crane operators shall not carry loads
  1. over the general public or VAMC personnel
  2. over any occupied building unless
    - a. the top two floors are vacated
    - b. or overhead protection with a design live load of 300 psf is provided

#### **1.18 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)**

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

#### **1.19 WELDING AND CUTTING**

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

#### **1.20 LADDERS**

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.

1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
  2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

#### **1.21 FLOOR & WALL OPENINGS**

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements.
- C. All floor openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
  2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.

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

**EP-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.

**EP-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.

**EP-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

**EP-4. SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - A. 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Representative to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Contracting Officer's Representative and the Contracting Officer in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. (Work cannot proceed without an accepted EPP). 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.

**EP-5. PROTECTION OF ENVIRONMENTAL RESOURCES**

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

- to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
    - a. Reuse or conserve the collected topsoil sediment as directed by the Contracting Officer's Representative. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
    - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
  5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  6. Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
  7. Manage and control spoil areas on Government property.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.

10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the Contracting Officer's Representative.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
- D. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California's Air Pollution Statute, Rule, or Regulation and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free

from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.

3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- E. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer's Representative. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

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

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

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
  - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95

GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	//--//
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

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

- G. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Contracting Officer's Representative. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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

### **1.1 DESCRIPTION**

This specification covers the requirements for management of non-hazardous building construction and demolition waste.

### **1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING
- C. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- D. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Reserved items which are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- F. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- G. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

### **1.3 GOVERNMENT POLICY**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building construction products.
- B. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators and facilitate their recycling.
- C. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling and any revenues or savings obtained from salvage or recycling shall accrue to the Contractor.
- D. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by federal, state and local regulations.

### **1.4 PLAN**

- A. Conduct a site assessment to estimate the types of materials that will be generated by demolition at the site. The Whole Building Design Guide website (<http://www.wbdg.org>) has a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects
- B. Develop and implement procedures to reuse and recycle materials to the greatest extent feasible based upon the contract, the construction and

demolition debris management plan, the estimated quantities of materials, and the availability of recycling facilities.

- C. Prepare and submit to the Contracting Officer's Representative a written demolition debris management plan. The Demolition Debris Plan shall be submitted for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted Demolition Debris Plan. Include, but not be limited to, the following information:

1. Contractor and project identification information;
2. Procedures to be used for debris management;
3. A listing of the materials to be reused, recycled, or taken to the landfill.
4. The names and locations of reuse and recycling facilities or sites.

#### 1.5 COLLECTION

- A. Provide necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

#### 1.6 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 law.
- B. Building or demolition materials with no practical use or that cannot be recycled shall be disposed of at a landfill or incinerator.

#### 1.7 REPORT

With each application for progress payment, the contractor shall submit a 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.

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**SECTION 01 81 11  
SUSTAINABLE DESIGN REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

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

**1.02 OBJECTIVES**

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

**1.03 RELATED DOCUMENTS**

- A. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT

**1.04 DEFINITIONS**

- A. Agrifiber Products: Composite panel products derived from agricultural fiber
- B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is

- composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight
  - D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
  - E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
  - F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
  - G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.
  - H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky
  - I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock
  - J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
  - K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims":  
[www.ftc.gov/bcp/grnrule/guides980427](http://www.ftc.gov/bcp/grnrule/guides980427)
  - L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site
  - M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured
  - N. Sealant: Any material that fills and seals gaps between other materials
  - O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.
  - P. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas

- Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

## 1.05 SUBMITTALS

- A. Sustainable Design Submittals:
1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
  2. Heat Island Effect:
    - a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.
  3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer's data on initial fixture lumens above 90° from nadir for all exterior lighting fixtures, and, for parking lot lighting, verification that the fixtures are classified by the IESNA as "full cutoff" (FCO); OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program.
  4. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns.
  5. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
  6. On-Site Renewable Energy Systems: Provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
  7. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
  8. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.
  9. Recycled Content: Submittals for all materials with recycled content (must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
    - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.

10. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation must include the following documentation:
  - a. Cost of each material or product, excluding cost of labor and equipment for installation
  - b. Location of product manufacture and distance from point of manufacture to the Project Site
  - c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
  - d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
  - e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB.
  - f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.
11. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
12. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
13. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
14. Seating: Provide manufacturer's product data verifying that all seating products meet the requirements of one of the following:
  - a. Greenguard certification
15. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
16. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
17. Blended Cement: It is the intent of this specification to reduce CO2 emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace portland cement as specified in Section 03 30 00, CONCRETE typically included in conventional construction. Provide the following submittals:
  - a. Copies of concrete design mixes for all installed concrete
  - b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
  - c. Quantities in cubic yards of each installed concrete mix

18. Green Housekeeping: Provide documentation that all cleaning products and meet the VOC limits and content requirements of this specification section.
- B. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Owner and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
    - a. Identify each reused or salvaged material, its cost, and its replacement value.
    - b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
    - c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
    - d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
    - e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.
  2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.
- C. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.

## 1.06 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS

## 2.01 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Site Clearing: Topsoil shall be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.
- B. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.
- C. Exterior Lighting Fixtures:
  - 1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
  - 2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
  - 3. No lighting of building facades or landscape features is permitted.
- D. Herbicides and Pest Control: Herbicides shall not be permitted, and pest control measures shall utilize EPA-registered biopesticides only.
- E. Landscape Irrigation: Use water-efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities).

Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 20% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements.
- F. Appliances and Equipment: All materials and equipment being installed that falls under the Energy Star or FEMP programs must be Energy Star or FEMP-rated. Eligible equipment includes motors, and more. Refer to each program's website for a complete list.
- G. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.
- H. The IPMVP provides guidance on situation-appropriate application of measurement and verification strategies.
- I. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.
  - 1. Salvaged materials: Use of salvaged materials reduces impacts of disposal and manufacturing of replacements.
- J. Recycled Content of Materials:
  - 1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.



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

<b>Category</b>	<b>Minimum Recycled Content</b>
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Fabrications	60% combined
Aluminum Fabrications	35% combined

--- E N D OF SECTION ---

**SECTION 02 41 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 017419 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. 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's Representative.. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required.

- 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, 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 buildings and structures, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new utility service lines.
- 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's 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 1500 mm (5 feet) 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's Representative. When Utility lines are encountered that are not indicated on the drawings, the Contracting Officer's Representative shall be notified prior to further work in that area.

**3.2 CLEAN-UP**

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

**--- E N D OF SECTION---**

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

**PART 1 - GENERAL**

**1.01 DESCRIPTION:**

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

**1.02 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Section 32 13 20, SITE CONCRETE
- C. Section 32 14 12 CONCRETE AND STONE PAVERS

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

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

**1.04 TOLERANCES:**

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

**1.05 REGULATORY REQUIREMENTS:**

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

**1.06 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Form Liner Panels: manufacturer's cut-sheets
- C. Mill Test Reports:
  - 1. Reinforcing Steel.
  - 2. Cement.
- D. Manufacturer's Certificates:
  - 1. Chemical admixtures, including chloride ion content.
  - 2. Waterproof paper for curing concrete.
  - 3. Liquid membrane-forming compounds for curing concrete.
  - 4. Non-shrinking grout.
  - 5. Liquid hardener.
  - 6. Waterstops.
  - 7. Expansion joint filler.
  - 8. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures stamped and signed by a registered professional engineer.
- G. Samples and mockups:
  - 1. Provide mock up of Smooth Form Finish concrete planter wall, 6 ft min in length. The mockup shall include finishes and reinforcement as specified and shown in plans. Contractor shall conform to installation practices as recommended by the form liner manufacturer to maximize the quality of finish results. The mockup and final walls shall have a clean, smooth finish, free of bug holes and air pockets.
  - 2. Mock up shall be constructed at an approved location at the project site and shall be available for review by the COTR in time to allow time for mix design revision as necessary to achieve acceptable level of quality.
  - 3. Provide mock-ups as necessary to achieve satisfactory results in finishing/textures/color, subject to approval by COR.
  - 4. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the work.

**1.07 DELIVERY, STORAGE, AND HANDLING:**

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

**COR**

**1.08 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117-10 ..... Tolerances for Concrete Construction and Materials
  - 211.1-91(R2009) ..... Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 214R-02..... Evaluation of Strength Test Results of Concrete
  - 301-10 ..... Structural Concrete
  - 304R-00(R2009)..... Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305R-10..... Hot Weather Concreting
  - 306R-10..... Cold Weather Concreting
  - 308R-01(R2008)..... Standard Practice for Curing Concrete
  - 309R-05..... Guide for Consolidation of Concrete
  - 318-08 ..... Building Code Requirements for Reinforced Concrete and Commentary
  - 347-04 ..... Guide to Formwork for Concrete
  - SP-66-04 ..... ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
  - A135.4-2004..... Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
  - A82/A82M-07 ..... Steel Wire, Plain, for Concrete Reinforcement
  - A185/185M-07..... Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
  - A615/A615M-09 ..... Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - A653/A653M-09 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

- A706/A706M-09 ..... Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- C31/C31M-09 ..... Making and Curing Concrete Test Specimens in the field
- C33-08..... Concrete Aggregates
- C39/C39M-09 ..... Compressive Strength of Cylindrical Concrete Specimens
- C94/C94M-09 ..... Ready-Mixed Concrete
- C143/C143M-10 ..... Slump of Hydraulic Cement Concrete
- C150-09..... Portland Cement
- C171-07..... Sheet Materials for Curing Concrete
- C172-08..... Sampling Freshly Mixed Concrete
- C192/C192M-07 ..... Making and Curing Concrete Test Specimens in the Laboratory
- C231-09..... Air Content of Freshly Mixed Concrete by the Pressure Method
- C309-07..... Liquid Membrane-Forming Compounds for Curing Concrete
- C494/C494M-10 ..... Chemical Admixtures for Concrete
- C881/C881M-02 ..... Epoxy-Resin-Base Bonding Systems for Concrete
- C1107/1107M-08..... Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- C1315-08..... Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
- D6-95(R2006)..... Loss on Heating of Oil and Asphaltic Compounds
- D297-93(R2006)..... Rubber Products-Chemical Analysis
- D1751-04(R2008)..... Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- D4397-09..... Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- E. American Welding Society (AWS):
  - D1.4/D1.4M-11 ..... Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI):  
Handbook 2008
- H. U. S. Department of Commerce Product Standard (PS):
  - PS 1..... Construction and Industrial Plywood
  - PS 20..... American Softwood Lumber
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
  - CRD C513 ..... Rubber Waterstops
  - CRD C572 ..... Polyvinyl Chloride Waterstops



## **PART 2 – PRODUCTS:**

### **2.01 FORMS:**

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Form Lining:
  - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
  - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
  - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- F. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.
- G. For Smooth Form Finish concrete walls use Dura-Pour Form Liner Panels, as available by Sylvan Industries LLC, or approved equivalent.

### **2.02 MATERIALS:**

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
  - 1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
  - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
  - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.

- E. Aggregate for Smooth Form Finish walls: natural round 3/8" pea gravel aggregate, per recommendations of form liner panel manufacturer.
- E. Mixing Water: Fresh, clean, and potable.
- F. Admixtures:
  - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
  - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
  - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
  - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  - 5. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
  - 6. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- G. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).
- H. Reinforcing Steel: ASTM A615, grade as shown.
- I. Welded Wire Fabric: ASTM A185.
- J. Reinforcing Bars to be Welded: ASTM A706.
- K. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- O. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- P. Non-Shrink Grout:
  - 1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (7000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.

2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

Q. Adhesive Binder: ASTM C881.

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
4. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
5. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
6. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

R. Dampproofing behind Planter Walls: Per CALTRANS Standard Specifications, Section 54.

**2.03 CONCRETE MIXES:**

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
  2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including fly ash, cement, admixtures, weight of fine and coarse aggregate per m<sup>3</sup> (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and consistency of each cylinder in terms of slump.
  3. Prepare a curve showing relationship between water-cement ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
  4. If the field experience method is used, submit complete standard deviation analysis.
- B. Cement and Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of cement delivered from source. Notify COR immediately when change in source is anticipated. Prior to beginning trial mixes submit to the COR the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical

and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.

1. Portland cement - 3.5 kg (8 pounds):
  2. Fly ash – 2.25 kg (5 pounds):
    - a. Address -Waterways Experiment Station (WES)
    - b. 3909 Halls Ferry Road
    - c. Vicksburg, MS 39180-6199
    - d. ATTN: Engineering Materials Group
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of COR or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement , providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. COR may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. For Smooth Form Finish Walls, use high fly-ash content per form liner panel manufacturer recommendations and no slag shall be used in the mix.

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

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

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
3. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

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

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Smooth form Finish Walls	6 to 8 inches	

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- G. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- H. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- I. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, COR may require any one or any combination of the following corrective actions, at no additional cost to the Government:
1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
  2. Require additional curing and protection.
  3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, COR

may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.

4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, COR may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COR.

**2.04 BATCHING AND MIXING:**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by COR. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

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

**CORCORPART 3 – EXECUTION**

**3.01 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
  1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COR approves their reuse.
  2. Provide forms for concrete footings unless COR determines forms are not necessary.
  3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.

2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
  3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. For Smooth Form Finish walls avoid any leakage from forms at both bottom and sides of formwork.
1. At bottom of form, use structural grout coating, waterproof membrane, or poly sheeting to completely eliminate flow or absorption into the earth below.
  2. Use neoprene panel gaskets or flat polyweather strips to seal all edge joints and corners, and place the gasket just below the polyethelene face overlay.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
  2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, and other items specified as furnished under this and other

sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
2. Do not install sleeves in beams, joists or columns except where shown or permitted by COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
3. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.

I. Construction Tolerances:

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

**3.02 PLACING REINFORCEMENT:**

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
  1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.



2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
  3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
  2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength ( $f_y$ ) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
    - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
    - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
    - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by COR.
  3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength ( $f_y$ ) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
    - a. Initial qualification: In the presence of COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
    - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by COR.

- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

**3.03 CONSTRUCTION JOINTS:**

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

**3.04 EXPANSION JOINTS:**

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

**3.05 PLACING CONCRETE:**

- A. Preparation:
  - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
  - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
  - 3. Have forms and reinforcement inspected and approved by COR before depositing concrete.
  - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
  - 1. Preparing surface for applied topping:
    - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
    - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
    - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush.  
New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of COR.

- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
  2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
  3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
  4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
  5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
  2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.
  3. For Smooth Form Finish low cycle external vibration may be applied in addition to internal vibration, as needed to avoid air pockets and bug holes, and uneven mix distribution at the surface.

**3.06 HOT WEATHER:**

- A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and

arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

### **3.07 COLD WEATHER:**

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

### **3.08 PROTECTION AND CURING:**

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by COR.
  - 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m<sup>2</sup>/L (400 square feet per gallon) on steel troweled surfaces and 7.5m<sup>2</sup>/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
  - 2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
  - 3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

### **3.09 CONCRETE SURFACE PREPARATION:**

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches)

- surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

### **3.10 CONCRETE FINISHES:**

- A. Vertical Surface Finishes:
1. Exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
    - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
    - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600  $\mu\text{m}$  (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
    - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
    - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.
  2. Textured: Finish as specified. Maximum quantity of patched area 0.2  $\text{m}^2$  (2 square feet) in each 93  $\text{m}^2$  (1000 square feet) of textured surface.
- B. Slab Finishes:
1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances.  
COR2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade

during strike-off, unless COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. 3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.

4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.

10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COR from sample panel.

**3.11 SITE WALLS:**

- A. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- B. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- C. Place porous backfill as shown.
- D. Mop apply one heavy coat of asphalt dampproofing to soil side of retaining walls and planter walls from top of wall footing to a minus 2 inches below finished soil grade.

- - - END OF SECTION- - -

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 – GENERAL**

**1.01 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Gate Panel
  - 2. Canopy Roof

**1.02 RELATED WORK**

- A. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Prime and finish painting: Section 09 91 00, PAINTING.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- C. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- D. Design Calculations for specified live loads including dead loads.
- E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

**1.04 QUALITY ASSURANCE**

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.



- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

### 1.05 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - B18.6.1-97..... Wood Screws
  - B18.2.2-87(R2005)..... Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
  - A36/A36M-08 ..... Structural Steel
  - A47-99(R2009)..... Malleable Iron Castings
  - A48-03(R2008)..... Gray Iron Castings
  - A53-10..... Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
  - A123-09..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A167-99(R2009)..... Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - A269-10..... Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - A307-10..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - A312/A312M-09 ..... Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
  - A391/A391M-07 ..... Grade 80 Alloy Steel Chain
  - A653/A653M-10 ..... Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A786/A786M-09 ..... Rolled Steel Floor Plate
  - B221-08..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - B456-03(R2009)..... Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - B632-08..... Aluminum-Alloy Rolled Tread Plate
  - C1107-08..... Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
  - D3656-07..... Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
  - F436-10 ..... Hardened Steel Washers
  - F468-10 ..... Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - F593-02(R2008) ..... Stainless Steel Bolts, Hex Cap Screws, and Studs
  - F1667-11 ..... Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
  - D1.1-10..... Structural Welding Code Steel
  - D1.2-08..... Structural Welding Code Aluminum
  - D1.3-08..... Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
  - AMP 521-01 ..... Pipe Railing Manual
  - AMP 500-06 ..... Metal Finishes Manual
  - MBG 531-09..... Metal Bar Grating Manual
  - MBG 532-09..... Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
  - SP 1-04 ..... No. 1, Solvent Cleaning

- SP 2-04 ..... No. 2, Hand Tool Cleaning
- SP 3-04 ..... No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
  - RR-T-650E ..... Treads, Metallic and Nonmetallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.01 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Manhole Covers: 1200 kg/m<sup>2</sup> (250 pounds per square foot).

### **2.02 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 316
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- E. Primer Paint: As specified in Section 09 91 00, PAINTING.
- F. Stainless Steel Tubing: ASTM A269, type 316

### **2.03 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
  - 2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.
- B. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
    - c. ASTM F468 for nonferrous bolts.
    - d. ASTM F593 for stainless steel.
  - 2. Screws: ASME B18.6.1.
  - 3. Washers: ASTM F436, type to suit material and anchorage.
  - 4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

### **2.04 FABRICATION GENERAL**

- A. Material
  - 1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
  - 2. Use material free of defects which could affect the appearance or service ability of the finished product.
  
- B. Size:
  - 1. Size and thickness of members as shown.
  - 2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.
  
- C. Connections
  - 1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
  - 2. Field riveting will not be approved.
  - 3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
  - 4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
  - 5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
  - 6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
  - 7. Use stainless steel connectors for removable members machine screws or bolts.
  
- D. Fasteners and Anchors
  - 1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
  - 2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
  - 3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
  - 4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
  - 5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.
  
- E. Workmanship
  - 1. General:
    - a. Fabricate items to design shown.
    - b. Furnish members in longest lengths commercially available within the limits shown and specified.
    - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
    - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
    - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
    - f. Prepare members for the installation and fitting of hardware.

- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
- 2. Welding:
  - a. Weld in accordance with AWS.
  - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
  - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
  - d. Finish welded joints to match finish of adjacent surface.
- 3. Joining:
  - a. Miter or butt members at corners.
  - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
- 4. Anchors:
  - a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
  - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
- 5. Cutting and Fitting:
  - a. Accurately cut, machine and fit joints, corners, copes, and miters.
  - b. Fit removable members to be easily removed.
  - c. Design and construct field connections in the most practical place for appearance and ease of installation.
  - d. Fit pieces together as required.
  - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
  - f. Joints firm when assembled.
  - g. Conceal joining, fitting and welding on exposed work as far as practical.
  - h. Do not show rivets and screws prominently on the exposed face.
  - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

SPEC WRITER NOTE: If more than one finish is used on project, specify applicable finish under the item. Coordinate paragraphs to delete finishes not used.

- F. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM AMP 501.
    - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
    - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
    - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
    - d. Painted: AA-C22R10.
  - 3. Steel and Iron: NAAMM AMP 504.
    - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.

- b. Surfaces exposed in the finished work:
    - i. Finish smooth rough surfaces and remove projections.
    - ii. Fill holes, dents and similar voids and depressions with epoxy type patching compound.
  - c. Shop Prime Painting:
    - i. Surfaces of Ferrous metal:
      - (a) Items not specified to have other coatings.
      - (b) Galvanized surfaces specified to have prime paint.
      - (c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
      - (d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
      - (e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
    - ii. Non ferrous metals: Comply with MAAMM-500 series.
  - 4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
  - 5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
- G. Protection:
- 1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
  - 2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

## 2.05 SUPPORTS

- A. General:
- 1. Fabricate ASTM A36 structural steel shapes as shown.
  - 2. Field connections may be welded or bolted.

## 2.06 FRAMES

- 1. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
    - a. Cut a slot in the lock jamb to receive the lock bolt.
    - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.
- B. Cast Iron Covers
- 1. Fabricate covers to support live loads specified.
  - 2. Fabricate from ASTM A48, cast-iron, 13 mm (1/2 inch) minimum metal thickness, cast with stiffeners as required.
  - 3. Fabricate as flush type with frame, reasonably watertight and be equipped with flush type lifting rings. Provide seals where watertight covers noted.
  - 4. Make covers in sections not over 90 kg (200 pounds) except round covers.
- C. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
  2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
  3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
  4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
  5. Drill and tap frames for screw anchors where plate covers occur.
  6. Gates:
    - a. Fabricate from steel as specified.
    - b. Fabricate gate fittings from steel.
    - c. Hang each gate on suitable hinges. Use hinges as specified for exterior gates.
    - d. Provide suitable stops, so that gate will swing as shown.
    - e. Provide lockset as specified.
- D. Finish with baked on prime coat.

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  1. Provide temporary bracing for such items until concrete or masonry is set.
  2. Place in accordance with setting drawings and instructions.
  3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, flush with side of opening.
- D. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- E. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- F. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

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

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

### 3.03 OTHER FRAMES

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

### 3.04 GUARDS

- A. Steel Angle Corner Guards:
  - 1. Build into masonry as the work progress.
  - 2. Set into formwork before concrete is placed.
  - 3. Set angles flush with edge of opening and finish floor or wall or as shown.
  - 4. At existing construction fasten angle and filler piece to adjoining construction with 16 mm (5/8 inch) diameter by 75 mm (3 inch) long expansion bolts 450 mm (18 inches) on center.
  - 5. Install Guard Angles at Edges of // Trench // Stairwell // Openings in Slab // Dock Leveler // Overhead Doors where shown.
- B. Channel Guard at Top Edge of Concrete Platforms:
  - 1. Install in formwork before concrete is placed.
  - 2. Set channel flush with top of the platform.
- C. Gates:
  - 1. Hang gate to swing as shown.
  - 2. Bolt gate hinges to jamb post with clamp on or through bolts.

### 3.05 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

--- E N D OF SECTION ---

**SECTION 08 71 00.01  
GATE HARDWARE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Door hardware and related items necessary for complete installation and operation of gate.

**1.02 RELATED WORK**

- A. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Painting: Section 09 91 00, PAINTING.

**1.03 GENERAL**

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.

**1.04 WARRANTY**

- A. Automatic door operator shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
  1. Door closer: 10 years.

**1.05 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

**1.06 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).
- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

- C. Samples and Manufacturers' Literature:



1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
  2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.
- D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

#### **1.07 DELIVERY AND MARKING**

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Contracting Officer's Representative (COR) for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

#### **1.08 PREINSTALLATION MEETING**

- A. Convene a pre-installation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
1. Inspection of door hardware.
  2. Job and surface readiness.
  3. Coordination with other work.
  4. Protection of hardware surfaces.
  5. Substrate surface protection.
  6. Installation.
  7. Adjusting.
  8. Repair.
  9. Field quality control.
  10. Cleaning.

#### **1.09 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Keying: All cylinders shall be keyed into existing Great Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the COR.

## 1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):  
F883-04 ..... Padlocks  
E2180-07 ..... Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials
- C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):  
A156.1-06 ..... Butts and Hinges  
A156.2-03 ..... Bored and Pre-assembled Locks and Latches  
A156.3-08 ..... Exit Devices, Coordinators, and Auto Flush Bolts  
A156.4-08 ..... Door Controls (Closers)  
A156.5-01 ..... Auxiliary Locks and Associated Products  
A156.6-05 ..... Architectural Door Trim  
A156.8-05 ..... Door Controls-Overhead Stops and Holders  
A156.12-05 ..... Interconnected Locks and Latches  
A156.13-05 ..... Mortise Locks and Latches Series 1000  
A156.14-07 ..... Sliding and Folding Door Hardware  
A156.15-06 ..... Release Devices-Closer Holder, Electromagnetic and Electromechanical  
A156.16-08 ..... Auxiliary Hardware  
A156.17-04 ..... Self-Closing Hinges and Pivots  
A156.18-06 ..... Materials and Finishes  
A156.20-06 ..... Strap and Tee Hinges, and Hasps  
A156.21-09 ..... Thresholds  
A156.22-05 ..... Door Gasketing and Edge Seal Systems  
A156.23-04 ..... Electromagnetic Locks  
A156.24-03 ..... Delayed Egress Locking Systems  
A156.25-07 ..... Electrified Locking Devices  
A156.26-06 ..... Continuous Hinges  
A156.28-07 ..... Master Keying Systems  
A156.29-07 ..... Exit Locks and Alarms  
A156.30-03 ..... High Security Cylinders  
A156.31-07 ..... Electric Strikes and Frame Mounted Actuators  
A250.8-03 ..... Standard Steel Doors and Frames
- D. National Fire Protection Association (NFPA):  
80-10 ..... Fire Doors and Fire Windows  
101-09 ..... Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):  
Building Materials Directory (2008)

## PART 2 - PRODUCTS

### 2.01 BUTT HINGES

- A. Provide quantity and size of hinges per door leaf as follows:
  - 1. Provide 3 min heavy-weight spring hinges where specified for gate.
  - 2. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.

## 2.02 LOCKS AND LATCHES

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with following requirements:
  - 1. Cylindrical Lock Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
  - 2. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.

## 2.03 KEYS

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

- B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

## 2.04 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under

"Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

## 2.05 BASE METALS

- A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	Base Metal
600	Weldable Steel- primed
652	Steel
626	Brass or bronze
630	Stainless steel

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.
- B. Hinges Required Per Door:
- Doors with spring hinges over 1370 mm (4 feet 6 inches) 3 butts
- C. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry.. All fastenings exposed to weather shall be of nonferrous metal.
- D. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

### 3.02 FINAL INSPECTION

- A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:
1. Re-adjust hardware.
  2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
  3. Identify items that have deteriorated or failed.
  4. Submit written report identifying problems.

### 3.03 DEMONSTRATION

- A. Demonstrate efficacy of mechanical hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

**3.04 HARDWARE SETS**

- A. Following hardware set corresponds to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

**EXTERIOR SINGLE GATES**

HW-G3

Each Gate to Have:

NON-RATED

3	Ea	Hinge	4030-6 4.5 X 5.0 (WELDABLE)	600	Bommer
1	Ea	Storeroom	ND80PD TLR (VERIFY GATE THICKNESS AND BACKSET )	626	SCH
1	Ea	Wieldable Lock Box			

--- E N D OF SECTION ---

B520 POD A COURTYARD  
Palo Alto, CA  
VA Palo Alto Health Care System

VA Project No. 640-13-132P

10-11

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**SECTION 09 06 00-SCHEDULE FOR FINISHES**

VAMC: Palo Alto Health Care System  
Location: 3801 Miranda Avenue, Palo Alto, California, 94304  
Project no. and Name: Pod A Courtyard  
Submission 100% CD  
Date: March 6, 2014

**INSTRUCTIONS FOR PREPARATON OF  
SECTION 09 06 00-SCHEDULE FOR FINISHES**

**GENERAL:**

Use, SECTION 09 06 00, SCHEDULE FOR FINISHES as a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement. Fully coordinate with other VA master construction specification sections for information, abbreviations and symbols contained in this Section to be consistent and fully coordinated with those in drawings, finish schedules and material boards.

Provide dimensions in metric followed by English equivalent in parenthesis, when applicable.

Slash symbol (//.. //) Edit information contained between these symbols for project or delete if not applicable. These are not always used.

Delete pages SECTION 09 06 00, SCHEDULE FOR FINISHES-i, ii, iii from final document. Submit complete master document that you received with edit marks during Design Development and Construction Document stage of project. Provide a re-typed version for final document.

Coordinate with VA handbook H-08-14, Room Finishes, Door and Hardware Schedule.

Explanation of Terms:

Material Abbreviations: Use in Room Finish Schedule to identify Finish Materials.

Example: GWB-W is Gypsum Wall Board- Vinyl coated fabric wallcovering finish surface.

Pain, Stain, or Coating Code and Finish Code: A number or abbreviation you assign for material color system texture and pattern in conjunction with a manufacturer's identification when applicable.

**Instructions for Part I – General**

Copy following paragraphs as stated: 1.1 DESCRIPTION, 1.2 MANUFACTURERS, 1.3 SUBMITTALS.

Paragraph 1.5 Digital Color Photos – Interior Views: Include a series of photographic slides, representing a sequential walk-through. Show typical public, patient, staff and all specialized areas. The photography is of architectural quality and are the property of the Department of Veterans Affairs, Office of Facility Management.

**Instruction for Part II Products – Interior and Exterior**

Edit outline to suit the project. The outline is divided by technical specification section and list items requiring finish selections. Locations are designated either in room finish schedule in this section or shown on drawings.

Some products are listed for which a VA guide specifications is not available; no technical Section number shown, Section will have to be written.

Identify locations for products not shown in Room Finish Schedule. Some items require identification of room number and name to establish location.

Identify color, texture, patterns as applicable with manufacturer's identification label with a product or abbreviations are identified throughout drawings and specification sections. Coordinate for uniformity and consistency. Do not duplicate abbreviations for different materials. Avoid conflicts with technical specification sections. Example; Vinyl Composition Tile (VCT).

Some Sections specify finish on product and are not included in Part II, i.e. 10350, FLAGPOLES.

Whenever possible minimize use of multiple manufacturer's for colors and ones which constitute large quantities such as paint, plastic, laminate and carpet.

Loose items are not permitted in construction contracts unless an integral component of a fixed item i.e. keys for locks, adjustable shelves in cabinets.

Give preference to products containing recovered materials when price performance and availability meets project requirements. Give sizes in metric followed by English in parenthesis, i.e. 100 mm (4 inches).

#### Instructions for Part III – Execution

Paragraph 3.1 a: Finish Schedules and Miscellaneous Abbreviations-provide a complete list of product abbreviations used on project. Edit list to suit project.

Paragraph 3.1 b: Finish Schedule Symbols: Edit symbol list to suit project.

Paragraph 3.2: Room Finish Schedule- Finish schedule format is contained in architectural package or at end of this Section. Surface for walls "C" is for free standing columns.

Finish Plans: these plans are a part of architectural drawing set as an adjunct to the finish schedule. Use for showing wall, ceiling and floor patterns and identifying stopping and starting points for finishes exterior elevations may be used to show locations of various finishes identified by finish code and materials.



**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**PART I – GENERAL**

**1.01 DESCRIPTION**

- A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

**1.02 MANUFACTURERS**

- A. Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.03 SUBMITALS**

- A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES-provide quadruplicate samples for color approval of materials and finishes specified in this section.

1. DIGITAL COLOR PHOTOS-INTERIOR VIEWS:

Courtyard	Item/View to be Photographed
1. Canopy	From Loop Road looking northwest
2. Planter wall and Gate	From Loop Road
3. Planter wall with Canopy	From Building Exit over courtyard
4. Art Sculpture	From Loop Road toward B520 and Courtyard

**1.04 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)  
2001 .....Architectural Painting Specification Manual

**PART 2 – PRODUCTS**

**2.01 DIGITAL COLOR PHOTOS**

- A. Size 24 x 35 mm.
- B. Labeled for:
  - 1. Building name and Number.
  - 2. Room Name and Number.

**2.02 DIVISION 05 – METALS**

A. SECTION 05 12 00, STRUCTURAL STEEL FRAMING

Component	Finish	Color
6'D Canopy columns	Powder Coated Paint	Kelly Moore-Sierra White
8"D Canopy Beam	Powder Coated Paint	Kelley Moore-Sierra White
Gate Frame and Supports	Powder Coated Paint	Kelly Moore, Cold Steel-KM3812-2

B. SECTION 05 50 00, METAL FABRICATION

Item	Finish	Color
Canopy Roof and Gate Skin	Powder Coated Paint	Kelly Moore, Cold Steel-KM3812-2

C. SECTION 09 91 00, PAINT AND COATINGS

1. MPI Gloss and Sheen Standards

Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4	a "satin-like" finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss Level 7	a high gloss	more than 85 units	

D. SECTION 26 56 00, SITE LIGHTING

Type and Component	Exterior Finish	Manufacturer	Mfg. Name/No.
LED Light Bollard	Swedish Iron	Sternberg Lighting	Euro E260
Linear LED	Powder Coat, Kelly Moore-"Sierra White"	Insight Lighting	Medley View / SMS
LED Step Light -	Standard Finish Silver	Bega	Bega 2197

**PART III EXECUTION**

**3.01 FINISH SCHEDULE SYMBOLS**

Symbol Definition

**	Same finish as adjoining walls
-	No color required
E	Existing
XX	To match existing
EFTR	Existing finish to remain
RM	Remove

--- E N D OF SECTION ---

**SECTION 09 91 00  
PAINTING**

**PART 1-GENERAL**

**1.01 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

**1.02 RELATED WORK**

- A. Shop prime painting of steel and ferrous metals: Division 05 – METALS
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
  - 3. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
    - c. Product type and color.
    - d. Name of project.
  - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- D. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. .

#### 1.04 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  1. Name of manufacturer.
  2. Product type.
  3. Batch number.
  4. Instructions for use.
  5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
  1. Federal Specification Number, where applicable, and name of material.
  2. Surface upon which material is to be applied.
  3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

#### 1.05 MOCK-UP PANEL

- A. Before starting application of water paint mixtures apply paint as specified to an area, not to exceed 9 m<sup>2</sup> (100 ft<sup>2</sup>), selected by COR.
- B. Finish and texture approved by COR will be used as a standard of quality for remainder of work.

#### 1.06 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):  
ACGIH TLV-BKLT-2012 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)  
ACGIH TLV-DOC-2012. Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):  
A13.1-07..... Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):  
D 16..... Standard Terminology for Paint, Related Coatings, Materials and Applications
- E. Commercial Item Description (CID):  
A-A-1555 ..... Water Paint, Powder (Cementitious, White and Colors) (WPC)  
(cancelled)  
A-A-3120 ..... Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

- G. Master Painters Institute (MPI):
  - No. 8-12 .....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
  - No. 9-12 .....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
  - No. 10-12 .....Exterior Latex, Flat (AE)
  - No. 11-12 .....Exterior Latex, Semi-Gloss (AE)
  - No. 18-12 .....Organic Zinc Rich Primer
  - No. 27-12 .....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
  - No. 31-12 .....Polyurethane, Moisture Cured, Clear Gloss (PV)
  - No. 71-12 .....Polyurethane, Moisture Cured, Clear, Flat (PV)
  - No. 77-12 .....Epoxy Cold Cured, Gloss (EC)
  - No. 79-12 .....Marine Alkyd Metal Primer
  - No. 94-12 .....Exterior Alkyd, Semi-Gloss (EO)
  - No. 95-12 .....Fast Drying Metal Primer
  - No. 98-12 .....High Build Epoxy Coating
  - No. 101-12 .....Epoxy Anti-Corrosive Metal Primer
  - No. 119-12 .....Exterior Latex, High Gloss (acrylic) (AE)
  
- H. Steel Structures Painting Council (SSPC):
  - SSPC SP 1-04 (R2004) Solvent Cleaning
  - SSPC SP 2-04 (R2004) Hand Tool Cleaning
  - SSPC SP 3-04 (R2004) Power Tool Cleaning
  - SSPC SP 6 Commercial Blast Cleaning Procedures

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Exterior Alkyd, Flat (EO): MPI 8.
- B. Exterior Alkyd Enamel (EO): MPI 9.
- C. Exterior Latex, Flat (AE): MPI 10.
- D. Exterior Latex, Semi-Gloss (AE): MPI 11.
- E. Organic Zinc rich Coating (HR): MPI 22.
- F. High Heat Resistant Coating (HR): MPI 22.
- G. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.
- H. Epoxy Cold Cured, Gloss (EC): MPI 77.
- I. Marine Alkyd Metal primer: MPI 79.
- J. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- K. Fast Drying Metal Primer: MPI 95.

- L. High Build Epoxy Coating: MPI 98.
- M. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- N. High Build Epoxy Marine Coating (EC): MPI 108.
- O. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- P. Waterborne Galvanized Primer: MPI 134.
- Q. Non-Cementitious Galvanized Primer: MPI 135.

## **2.02 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

## **2.03 REGULATORY REQUIREMENTS/QUALITY ASSURANCE**

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Lead-Base Paint:
    - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
    - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
    - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
  - 3. Asbestos: Materials shall not contain asbestos.
  - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 6. Use high performance acrylic paints in place of alkyd paints, where possible.
  - 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

## **PART 3 – EXECUTION**

### 3.01 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
  
- B. Atmospheric and Surface Conditions:
  - 1. Do not apply coating when air or substrate conditions are:
    - a. Less than 3 degrees C (5 degrees F) above dew point.
    - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
  - 2. Maintain interior temperatures until paint dries hard.
  - 3. Do no exterior painting when it is windy and dusty.
  - 4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.

### 3.02 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
  
- B. General:
  - 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  - 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
  - 3. See other sections of specifications for specified surface conditions and prime coat.
  - 4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
  
- C. Ferrous Metals:
  - 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
  - 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
  - 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
    - a. This includes flat head countersunk screws used for permanent anchors.
    - b. Do not fill screws of item intended for removal such as glazing beads.
  - 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  - 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

- D. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:
  - 1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
  - 2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

### 3.03 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

### 3.04 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between applications of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by COR, except in spaces sealed from existing occupied spaces.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical



equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

### 3.05 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron: // MPI 79 (Marine Alkyd Metal Primer) // MPI 95 (Fast Drying Metal Primer) //. Use MPI 101 (Cold Curing Epoxy Primer) where // MPI 77 (Epoxy Cold Cured, Gloss (EC))// MPI 98 (High Build Epoxy Coating) // MPI 108 (High Build Epoxy Marine Coating (EC)) // finish is specified.
  - 2. Zinc-coated steel and iron: // MPI 134 (Waterborne Galvanized Primer) // MPI 135 (Non-Cementitious Galvanized Primer) //.
  - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
  - 4. Terne Metal: // MPI 79 (Marine Alkyd Metal Primer) // MPI 95 (Fast Drying Metal Primer) //.
  - 5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
  - 6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
  - 7. Asphalt coated metal: MPI 1 (Aluminum Paint (AP)).
  - 8. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

### EXTERIOR FINISHES

- E. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- F. Steel and Ferrous Metal, // Including Tern //:
  - 1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) // MPI 9 (Exterior Alkyd Enamel (EO)) // MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

### 3.06 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Coat Colors:
  - 1. Color of priming coat: Lighter than body coat.
  - 2. Color of body coat: Lighter than finish coat.
  - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

- C. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  - 1. Paint to match color of casework where casework has a paint finish.
  - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

### 3.07 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11
- B.
  - 1. Painting and finishing of new // and existing // work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space // except shingles.
  - 5. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
  - 1. Prefinished items:
    - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
    - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
  - 2. Finished surfaces:
    - a. Hardware except ferrous metal.
    - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
    - c. Signs, fixtures, and other similar items integrally finished.
  - 3. Concealed surfaces:
    - a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
    - b. Inside walls or other spaces behind access doors or panels.
    - c. Surfaces concealed behind permanently installed casework and equipment.
  - 4. Moving and operating parts:
    - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
    - b. Tracks for overhead or coiling doors, shutters, and grilles.
  - 5. Labels:
    - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
    - b. Identification plates, instruction plates, performance rating, and nomenclature.
  - 6. Galvanized metal:
    - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
    - b. Gas Storage Racks.
    - c. Except where specifically specified to be painted.
  - 7. Metal safety treads and nosings.
  - 8. Gaskets.
  - 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.

10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

**3.08 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

--- E N D OF SECTION ---

**SECTION 12 93 00  
SITE FURNISHINGS**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Furnish and install all site furnishings shown on drawings and specified in accordance with the manufacturer's instructions and as shown on the drawings and as specified

**1.02 RELATED WORK**

- A. Section **32 13 20**, SITE CONCRETE
- B. Section **32 90 00**, PLANTING

**1.02 REFERENCES**

- A. Perform work in accordance with all applicable laws, codes and regulations required by the City and the State of California.
- B. Manufacturer's Instructions: Where required in the Specifications that materials, products, processes, equipment or the like to be installed or applied in accordance with manufacturer's instructions, directions or specifications, or words to this effect, it shall be constructed to mean that said application or installation shall be in strict accordance with printed instructions furnished by the manufacturer of the material for use under conditions similar to those at the job site.
- C. Reference Standards:
  - 1. State of California, Business and Transportation Agency, Department of Transportation: Caltrans Standard Specifications
  - 2. Manufacturers' specifications and recommendations.

**1.03 COORDINATION**

- A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in concrete and for the provision of connections, holes, openings, etc., necessary to the execution of the work of the trades.

**1.04 SUBMITTALS**

- A. Per Section **01 33 23**, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Surface-Mounted Benches
  - 1. Manufacturer cut-sheets including materials, dimensions, model
  - 2. Color / finish samples
- C. Paver Grates
  - 1. Cut sheet & Shop Drawings

**PART 2 – MATERIALS**

**2.01 BASIS OF DESIGN**

- A. The design of Site Furnishing equipment is based on products specified. Subject to compliance with requirements, provide named product or a comparable product.

**2.02 SURFACE-MOUNTED BENCHES:**

- A. "Knight" Bench by Forms+Surfaces or approved equal
  - 1. With back-rest
  - 2. With arm-rests
  - 3. Surface mount per manufacturer's specifications
  - 4. Bench to be furnished by contractor and installed by contractor
  - 5. Ipe wood slats

6. "Aluminum Texture" powder-coat finish on hardware
7. 6 ft. Long or as noted in plans

### **2.03 PAVER GRATE:**

- A. Galvanized Steel Paver Grate as available from Ironsmith, 41-701 Corporate Way, Unit 3, Palm Desert, CA 92260 (800) 338-4766
- B. Paver-Grates shall be manufactured from standard steel shapes to ASTM A36 and expanded metal grating 3# to ASTM A569/569M. If required, Tubing to ASTM A500. Units shall be manufactured true to design and all components shall fit together in a satisfactory manner. Grates are to be of uniform quality, flat and free from distortion.
- C. Tree grates shall be modified/customized version of PAVER GRATE Model 6220 "72"  
Galvanized steel PAVER-GRATE in halves for use with pavers with "12,24" inch tree opening, or approved equal. Provide customized dimensions as shown in details.
- D. Finish: Grates are to be supplied galvanized by hot spray and / or hot dip method.

### **2.04 FILTER FABRIC:**

- A. See Section **32 90 00, PLANTING**

## **PART 3 - EXECUTION**

### **3.01 GENERAL INSTALLATION:**

- A. Install manufactured items in accordance with the manufacturer's instruction and as shown in the drawings and as specified herein.
- B. Perform all work in accordance with all applicable laws, codes and regulations required by State of California and the City of Palo Alto.
- C. Set all work true and square, plumb and level. Remove and replace any wood that splits during or after erection until acceptance.
- D. Place washer under the head and nut of bolts where same bear on wood, except head of carriage bolt. Drill bolt holes same diameter as bolt.
- E. Size bolts to fit flush with nuts. Countersink nuts and bolts as detailed.
- F. Supply all miscellaneous metal units and install as specified herein under the Sections titled Miscellaneous Metal work
- G. Hot-dip galvanize all metal fastenings, angles, etc., after complete fabrication.
- H. Galvanized metal that is cut damaged or modified after fabrication shall be immediately painted with Zinc-rich paint to prevent rusting.
- I. Touch up paint any damaged surfaces to match original finish as accepted by the Contracting Officer's Representative.
- J. Set site furniture, level. Provide spacers under furniture to level as acceptable to Contracting Officer's Representative.
- K. Transport, store and handle precast units and manufactured items in a manner to avoid hairline cracks, staining or other damage. Store units free of the ground and protected from mud or rain splashes. Cover units, secure covers firmly, and protect the units from dust, dirt or other staining material.

### **3.02 SURFACE-MOUNT BENCHES**

- A. Install in accordance with the manufacturer's instructions and as shown.

### **3.03 PAVER GRATE:**

- A. Install in accordance with the manufacturer's instruction and as shown.

**--- END OF SECTION ---**

**SECTION 26 05 11  
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**1.01 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.
- D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.02 MINIMUM REQUIREMENTS**

- A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.03 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
  - 1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with

evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
  - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Are periodically inspected by a NRTL.
  - c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

#### **1.04 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.05 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

**1.06 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of 15 working days prior to the manufacturer's performing the factory tests.
  - 2. Four copies of certified test reports shall be furnished to the COR two weeks prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

**1.07 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.



## **1.08 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  - 1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  - 2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  - 3. Damaged equipment shall be repaired or replaced, as determined by the COR.
  - 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  - 5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

## **1.09 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
  - 3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.

- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
- D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus

amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

- C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### 1.12 SUBMITTALS

- A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  - 1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  - 3. Submit each section separately.
- E. The submittals shall include the following:
  - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
  - 2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so

- that appropriate mounting and securing provisions may be designed and attached to the equipment.
3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
- F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
  2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
  3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
  4. The manuals shall include:
    - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    - b. A control sequence describing start-up, operation, and shutdown.
    - c. Description of the function of each principal item of equipment.
    - d. Installation instructions.
    - e. Safety precautions for operation and maintenance.
    - f. Diagrams and illustrations.
    - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    - h. Performance data.
    - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.

- j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
  - 1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  - 2. Each type of conduit coupling, bushing, and termination fitting.
  - 3. Conduit hangers, clamps, and supports.
  - 4. Duct sealing compound.
  - 5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

#### **1.14 POLYCHLORINATED BIPHENYL (PCB) EQUIPMENT**

- A. This project requires the removal, transport, and disposal of electrical equipment containing Polychlorinated Biphenyls (PCB) in accordance with the Federal Toxic Substances Control Act (TSCA).
- B. The equipment to be removed is shown on the drawings.
- C. The selective demolition shall be in accordance with Section 02 41 00, DEMOLITION.

#### **1.15 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

**1.16 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.17 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

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

**PART 3 - EXECUTION (NOT USED)**

**---END OF SECTION---**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.02 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.
- D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

**1.03 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.04 FACTORY TESTS**

- A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

**1.05 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings and insulation type for each conductor and cable.
      - 2) Splicing materials and pulling lubricant.
  - 2. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

**1.06 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
  - D2301-10 ..... Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
  - D2304-10 ..... Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
  - D3005-10 ..... Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
- C. National Electrical Manufacturers Association (NEMA):
  - WC 70-09 ..... Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- D. National Fire Protection Association (NFPA):
  - 70-11 ..... National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
  - 44-10 ..... Thermoset-Insulated Wires and Cables
  - 83-08 ..... Thermoplastic-Insulated Wires and Cables
  - 467-07 ..... Grounding and Bonding Equipment
  - 486A-486B-03 ..... Wire Connectors
  - 486C-04 ..... Splicing Wire Connectors
  - 486D-05 ..... Sealed Wire Connector Systems
  - 486E-09 ..... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
  - 493-07 ..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
  - 514B-04 ..... Conduit, Tubing, and Cable Fittings



## PART 2 - PRODUCTS

### 2.01 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.
- C. Single Conductor and Cable:
  - 1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
  - 2. No. 8 AWG and larger: Stranded.
  - 3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
  - 4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.
- D. Direct Burial Cable: UF or USE cable.
- E. Color Code:
  - 1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
  - 2. No. 8 AWG and larger: Color-coded using one of the following methods:
    - a. Solid color insulation or solid color coating.
    - b. Stripes, bands, or hash marks of color specified.
    - c. Color using 19 mm (0.75 inches) wide tape.
  - 4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
  - 5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- 6. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.

7. Color code for isolated power system wiring shall be in accordance with the NEC.

## 2.02 SPLICES

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
  1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
  4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.
- D. Above Ground Splices for 250 kcmil and Larger:
  1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
- E. Underground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- F. Underground Splices for No. 8 AWG and Larger:
  1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.

2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
- G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

### **2.03 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

### **2.04 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

### **2.05 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
- B. Shall not be used on conductors for isolated power systems.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
  - 2. Use nonmetallic pull ropes.
  - 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
  - 4. All conductors in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three branch circuits shall be installed in any one conduit.
- K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

### **3.02 INSTALLATION IN MANHOLES**

- A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.
- B. Fireproofing:
  - 1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.
  - 2. Use fireproofing tape as specified in Section 26 05 13, MEDIUM-VOLTAGE CABLES, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
  - 3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

### **3.03 SPLICE AND TERMINATION INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

### **3.04 CONDUCTOR IDENTIFICATION**

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

### **3.05 FEEDER CONDUCTOR IDENTIFICATION**

- A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.06 EXISTING CONDUCTORS**

- A. Unless specifically indicated on the plans, existing conductors shall not be reused.

### **3.07 CONTROL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

### **3.08 CONTROL WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

### **3.09 DIRECT BURIAL CABLE INSTALLATION**

- A. Tops of the cables:
  - 1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.
  - 2. Below road and other pavement surfaces: In conduit as specified, minimum 760 mm (30 inches) unless greater depth is shown.
  - 3. Do not install cables under railroad tracks.
- B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on plans, but not less than 50 mm (2 inches) trade size with

- bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.
  - D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
    - 1. Place 75 mm (3 inches) bedding sand in the trenches before installing the cables.
    - 2. Place 75 mm (3 inches) shading sand over the installed cables.
    - 3. Install continuous horizontal 25 mm by 200 mm (1 inch x 8 inches) preservative-impregnated wood planking 75 mm (3 inches) above the cables before backfilling.
  - E. Provide horizontal slack in the cables for contraction during cold weather.
  - F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
  - G. Connections and terminations shall be listed submersible-type designed for the cables being installed.
  - H. Warning tape shall be continuously placed 300 mm (12 inches) above the buried cables.

### **3.10 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests: Inspect physical condition.
  - 2. Electrical tests:
    - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
    - b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
    - c. Perform phase rotation test on all three-phase circuits.

**---END OF SECTION---**

**SECTION 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.02 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

**1.03 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.04 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
  - 2. Test Reports:
    - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
  - 3. Certifications:

- a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

**1.05 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
  - B1-07 ..... Standard Specification for Hard-Drawn Copper Wire
  - B3-07 ..... Standard Specification for Soft or Annealed Copper Wire
  - B8-11 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-83 ..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- D. National Fire Protection Association (NFPA):
  - 70-11 ..... National Electrical Code (NEC)
  - 70E-12 ..... National Electrical Safety Code
  - 99-12 ..... Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
  - 44-10 ..... Thermoset-Insulated Wires and Cables
  - 83-08 ..... Thermoplastic-Insulated Wires and Cables
  - 467-07 ..... Grounding and Bonding Equipment

**PART 2 - PRODUCTS**

**2.01 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.



- D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

## **2.02 GROUND RODS**

- A. copper clad steel 19 mm (0.75 inch) diameter by 3 M (10 feet) long.
- B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

## **2.03 CONCRETE ENCASED ELECTRODE**

- A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

## **2.04 GROUND CONNECTIONS**

- A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.
- B. Above Grade:
  - 1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

### **3.02 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

### **3.03 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

- B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.
- C. Pad-Mounted Transformers:
  - 1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
  - 2. Ground the secondary neutral.
- D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

### **3.04 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):
  - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
  - 2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

### **3.05 RACEWAY**

- A. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
  - 3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
  - 4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be

- provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.
  - C. Boxes, Cabinets, Enclosures, and Panelboards:
    - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
    - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
  - D. Wireway Systems:
    - 1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
    - 2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
    - 3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
    - 4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).
  - E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
  - F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
  - G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
  - H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.
  - I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient

vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

**3.06 CORROSION INHIBITORS**

- A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

**3.07 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

**3.08 EXTERIOR LIGHT POLES**

- A. Provide 6.1 M (20 feet) of No. 4 AWG bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

**3.09 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

**3.10 GROUND ROD INSTALLATION**

- A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.
- B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.
- C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

**3.11 ACCEPTANCE CHECKS AND TESTS**

- A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be

made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

- B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the COR prior to backfilling. The Contractor shall notify the COR 24 hours before the connections are ready for inspection.

**---END OF SECTION---**

**SECTION 26 05 33  
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.02 RELATED WORK**

- A. Mounting board for telephone closets: Section 06 10 00, ROUGH CARPENTRY.
- B. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.
- C. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.
- D. General electrical requirements and items that is common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

**1.03 SUBMITTALS**

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

- A. Shop Drawings:
  - 1. Size and location of pull boxes
  - 2. Layout of required conduit penetrations through structural elements.
  - 4. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Certification: Prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

**1.04 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):  
70-05 ..... National Electrical Code (NEC)

- C. Underwriters Laboratories, Inc. (UL):
  - 6-03 ..... Rigid Metal Conduit
  - 50-03 ..... Enclosures for Electrical Equipment
  - 360-03 ..... Liquid-Tight Flexible Steel Conduit
  - 467-01 ..... Grounding and Bonding Equipment
  - 514A-01 ..... Metallic Outlet Boxes
  - 514B-02 ..... Fittings for Cable and Conduit
  - 797-03 ..... Electrical Metallic Tubing
  - 1242-00 ..... Intermediate Metal Conduit
- D. National Electrical Manufacturers Association (NEMA):
  - TC-3-04 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing
  - FB1-03 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit,  
Electrical Metallic Tubing and Cable

## PART 2 - PRODUCTS

### 2.01 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 19 mm (3/4 inch) unless otherwise shown. Where permitted by the NEC, 19 mm (3/4 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
  - 1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
  - 2. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
  - 3. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
  - 4. Flexible galvanized steel conduit: Shall Conform to UL 1.
  - 5. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
- C. Conduit Fittings:
  - 1. Rigid steel and IMC conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
    - b. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
    - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

- d. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
3. Electrical metallic tubing fittings:
- a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
  - d. Indent type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Direct burial plastic conduit fittings:
- a. Fittings shall meet the requirements of UL 514C and NEMA TC3.



- b. As recommended by the conduit manufacturer.
- 7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
- 8. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
  - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
- E. Outlet, Junction, and Pull Boxes:
  - 1. UL-50 and UL-514A.
  - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
  - 4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.
- G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

## **PART 3 - EXECUTION**

### **3.01 PENETRATIONS**

- A. Cutting or Holes:
  - 1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COR prior to drilling through structural sections.

- B. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

### **3.02 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, as shown, and as hereinafter specified.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where specifically "accepted" by NEC Article 517.
- C. Install conduit as follows:
  - 1. In complete runs before pulling in cables or wires.
  - 2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
  - 3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  - 4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
  - 5. Mechanically and electrically continuous.
  - 6. Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
  - 7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
  - 8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
  - 9. Conduit installations under fume and vent hoods are prohibited.
  - 10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  - 11. Do not use aluminum conduits in wet locations.
  - 12. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.
- D. Conduit Bends:

1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown.
  2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.

### **3.03 CONCEALED WORK INSTALLATION**

- A. Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors above 600 volts:
    - a. Rigid steel or rigid aluminum.
    - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
  2. Conduit for conductors 600 volts and below:
    - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
  3. Align and run conduit parallel or perpendicular to the building lines.
  4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.
  5. Tightening set screws with pliers is prohibited.

### **3.04 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for conductors above 600 volts:
1. Rigid steel or rigid aluminum.
  2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
- C. Conduit for Conductors 600 volts and below:
1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.

- G. Surface metal raceways: Use only where shown.
- H. Painting:
  - 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  - 2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

### **3.05 DIRECT BURIAL INSTALLATION**

- A. Exterior routing of Lighting Systems and Other Branch circuits (600 Volt and Less, and 1500 mm (5 feet) from the buildings):
  - 1. Conduit: Thick wall PVC or high density PE, unless otherwise shown.
  - 2. Mark conduit at uniform intervals to show the kind of material, direct burial type, and the UL approval label.
  - 3. Install conduit fittings and terminations as recommended by the conduit manufacturer.
  - 4. Tops of conduits shall be as follows unless otherwise shown:
    - a. Not less than 600 mm (24 inches) below finished grade.
    - b. Not less than 750 mm (30 inches) below road and other paved surfaces.
  - 5. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
  - 6. Seal conduits, including spare conduits, at building entrances and at outdoor terminations for equipment with a suitable compound that prevents the entrance of moisture and gases.
  - 7. Where metal conduit is shown, install threaded heavy wall rigid steel galvanized conduit or type A20 rigid steel galvanized conduit coated with .5 mm (20 mil) bonded PVC, or rigid steel or IMC, PVC coated or standard coated with bituminous asphaltic compound.
  - 8. Warning tape shall be continuously placed 300 mm (12 inches) above conduits or electric lines.

### **3.06 HAZARDOUS LOCATIONS**

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.

- B. Install UL approved sealing fittings, that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles, as required by the NEC.

### **3.07 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces building exterior walls, roofs) or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within 1500 mm (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall include an outer factory coating of .5 mm (20 mil) bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

### **3.08 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside (air stream) of HVAC units, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

### **3.09 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.//

### **3.10 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- F. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- G. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- H. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- I. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- J. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### **3.11 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes.)
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

- G. On all Branch Circuit junction box covers, identify the circuits with black marker.

**--- END OF SECTION---**

**SECTION 26 05 41  
UNDERGROUND ELECTRICAL CONSTRUCTION**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of precast manholes and pullboxes with ducts to form a complete underground raceway system.
- B. "Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

**1.02 RELATED WORK**

- A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings and boxes for raceway systems.

**1.03 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Coordinate layout and installation of ducts, manholes, pullboxes, and pull-boxes with final arrangement of other utilities, site grading, and surface features, as determined in the field.

**1.04 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include manholes, pullboxes, duct materials, and hardware. Submit plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories and details.
  - 3. Proposed deviations from details on the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes or pullboxes at locations other



than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit four copies to the CONTRACTING OFFICER'S REPRESENTATIVE for approval prior to construction.

- C. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the CONTRACTING OFFICER'S REPRESENTATIVE:
  - 1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  - 2. Certification by the contractor that the materials have been properly installed, connected, and tested.

**1.05 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Concrete Institute (ACI):
  - Building Code Requirements for Structural Concrete
  - 318/318M-05 ..... Building Code Requirements for Structural Concrete & Commentary
  - SP-66-04 ..... ACI Detailing Manual
- C. American National Standards Institute (ANSI):
  - 77-07 ..... Underground Enclosure Integrity
- D. American Society for Testing and Materials (ASTM):
  - C478-09 ..... Standard Specification for Precast Reinforced Concrete Manhole Sections
  - C858-09 ..... Underground Precast Concrete Utility Structures
  - C990-09 ..... Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
- E. Institute of Electrical and Electronic Engineers (IEEE):
  - C2-07 ..... National Electrical Safety Code
- F. National Electrical Manufacturers Association (NEMA):
  - TC 2-03 ..... Electrical Polyvinyl Chloride (PVC) Tubing And Conduit
  - TC 3-2004 ..... PVC Fittings for Use With Rigid PVC Conduit And Tubing
  - TC 6 & 8 2003 ..... PVC Plastic Utilities Duct For Underground Installations
  - TC 9-2004 ..... Fittings For PVC Plastic Utilities Duct For Underground Installation
- G. National Fire Protection Association (NFPA):

- 70-08 ..... National Electrical Code (NEC)
- H. Underwriters Laboratories, Inc. (UL):
  - 6-07 ..... Electrical Rigid Metal Conduit-Steel
  - 467-07 ..... Grounding and Bonding Equipment
  - 651-05 ..... Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-00 ..... Type EB and A Rigid PVC Conduit and HDPE Conduit
  - 651B-07 ..... Continuous Length HDPE Conduit
- I. U.S. General Services Administration (GSA):
  - A-A-60005-1998 ..... Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

**1.06 STORAGE**

Lift and support pre-cast concrete structures only at designated lifting or supporting points.

**PART 2 - PRODUCTS**

**2.01 PRE-CAST CONCRETE MANHOLES AND HARDWARE**

- A. Structure: Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole. Comply with ASTM C 858.
- B. Cable Supports:
  - 1. Cable stanchions shall be hot-rolled, heavy duty, hot-dipped galvanized "T" section steel, 2.25 in [56 mm] x 0.25 in [6 mm] in size, and punched with 14 holes on 1.5 in [38 mm] centers for attaching cable arms.
  - 2. Cable arms shall be 0.1875 in [5 mm] gauge, hot-rolled, hot-dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 2.5 in [63 mm] wide x 14 in [350 mm] long.
  - 3. Insulators for cable supports shall be high-glazed, wet process porcelain, and shall completely encircle the cable.
  - 4. Equip each cable stanchion with two spare cable arms and six spare insulators for future use.
- C. Ground Rod Sleeve: Provide a 3 in [75 mm] PVC sleeve in manhole floors so that a driven ground rod may be installed.

**2.02 PULLBOXES**

- A. General: Size as indicated on drawings. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of

ANSI/SCTE 77 loading. Provide pulling irons, 0.875 in [22 mm] diameter galvanized steel bar with exposed triangular-shaped opening.

- B. Concrete Pullboxes: Shall be monolithically-poured reinforced concrete.

## 2.03 DUCTS

- A. Number and sizes shall be as shown on drawings.
- B. Ducts (concrete-encased):
1. Plastic Duct:
    - a. UL 651 and 651A Schedule 40 PVC.
    - b. Duct shall be suitable for use with 194° F [90° C] rated conductors.
  2. Conduit Spacers: Prefabricated plastic.
- C. Ducts (direct-burial):
1. Plastic duct:
    - a. NEMA TC2 and TC3
    - b. UL 651, 651A, and 651B, Schedule 40 PVC or HDPE.
    - c. Duct shall be suitable for use with 167° F [75° C] rated conductors.
  2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid steel, threaded type, half-lapped with 10 mil PVC tape.

## 2.04 GROUNDING

- A. Rods: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Ground Wire: Stranded bare copper 6 AWG [16 mm<sup>2</sup>] minimum.

## 2.05 WARNING TAPE

Standard 4-mil polyethylene 3 in [76 mm] wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

## 2.06 PULL ROPE FOR SPARE DUCTS

Plastic with 200 lb [890 N] minimum tensile strength.

## PART 3 - EXECUTION

### 3.01 MANHOLE AND PULLBOX INSTALLATION

- A. Assembly and installation shall follow the printed instructions and recommendations of the manufacturer. Install manholes and pullboxes level and plumb.
1. Units shall be installed on a 12 in [300 mm] level bed of 90% compacted granular fill, well-graded from the 1 in [25 mm] sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
  2. Seal duct terminations so they are watertight.
- B. Access: Ensure the top of frames and covers are flush with finished grade.

- C. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 4 in [100 mm] above the manhole floor.
- D. Grounding in Manholes:
  - 1. Install a No. 3/0 AWG [95 mm<sup>2</sup>] bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
  - 2. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
  - 3. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG [16 mm<sup>2</sup>] bare copper jumper.

### 3.02 TRENCHING

- A. Refer to EARTH MOVING for trenching, backfilling, and compaction.
- B. Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
- D. Cut the trenches neatly and uniformly.
- E. For Concrete-Encased Ducts:
  - 1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 4 ft [1.2 M] intervals to establish the grade and route of the duct bank.
  - 2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
  - 3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
  - 4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.
- F. Conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place. Conduits shall be heavy wall rigid steel.

### 3.03 DUCT INSTALLATION

#### A. General Requirements:

1. Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.
2. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 4 in [100 mm] in 100 ft [30 M].
3. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] outside the building foundation. Tops of conduits below building slab shall be minimum 24 in [610 mm] below bottom of slab.
4. Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] away from the edge of slab.
5. Install insulated grounding bushings on the terminations.
6. Radius for turns of direction shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter. Use manufactured long sweep bends.
7. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3 in [75 mm] above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 5 ft [1.5 M]. Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during pouring of concrete. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 12 in [300 mm] from other utility systems, such as water, sewer, and chilled water.
10. Clearances between individual ducts:
  - a. For like services, not less than 3 in [75 mm].
  - b. For power and signal services, not less than 6 in [150 mm].
11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.

13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
  14. Seal conduits, including spare conduits, at building entrances and at outdoor equipment terminations with a suitable compound to prevent entrance of moisture and gases.
- B. and Direct-Burial Duct and Conduit Identification: Place continuous strip of warning tape approximately 12 in [300 mm] above ducts or conduits before backfilling trenches. Warning tape shall be preprinted with proper identification.
- C. Spare Ducts and Conduits: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
- D. Duct and Conduit Cleaning:
1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct. The mandrel shall be not less than 12 in [3600 mm] long, and shall have a diameter not less than 0.5 in [13 mm] less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
  2. Mandrel pulls shall be witnessed by the CONTRACTING OFFICER'S REPRESENTATIVE.
- E. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.
- F. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 12 in [300 mm] in each direction. Perimeter of the duct bank opening in the underground structure shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.
- G. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct

bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

- H. Connections to Existing Ducts: Where connections to existing duct banks are indicated, excavate around the duct banks as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.
- I. Partially-Completed Duct Banks: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 ft [0.6 M] back into the envelope and a minimum of 2 ft [0.6 M] beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 in [75 mm] from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 12 in [300 mm] apart. Restrain reinforcing assembly from moving during pouring of concrete.

**--- END OF SECTION ---**

**SECTION 26 09 23  
LIGHTING CONTROLS**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

This section specifies the furnishing, installation and connection of the lighting controls.

**1.02 RELATED WORK**

- A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Interface of lighting controls with HVAC control systems.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 24 26 16, PANELBOARDS: panelboard enclosure and interior bussing used for lighting control panels.
- F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.03 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.04 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting control, submit the following information.
  - 1. Manufacturer's catalog data.
  - 2. Wiring schematic and connection diagram.
  - 3. Installation details.
- C. Manuals:
  - 1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
  - 2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the COR.



- D. Certifications:
  - 1. Two weeks prior to final inspection, submit four copies of the following certifications to the COR:
    - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

**1.05 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Green Seal (GS):
  - GC-12..... Occupancy Sensors
- C. Illuminating Engineering Society of North America (IESNA):
  - IESNA LM-48 ..... Guide for Calibration of Photoelectric Control Devices
- D. National Electrical Manufacturer's Association (NEMA)
  - C136.10..... American National Standard for Roadway Lighting Equipment-  
Locking-Type Photocontrol Devices and Mating Receptacles -  
Physical and Electrical Interchangeability and Testing
  - ICS-1 ..... Standard for Industrial Control and Systems General Requirements
  - ICS-2..... Standard for Industrial Control and Systems: Controllers,  
Contractors, and Overload Relays Rated Not More than 2000  
Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in  
Industrial Control Equipment
  - ICS-6 ..... Standard for Industrial Controls and Systems Enclosures
- E. Underwriters Laboratories, Inc. (UL):
  - 20 ..... Standard for General-Use Snap Switches
  - 773 ..... Standard for Plug-In Locking Type Photocontrols for Use with Area  
Lighting
  - 773A..... Nonindustrial Photoelectric Switches for Lighting Control
  - 98 ..... Enclosed and Dead-Front Switches
  - 917..... Clock Operated Switches

**PART 2 - PRODUCTS**

**2.01 ELECTRONIC TIME SWITCHES**

- A. Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST.

2. Contact Rating: 30-A inductive or resistive, 240-V ac 20-A ballast load, 120/240-V ac.
3. Astronomical Clock: Capable of switching a load on at sunset and off at sunrise, and automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Additionally, it shall be programmable to a fixed on/off weekly schedule.
4. Battery Backup: For schedules and time clock.

## **2.02 ELECTROMECHANICAL-DIAL TIME SWITCHES**

- A. Electromechanical-dial time switches; complying with UL 917.
1. Contact Configuration: SPST.
  2. Contact Rating: 30-A inductive or resistive, 240-V ac and 20-A ballast load, 120/240-V ac.
  3. Wound-spring reserve carryover mechanism to keep time during power failures.

## **2.03 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Solid state, with SPST dry contacts rated for 1800 VA tungsten or 1000 VA inductive, complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc [16.14 to 108 lx], with adjustable turn-on and turn-off levels.
  2. Time Delay: 15-second minimum.
  3. Surge Protection: Metal-oxide varistor.
  4. Mounting: Twist lock, with base-and-stem mounting or stem-and-swivel mounting accessories as required.

## **2.04 TIMER SWITCHES**

- A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
1. Compatibility: Compatible with all ballasts.
  2. Warning: Audible warning to sound during the last minute of "on" operation.
  3. Time-out: Adjustable from 5 minutes to 12 hours.
  4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

## **2.05 OUTDOOR MOTION SENSOR (PIR)**

- A. Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C).
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a 1 to 15 minute adjustable time delay for turning lights off.

2. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
    - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  3. Bypass Switch: Override the on function in case of sensor failure.
  4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc [11 to 215 lx]; keep lighting off during daylight hours.
- B. Detector Sensitivity: Detect occurrences of 6-inch [150mm] minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. [232 sq. cm].
- C. Detection Coverage: as scheduled on drawings.
- D. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
1. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
  2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

## **2.09 LIGHTING CONTROL PANEL – RELAY TYPE**

- A. Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Controller communication protocol shall be compatible with the building automation system specified in SECTION 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.
- B. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.
- C. Directory: Identifies each relay as to load controlled.
- D. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-V ac for tungsten filaments and 20 A, 277-V ac for ballasts, 50,000 cycles at rated capacity.

## **2.10 LIGHTING CONTROL PANEL – CIRCUIT BREAKER TYPE**

- A. Controller: Panelboard mounted in compliance with UL 916, programmable, solid-state, astronomic 365-day timing and control unit with non-volatile memory. Controller shall be integral to panelboard as specified in Section 26 24 16, PANELBOARDS. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Controller communication protocol shall be compatible with the building automation system specified in SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Panelboard shall use low-voltage-controlled, electrically operated molded-case branch circuit breakers or molded-case branch circuit breakers with switching accessories. Circuit breakers and a limited number of digital or analog, low-voltage control-circuit outputs shall be individually controlled by control module. Panelboard shall also comply with Section 24 26 16, PANELBOARDS.
- B. Electrically Operated, Molded-Case Circuit-Breaker Panelboard: Per Section 24 26 16, PANELBOARDS.
- C. Electrically Operated, Molded-Case Circuit Breakers: Per Section 26 24 16, PANELBOARDS.
- D. Switching Endurance Ratings: Rated at least 20,000 open and close operations under rated load at 0.8 power factor.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION:**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Aim outdoor photocell switch according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle photocell turn-on.
- C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer's recommendations.
- D. Set occupancy sensor "on" duration to 15 minutes.
- E. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.
- F. Label time switches and contactors with a unique designation.

### **3.02 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations.
- B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

- C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.
- D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.
- E. Program lighting control panels per schedule on drawings.
- F. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory-authorized technician who will verify all adjustments and sensor placements.

**3.03 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

**- - - END OF SECTION - - -**

**SECTION 26 56 00  
EXTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

This section specifies the furnishing, installation, and connection of exterior luminaires, poles, and supports.

**1.02 RELATED WORK**

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- F. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.
- G. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

**1.03 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.04 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, lamps, and accessories.
- C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the CONTRACTING OFFICER'S REPRESENTATIVE. Include

technical data sheets, wiring and connection diagrams, and information for ordering replacement lamps, ballasts, and parts.

- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the CONTRACTING OFFICER'S REPRESENTATIVE:
1. Certification by the manufacturer that the materials are in accordance with the drawings and specifications.
  2. Certification by the contractor that the complete installation has been properly installed and tested.

**1.05 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Aluminum Association Inc. (AA):  
AAH35.1-06.....Alloy and Temper Designation Systems for Aluminum
- C. American Association of State Highway and Transportation Officials (AASHTO):  
LTS-5-09 .....Structural Supports for Highway Signs, Luminaires and Traffic Signals
- D. American Concrete Institute (ACI):  
318-05 .....Building Code Requirements for Structural Concrete
- E. American National Standards Institute (ANSI):  
C81.61-09 .....Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps
- F. American Society for Testing and Materials (ASTM):  
A123/A123M-09 .....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  
A153/A153M-09 .....Zinc Coating (Hot-Dip) on Iron and Steel Hardware  
B108-03a-08 .....Aluminum-Alloy Permanent Mold Castings  
C1089-06 .....Spun Cast Prestressed Concrete Poles
- G. Federal Aviation Administration (FAA):  
AC 70/7460-IK-07 .....Obstruction Lighting and Marking  
AC 150/5345-43F-06.....Obstruction Lighting Equipment
- H. Illuminating Engineering Society of North America (IESNA)  
HB-9-00 .....Lighting Handbook  
RP-8-05 .....Roadway Lighting  
RP-20-98 .....Lighting for Parking Facilities  
RP-33-99 .....Lighting for Exterior Environments

- LM-5-96 ..... Photometric Measurements of Area and Sports Lighting Installations
- LM-50-99 ..... Photometric Measurements of Roadway Lighting Installations
- LM-52-99 ..... Photometric Measurements of Roadway Sign Installations
- LM-64-01 ..... Photometric Measurements of Parking Areas
- LM-72-97 ..... Directional Positioning of Photometric Data
- LM-79-08 ..... Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80-08 ..... Approved Method for Measuring Lumen Maintenance of LED Light Sources
- I. National Electrical Manufacturers Association (NEMA):
  - C78.41-06 ..... Electric Lamps – Guidelines for Low-Pressure Sodium Lamps
  - C78.42-07 ..... Electric Lamps – Guidelines for High-Pressure Sodium Lamps
  - C78.43-07 ..... Electric Lamps – Single-Ended Metal-Halide Lamps
  - C78.1381-98 ..... Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps
  - C82.4-02 ..... Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
  - C136.3-05 ..... For Roadway and Area Lighting Equipment – Luminaire Attachments
  - C136.17-05 ..... Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors
  - ICS 2-00 (R2005) ..... Controllers, Contactors and Overload Relays Rated 600 Volts
  - ICS 6-93 (R2006) ..... Enclosures
- J. National Fire Protection Association (NFPA):
  - 70-08 ..... National Electrical Code (NEC)
- K. Underwriters Laboratories, Inc. (UL):
  - 496-08 ..... Lampholders
  - 773-95 ..... Plug-In, Locking Type Photocontrols for Use with Area Lighting
  - 773A-06 ..... Nonindustrial Photoelectric Switches for Lighting Control
  - 1029-94 ..... High-Intensity-Discharge Lamp Ballasts
  - 1598-08 ..... Luminaires
  - 8750-08 ..... Light Emitting Diode (LED) Light Sources for Use in Lighting Products



## **1.06 DELIVERY, STORAGE, AND HANDLING**

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 12 in [305 mm] above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS AND EQUIPMENT**

Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

### **2.02 LUMINAIRES**

- A. Per UL 1598 and NEMA C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.
- B. Light distribution pattern types shall be as shown on the drawings.
- C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Pre-wire internal components to terminal strips at the factory.
- F. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- G. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- H. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.
- I. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

### **2.03 LAMPS**

- A. Install the proper lamps in every luminaire installed and every existing luminaire relocated or reinstalled.
- B. Lamps shall be general-service, outdoor lighting types.
- C. LED sources shall meet the following requirements:
  - 1. Operating temperature rating shall be between -40° F [-40° C] and 120° F [50° C].

2. Correlated Color Temperature (CCT): 3000K.
3. Color Rendering Index (CRI):  $\geq 80$ .
4. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

D. Mercury vapor lamps shall not be used.

#### **2.04 LED DRIVERS**

- A. LED drivers shall meet the following requirements:
1. Drivers shall have a minimum efficiency of 85%.
  2. Starting Temperature:  $-40^{\circ}$  F [ $-40^{\circ}$  C].
  3. Input Voltage: 120 to 480 ( $\pm 10\%$ ) V.
  4. Power Supplies: Class I or II output.
  5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50  $\mu$ s, 10kA/8 x 20  $\mu$ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
  6. Power Factor (PF):  $\geq 0.90$ .
  7. Total Harmonic Distortion (THD):  $\leq 20\%$ .
  8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
  9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

#### **2.05 EXISTING LIGHTING SYSTEMS**

- A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Install lamps in each luminaire.
- C. Adjust luminaires that require field adjustment or aiming.

#### **3.02 GROUNDING**

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a

metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

**3.03 ACCEPTANCE CHECKS AND TESTS**

Verify operation after installing luminaires and energizing circuits.

**--- END OF SECTION---**

**SECTION 31 20 00  
EARTH MOVING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK**

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
  2. Excavation.
  3. Underpinning.
  4. Filling and backfilling.
  5. Grading.
  6. Soil Disposal.
  7. Clean Up.

**1.2 DEFINITIONS**

- A. Unsuitable Materials:
1. Select Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 12 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction (less than 3 percent for native expansive soil), as defined by ASTM [ D 1557 ].
  2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, lime-treatment, or similar methods.
  3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Contracting Officer's Representative's (COR) approval.
- B. Trench Earthwork: Trenchwork required for utility lines.
- C. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- D. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure ASTM D1557. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.
- E. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.

- F. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- G. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- H. Authorized additional excavation: Removal of additional material authorized by the COR that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- I. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- J. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- L. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- M. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.
- N. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- O. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- P. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- Q. Contaminated soils: Soil that contains contaminants as defined and determined by the COR or the Government's testing agency.

### **1.3 RELATED WORK**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Site preparation: Section 31 23 19, DEWATERING, and Section 02 41 00, DEMOLITION.
- G. Foundation system requirements: Section 31 23 23.33, FLOWABLE FILL.

- H. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

#### 1.4 CLASSIFICATION OF EXCAVATION

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

#### 1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Furnish to COR:
1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
  2. Soil samples.
    - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
    - b. Laboratory compaction curve in accordance with ASTM D 1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
    - c. Test reports for compliance with ASTM D 2940 requirements for subbase material.
    - d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
    - e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

#### 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
1. T99-01(2004) Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
  2. T180-01(2004) Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM)
1. D448-03a Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  2. D1556-00 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

3. D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2700 kN m/m<sup>3</sup>))
  4. D2167-94 (2001) Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
  5. D2487-06 Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
  6. D2922-05 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  7. D2940-03 Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D. Society of Automotive Engineers (SAE):
1. J732-92 Specification Definitions - Loaders
  2. J1179-02 Hydraulic Excavator and Backhoe Digging Forces

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Select Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m<sup>3</sup> (110 pcf), a maximum Plasticity Index of 12, and a maximum Liquid Limit of 40, at least 20 percent fines (particles passing the No. 200 sieve).
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75- $\mu$ m (No. 200) sieve, per ASTM D2940. Also, the Liquid Limit shall be less than 40, the Plasticity Index shall be less than 12, and shall not contain rocks greater than three inches in maximum dimension.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75- $\mu$ m (No. 200) sieve.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- F. Granular Fill:
  1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4), per ASTM D 2940.

2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D 2940.

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION**

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by COR. Remove materials from Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by COR. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m<sup>3</sup> (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
  1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while



- maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
2. Locations of existing elevations indicated on plans are from a site survey that measured spot elevations. Contractor is responsible to notify COR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COR of any differences between existing or constructed grades, as compared to those shown on the plans.
  3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.
  4. Finish grading is specified in Section 32 90 00, PLANTING.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

### **3.2 EXCAVATION**

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the COR, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.
1. Design of the temporary support of excavation system is the responsibility of the Contractor.
  2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the COR.
  3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
  4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall provide a concrete fill support under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COR.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from COR. Approval by the COR is also required before placement of the permanent work on all subgrades.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the COR.
- D. Proofrolling
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.

2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proofrolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.
- E. Trench Earthwork
1. Utility trenches (except sanitary and storm sewer):
    - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
    - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
    - c. Support piping on undisturbed earth unless a mechanical support is shown.
    - d. Length of open trench in advance of piping laying shall not be greater than is authorized by COR.
  2. Storm sewer trenches:
    - a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
    - b. Bed bottom quadrant of pipe on undisturbed soil or granular fill.
      - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
      - 2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
    - c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
    - d. Use granular fill for bedding where rock or rocky materials are excavated.
- F. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, and the materials shall be examined by the COR for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:
  - a. Provide a smooth transition between adjacent existing grades and new grades.
  - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
  - c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
    - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
    - 2) Walks: Plus or minus 25 mm (1 inch).
    - 3) Pavements: Plus or minus 13 mm (1/2 inch).
  - d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

### **3.3 FILLING AND BACKFILLING**

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by COR.
- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of COR. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D1557 as specified below:
  1. Fills, Embankments, and Backfill
    - a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material in accordance with ASTM D1557, Method A, 95 percent.
    - b. Curbs, curbs and gutters, ASTM D1557, Method A, 95 percent.
    - c. Under Sidewalks, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material in accordance with ASTM D1557, Method A, 95 percent.

- d. Landscaped areas, top 400 mm (16 inches), ASTM D1557 Method A, between 88 and 92 percent.
  - e. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D1557 Method A, between 88 and 92 percent.
2. Natural Ground (Cut or Existing)
- a. Under building slabs, steps and paved areas, top 6 inches, ASTM D1557, Method A, 95 percent.
  - b. Curbs, curbs and gutters, top 6 inches, ASTM D1557, Method A, 95 percent.
  - c. Under sidewalks, top 6 inches, ASTM D1557, Method A, 95 percent.

### **3.4 GRADING**

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet) at minimum 2% slope.
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to COR at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

### **3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A

designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

### **3.6 CLEAN UP**

- A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center.

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

**SECTION 31 23 19  
DEWATERING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

**1.2 SUMMARY**

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
  - 1. Implementation of the Erosion and Sedimentation Control Plan.
  - 2. Dewater excavations, including seepage and precipitation.
- B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

**1.3 REQUIREMENT**

- A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 300 mm (1 foot) below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.
- B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 300 mm (1 foot) below prevailing excavation surface.
- C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
- D. Maintain stability of sides and bottom of excavation.
- E. Construction operations are performed in the dry.
- F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
  - 1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
  - 2. Erosion is controlled.
  - 3. Flooding of excavations or damage to structures does not occur.
  - 4. Surface water drains away from excavations.

5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

#### **1.4 RELATED WORK**

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

D. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

E. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.

F. Excavation, backfilling, site grade and utilities: Section 31 20 00, EARTH MOVING.

#### **1.5 SUBMITTALS**

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

B. Drawings and Design Data:

1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.

2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.

3. Include a written report outlining control procedures to be adopted if dewatering problem arises.

4. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.

5. Inspection Reports.

6. All required permits.

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

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.
- B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 300 mm (1 foot) below prevailing excavation surface at all times.

### **3.2 OPERATION**

- A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

### **3.3 WATER DISPOSAL**

- A. Dispose of water removed from the excavations in such a manner as:
  - 1. Will not endanger portions of work under construction or completed.
  - 2. Will cause no inconvenience to Government or to others working near site.
  - 3. Will comply with the stipulations of required permits for disposal of water.
  - 4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.
- B. Excavation Dewatering:
  - 1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
  - 2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
  - 3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
  - 4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.



- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

**3.4 STANDBY EQUIPMENT:**

- A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

**3.5 CORRECTIVE ACTION:**

- A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

**3.6 DAMAGES:**

- A. Immediately repair damages to adjacent facilities caused by dewatering operations.

**3.7 REMOVAL:**

- A. Insure compliance with all conditions of regulating permits and provide such information to the Contracting Officer's Representative (COR). Obtain written approval from COR before discontinuing operation of dewatering system.

--- E N D ---

**SECTION 31 23 23.33  
FLOWABLE FILL**

**PART 1 - GENERAL**

**1.1 INTRODUCTION**

- A. Flowable fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers. Flowable fill is sometimes referred to as controlled density fill (CDF), controlled low strength material (CLSM), lean concrete slurry, and unshrinkable fill.
- B. Flowable fill materials will be used as only as a structural fill replacement on VA projects. The materials and mix design for the flowable fill should be designed to produce a comparable compressive strength to the surrounding soil after hardening, making excavation at a later time possible.

**1.2 DESCRIPTION:**

- A. Furnish and place flowable fill in a fluid condition, that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans or as directed by the Contracting Officer's Representative (COR), verbally or in writing. This section specifies flowable fill for use as structural fill to remain excavatable using hand tools.

**1.3 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Earthwork, excavation and backfill and compaction requirements: Section 31 20 00, EARTH MOVING.

**1.4 DEFINITIONS:**

- A. Flowable fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal. Unless specifically approved otherwise, by the COR, flowable fill shall be designed as a permanent material, not designed for future removal. Design strength for this permanent type flowable fill shall be a compressive strength of 2.1 MPa (300 psi) minimum at 28 days. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.
- B. Excavatable Flowable fill – flowable fill designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

**1.5 SUBMITTALS**

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

- B. Flowable fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications.
1. Test and Performance - Submit the following data:
    - a. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C 39 at 28 days after placement.
    - b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
    - c. Flowable fill shall have a unit weight of 1900 – 2300 kg/m<sup>3</sup> (115 – 145 lb/ft<sup>3</sup>) measured at the point of placement after a 60 minute ready-mix truck ride.
  - C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.
  - D. Manufacturer's Certificates: Provide COR with a certification that the materials incorporated in the flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.

#### 1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
1. D4832-02 Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
  2. C618-03 Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as Mineral Admixture in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)
  3. C403/C403M-05 Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
  4. C150-99 Rev.A-04 Standard Specification for Portland Cement
  5. C33-03 Standard Specification for Concrete Aggregates
  6. C494/C494M-04 Standard Specification for Chemical Admixtures for Concrete
  7. RevA-98 Standard Specification for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced – Aggregate Concrete in the Laboratory
- C. American Concrete Institute (ACI):

1. SP-150-94 Controlled Low-Strength Materials

**1.7 QUALITY ASSURANCE:**

- A. Manufacturer: Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.
- B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, "Controlled Low Strength Materials."
- C. Pre-Approval Procedures: The use of flowable fill during any part of the project shall be restricted to those incidences where, due to field conditions, the Contractor has made the COR aware of the conditions for which he recommends the use of the flowable, and the COR has confirmed those conditions and approved the use of the flowable fill, in advance. During the submittal process, the contractor shall prepare and submit various flowable fill mix designs corresponding to required conditions or if the contractor desires to use flowable fill due to economics. Approval for the strength of the flowable fill shall be obtained from the COR when the contractor desires, or is required, to use flowable fill at specific location(s) within the project. Prior to commencement of field operations the contractor shall establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

**1.8 DELIVERY, STORAGE, AND HANDLING:**

- A. Deliver and handle all products and equipment required, in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

**1.9 PROJECT CONDITIONS:**

- A. Perform installation of flowable fill only when approved by the COR, and when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Provide flowable fill containing, at a minimum, cementitious materials and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option, and following approval by the COR. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the COR.
- B. Portland Cement: ASTM C150, Type 2. Meeting Caltrans Standard Specifications.
- C. Mixing Water: Meeting Caltrans Standard Specifications for use as mix-water for cast-in-place concrete.
- D. Air-Entraining Admixture: ASTM C260.
- E. Chemical Admixtures: ASTM C494.
- F. Aggregate: ASTM C33.

## **2.2 FLOWABLE FILL MIXTURE:**

- A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
- B. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C39 at 28 days after placement.
- C. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
- D. Flowable fill shall have a unit weight of 1900 – 2300 kg/m<sup>3</sup> (115 – 145 lbs/feet<sup>3</sup>) measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m<sup>3</sup> (150 lbs/cy).
- E. Flowable fill shall have an in-place yield of a maximum of 110% of design yield for removable types at 1 year.
- F. Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION:**

- A. Examine conditions of substrates and other conditions under which work is to be performed and notify COR, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

### **3.2 APPLICATION OF FLOWABLE FILL:**

- A. Secure tanks, pipes and other members to be encased in flowable fill. Insure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the flowable fill. Replacement or protection of metallic objects is subject to the approval of the COR.

### **3.3 PROTECTION AND CURING:**

- A. Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by COR.

--- E N D---

**SECTION 32 13 20  
SITE CONCRETE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Provide all labor, materials, equipment and services required for and incidental to the installation of site concrete including the following.
  - 1. Curbs, walks, and pavements, including aggregate base
  - 2. Footings for posts and structures, excluding architectural canopies
- B. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

**1.02 RELATED WORK**

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 00, EARTH MOVING.
- C. Site drainage structures: Section 33 40 00, STORM DRAINAGE UTILITIES
- D. Section 32 14 12, CONCRETE PAVERS
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE, for Smooth Form Finish Walls

**1.03 TOLERANCES:**

- A. ACI 117

**1.04 DESIGN REQUIREMENTS**

- A. Design all elements with the latest published version of applicable codes.

**1.05 TESTS**

- A. The Contracting Officer's Representative will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. Costs for such tests will be paid by the Contracting Officer's Representative. Contractor shall cooperate in arranging tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of samples at time of pour.
- B. Should tests show that concrete is below specified strength, Contractor shall remove all such concrete, as directed by the Contracting Officer's Representative. Full cost of removal of low strength concrete, its replacement with concrete of proper specified strength and testing, shall be borne by Contractor.
- C. Tests shall include:
  - 1. Subgrade compaction testing for concrete flatwork.
  - 2. Subgrade compaction testing for concrete pavers

**1.06 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
  - 1. Expansion joint filler
  - 2. Reinforcement

3. Curing materials
- C. Data and Test Reports: Select subbase material.
  1. Job-mix formula.
  2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
- D. Samples and Mockups:
  1. Full-scale mock-up (minimum 4' by 4') sample panels of all concrete paving finishes and color, subject to approval by Contracting Officer's Representative. The samples shall include curing compound if any is to be used, and include example of an expansion joint and a score joint, as indicated in drawings.
    - a. Provide mock-ups as necessary to achieve satisfactory results in finishing/textures/color, subject to approval by Contracting Officer's Representative.
    - b. Mock ups shall be constructed at the project site and available for review by Contracting Officer's Representative in time to allow time for mix design revision as necessary to achieve color and finish matching existing concrete paving. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the work.
  2. Caulking – Submit samples colored to match adjacent paving
- E. Concrete Mix Design: Submit for each type and strength of concrete.
  1. Include unit weight, slump, water-cement fly ash ratio curves, concrete mix ingredients, admixtures and compression test reports. Results of testing or test data used to establish mix proportions are to be provided for each mix design.
  2. Mix designs to be prepared, stamped and signed by a Professional Engineer registered in the State of California.
- F. Shop Drawings: Reinforcing steel: Complete shop drawings. Comply with requirements of ACI SP-66. Include bar sizes, material types, lengths, spacings, locations, and quantities of reinforcing steel; bar schedules, stirrup spacing, shapes of bent bars, spacing of bars, and types and location of splices.

## 1.07 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - M31 ..... Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A)
  - M55M/55M ..... Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185)
  - M147 ..... Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996)
  - M148 ..... Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A)
  - M171 ..... Sheet Materials for Curing Concrete (ASTM C171)
  - M182 ..... Burlap Cloth Made from Jute or Kenaf
  - M213 ..... Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)
  - T99 ..... Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
  - T180 ..... Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- C. American Concrete Institute (ACI):
  - 117R-06..... Tolerances for Concrete Construction and Materials
  - 211.1-91(R2002) ..... Proportions for Normal, Heavyweight, and Mass Concrete

- 301-05 ..... Specification for Structural Concrete
- SP-66-04 ..... ACI Detailing Manual
- 318/318R-05..... Building Code Requirements for Reinforced Concrete
- 347R-04..... Guide to Formwork for Concrete
- D. American Society for Testing and Materials (ASTM):
  - A615/A615M-08 ..... Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - C33-07..... Concrete Aggregates
  - C39/C39M-05 ..... Compressive Strength of Cylindrical Concrete Specimens
  - C94/C94M-07 ..... Ready-Mixed Concrete
  - C143/C143M-05 ..... Standard Test Method for Slump of Hydraulic Cement Concrete
  - C150-07..... Portland Cement
  - C171-07..... Sheet Material for Curing Concrete
  - C172-07..... Sampling Freshly Mixed Concrete
  - C173-07..... Air Content of Freshly Mixed Concrete by the Volumetric Method
  - C192/C192M-07 ..... Making and Curing Concrete Test Specimens in the Laboratory
  - C260-06..... Air-Entraining Admixtures for Concrete
  - C494/C494M-08 ..... Chemical Admixtures for Concrete
  - C618-08..... Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
  - A775/A775M..... Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b
  - D3963/D3963M ..... Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007)

**1.08 DELIVERY, STORAGE, AND HANDLING:**

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.
- D. Store reinforcement in a manner that will prevent rusting or coating with grease, oil, dirt, and other objectionable material.
- E. Deliver reinforcement to the job site bundled, tagged and marked using metal tags.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

- A. Cement and aggregates shall have proven history of successful use with one another. Sources of cement and aggregate shall remain unchanged throughout work.
- B. Mixes:
  - 1. Ready-mixed concrete shall meet requirements of ASTM C94.
  - 2. The Contractor shall perform tests or assemble the necessary data indicating conformance with specifications.
  - 3. For each mix, submit data showing that proposed mix will attain the required strength in accordance with requirements of Caltrans Standard Specifications, Section 90.
  - 4. Instruct Laboratory to base mix design on use of materials specified and approved by the Contracting Officer's Representative.
  - 5. Insure mix designs will produce concrete to strengths specified and of uniform



- density without segregation.
  - 6. If mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard, without changing cement content.
  - 7. Introduction of calcium chloride will not be permitted.
  - 8. Mix design shall match appearance of existing site concrete, subject to approval by Contracting Officer's Representative.
- C. Concrete Types (See Drawings for any other miscellaneous items not listed below):

TYPE	28-DAY STRENGTH	AGGREGATE SIZE	FINISH & COLOR	COMMENTS
Concrete Slabs and Pavement	3,000	1" X #4	Davis Color 'Pebble' per campus standards; Light Sandblast	Finish shall match existing adjacent concrete paving

**2.02 REINFORCEMENT**

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. New, free of rust, Billet steel bars: Current ASTM designation A615.
- C. Bar Reinforcement: ASTM A615.
  - 1. #3 and smaller: Grade 40.
  - 2. #4 and larger: Grade 60.
- D. Bar Reinforcement recycled content shall be a minimum of 75% recycled post consumer steel.
- E. Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.
- F. Epoxy coated reinforcement bars:
  - 1. Shall be in accordance with ASTM A775/A775M
  - 2. Shall be fabricated and handled in accordance with ASTM D3963/D3963M.

**2.03 SELECT SUBBASE (WHERE REQUIRED)**

- A. Subbase material shall consist of select granular material composed of sand, sand gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.
- B. Materials meeting other gradations than that noted will be acceptable whenever the gradations are within a tolerance of three to five percent, plus or minus, of the single gradation established by the job mix formula.
- C. Subbase material shall produce a compacted, dense graded course, meeting the density requirement specified herein.

**2.04 FORMWORK MATERIALS**

- A. Chamfer Strips: Meadow-Burke Concrete Accessories, PVC type CSF ½-inch or as otherwise noted, all exposed corners.
- B. Form Release Agent: Form release agent may be used at the discretion of the contractor as necessary to prevent peeling away of concrete material when forms are removed. Must not stain or otherwise adversely affect architectural concrete surfaces. "Nox-Crete Form Coating"; Industrial Synthetics Corp.'s "Synthex"; or equal.
- C. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.
- D. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or

curved forms for forming radii.

**2.05 CONCRETE MATERIALS**

- A. Portland Cement: ASTM C150, Type II. Use one brand of cement throughout project.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Aggregates: ASTM C33, materials from established sources with proven history of successful use in producing concrete with minimum shrinkage. Course Aggregate to be Size 67.
- D. Water: Clear and potable, free from deleterious impurities.
- E. Admixtures:
  - 1. Admixtures are at the discretion of and shall be determined by the contractor as needed to achieve the design intent of the drawings and prevent honeycombing, bug holes, rock pockets, voids, spalling, or other deficiencies. However, a water reducer or plasticizing admixture shall be included in the concrete mix.
  - 2. Any proposed admixture shall comply with ASTM C494.
  - 3. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
  - 4. Accelerating admixtures and admixtures containing more than 0.05 percent chloride ions are not permitted. If an accelerator is used, it shall be a non-chloride accelerator.
  - 5. Liquid admixtures shall be considered part of the total water.
  - 6. Admixtures must be compatible with color pigments where color pigments are used.
  - 7. Refer to Color Additives/Pigments herein for color admixtures.
- F. Color Additives/Pigments: Insoluble minerals, light fast, at least 95 percent passing #325 sieve complying with ASTM C979: Davis Colors, Los Angeles, CA (800) 356-4848; Color(s) shall be as follows:
  - 1. As noted in chart above
  - 2. Color additives containing carbon black are not acceptable.

**2.06 CURING COMPOUNDS FOR COLORED CONCRETE**

- A. Curing Compound for Colored Concrete: Water-base acrylic type, free of permanent color, oil or wax, complying with ASTM C309: "W 1000" by Davis Colors, Los Angeles, CA (800) 356-4848; or equal.

**2.07 CONCRETE MIXES**

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Cementitious Material: An intimate blend of type II Portland cement and fly ash. Cementitious material shall include 15 percent maximum fly ash by weight unless the strength is specified to be achieved on 7 or 14 days.
- C. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- D. Cement and water factor (See Table I):

**TABLE 2 - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete: Strength	Non-Air-Entrained	Air-Entrained
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Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
30 (4000) <sup>1</sup>	325 (550)	0.50	340 (570)	0.50
25 (3000) <sup>1</sup>	280 (470)	0.55	290 (490)	0.55

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
- E. Air-entrainment is required for all exterior concrete. Air content shall conform with the following table:

**TABLE 3 - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

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

- F. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Contracting Officer's Representative. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

**2.08 BATCHING & MIXING:**

- A. Store, batch, and mix materials as specified in ASTM C94.
1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
  2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

**2.09 ANCILLARY MATERIALS**

- A. Aggregate Base: Class II aggregate base conforming to Section 26 of the Standard Specifications and Subgrade Specifications herein.
- B. Expansion Joint Material
1. Fiber Expansion Joint: A non-extruding resilient filler, saturated with high quality bituminous materials having preserving characteristics. Conform to ASTM-D1751-04.
  2. Caulking at Expansion Joint: "Sonolastic Sealant Two-Part" as manufactured by Sonneborn-Contech, Building Products Division, Contech, Inc.; or approved

- equal. Joint caps or bond breaker tape to be as recommended by sealant manufacturer. Color shall be to match adjacent paving.
- C. Dampproofing behind Planter Walls: Per CALTRANS Standard Specifications, Section 54.
  - D. Subsurface Drain behind Planter Walls: All concrete walls that retain 30 inches of soil or more shall include a subsurface drainage system to relieve water pressure in accordance with Section 68 of the CALTRANS Standard Specifications and as shown. If no subsurface drain is shown, provide corrugated polyethylene plastic tubing per 68-1.02K surrounded with an envelope of Class 2 permeable material per 68-1.025 and wrapped with filter fabric per 68-1.028. Provide black colored rodent-proof cap over exposed outfalls as accepted by Contracting Officer's Representative.
  - E. Form-Ties: Form-ties shall not be used for any exposed concrete surfaces.
  - F. Surface Retarder (to achieve "etch" finish): Top-Cast Surface Retarder by Grace Company/Dayton Superior. Specific product number shall be selected and applied per manufacturer recommendations as necessary to achieve finish texture to match adjacent pedestrian concrete paving.

### **PART 3 - EXECUTION**

#### **3.01 SUBGRADE PENETRATION**

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

#### **3.02 SETTING FORMS**

- A. Base Support:
  - 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
  - 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
  - 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
  - 2. Formwork installation conform to ACI 347. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction and will hold concrete without leakage.
  - 3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
  - 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
  - 5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.
  - 1. Make necessary corrections to forms immediately before placing concrete.
  - 2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

- D. Form Liners:
  - 1. Provide form-liners for specialty textures as shown in drawings

### **3.03 EQUIPMENT**

- A. The Contracting Officer's Representative shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

### **3.04 PLACING REINFORCEMENT**

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the Contracting Officer's Representative shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

### **3.05 PLACING CONCRETE – GENERAL**

- A. Obtain approval of the Contracting Officer's Representative before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Contracting Officer's Representative before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.
- H. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- I. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Contracting Officer's Representative.

### **3.06 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS**

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.

- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

### **3.07 CONCRETE FINISHING – GENERAL**

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
  - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
  - 2. Maintain finishing equipment and tools in a clean and approved condition.

### **3.08 JOINTS – GENERAL**

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.
- C. Sawn Contraction Joints:
  - 1. General: Provide where shown. Saw cut straight, true, and uniform, and not less than 1/4 of slab thickness in depth, unless otherwise noted. Cut with a power saw fitted with an abrasive or diamond blade.
  - 2. Commence saw cutting operations after concrete has cured long enough to resist damage by the saw cutting operations and early enough to avoid random contraction cracks.
  - 3. Contractor shall coordinate form removal and sequencing of adjacent concrete placement to minimize unnecessary saw cutting of adjacent surfaces.
  - 4. Contractor shall plan for the use of varying types of saw cutting apparatus to provide acceptable finishes in areas limited in accessibility.
  - 5. Fill saw cut over-runs and inadvertent saw cutting of adjacent surfaces with cement mortar to match color and finish of sawn pavement.
  - 6. If the joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Contracting Officer's Representative.
- D. Tooled Joints / Score Joints
  - 1. Form joints in fresh concrete using a jointer to cut the groove so that a smooth, uniform impression is obtained to 1/4 depth of pavement unless shown otherwise.
  - 2. All joints shall be struck before and after brooming. Tool concrete both sides of joint.
  - 3. If joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Contracting Officer's Representative.

### **3.09 CONTRACTION JOINTS**

- A. Cut joints to depth as shown, min 1/4 of slab thickness, by sawing with a blade producing the required width and depth.
- B. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

### **3.10 EXPANSION JOINTS**

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.

- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown,
- C. Top edges of joint filler shall not exceed 1/8 inch below finish grade of adjacent concrete, except that top edges of joint filler shall be below the finished concrete surface to allow for sealing where shown.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Round the edges of joints with an edging tool.
- F. Form expansion joints as follows:
  - 1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
  - 2. Using joint filler of the type, thickness, and width as shown.
  - 3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.
- G. Sealed (Caulked) Joints:
  - 1. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint sealant to just below adjacent paved surface in such a manner as to avoid spilling on paved surfaces or overflowing from joint.
  - 2. Place backer rod within joint so it is held firmly in place at a consistent depth as shown in drawings.

### 3.11 FINISHING OF FLATWORK

- A. Pedestrian Flatwork
  - 1. Sandblast Finish:
    - a. Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.
    - b. Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to match sample panel, as follows:
      - i. Light Cut: approximately 1/16" depth
      - ii. Medium Cut: approximately 1/8" to 3/16" depth
      - iii. Heavy Cut: approximately 1/4" to 5/16" depth
    - c. Blast corners and edge of patterns carefully, using backup boards in order to maintain a uniform corner of edge line.
    - d. Use same nozzle, nozzle pressure and blasting technique as used for sample panel.
    - e. Maintain control of abrasive grit and concrete dust in each area of blasting. Clean up and remove all expended abrasive grit, concrete dust and debris at the end of each day of blasting operations.
- B. Sub-slabs:
  - 1. Medium Broom Finish: Obtain by drawing a stiff bristled broom across a floated finish for a nonslip surface. Perform brooming while concrete is still wet enough to receive broom marks to match approved sample. Direction of brooming to be perpendicular to direction of work or as otherwise shown on the drawings.

### 3.12 FORM REMOVAL

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

### 3.13 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Contracting Officer's Representative.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.
- D. Liquid Membrane Curing:
  - 1. For colored concrete, refer to CURING COMPOUNDS FOR COLORED CONCRETE above in PART 2- PRODUCTS. Apply as recommended by manufacturer.

### **3.14 CLEANING, PATCHING AND DEFECTIVE WORK**

- A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, mismatched color, or is otherwise defective or impairs proper strength or appearance of the work in the Contracting Officer's Representative's judgment, the concrete work shall be removed and replaced at the Contractor's expense.
- B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, etc., with patching mortar colored and textured to match concrete. Remove ledges and bulges.
- C. Compact mortar into place and neatly file defective surfaces to produce level, true planes. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.
- D. Rock Pockets:
  - 1. Cut out to full solid surface and form key.
  - 2. Thoroughly wet before casting mortar.
  - 3. Where the Contracting Officer's Representative deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, and replace.
- E. Cleaning
  - 1. Insure removal of bituminous materials, form release agents, bond breakers, curing compounds, if permitted and other materials employed in work of concreting that would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
  - 2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

### **3.15 PROTECTION**

- A. The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Contracting Officer's Representative, and at no additional cost to the



Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Contracting Officer's Representative.

**3.16 FINAL CLEAN-UP**

- A. Remove all debris, rubbish and excess material from the project site.

**--- END OF SECTION ---**

**SECTION 32 14 12  
CONCRETE & STONE PAVERS**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Provide all labor, materials, equipment and services required for and incidental to the installation of concrete pavers.

**1.02 RELATED WORK**

- A. Section **31 20 00**, EARTH MOVING
- B. Section **32 13 20**, SITE CONCRETE
- C. Section **01 45 29**, TESTING LABORATORY SERVICES

**1.03 QUALITY ASSURANCE**

- A. A person who is thoroughly familiar with the type of materials being installed and the methods for their installation shall be present at all times during execution of the work.

**1.04 SUBMITTALS**

- A. Per Section **01 33 23**, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Concrete and Stone Pavers, submit the following:
  - 1. Product cut-sheet and product literature.
  - 2. Full size paver samples of each type of paver used indicating full range of color and finish to be expected in completed work.
- C. Construct an 8'-0" x 8'-0" minimum sample area at job site with 2x4s restraints and vibrate in place including all color patterns, bands and paver field with edges cut to match the restraints. Protect sample panel until unit paving work is accepted. Locate panel where directed by Contracting Officer's Representative.

**1.05 CODE REQUIREMENTS:**

- A. Conform to the requirements of all applicable local, state and federal building and safety codes, ordinances and regulations.

**1.06 PRODUCT HANDLING:**

- A. Deliver and unload concrete and stone pavers at job site on pallets and bound in such a manner that no damage occurs to the product during hauling, handling or unloading at the job site. Provide bedding and joint sand in such a manner as to deter contamination including saturation of water..

**1.07 WARRANTY:**

- A. Warrant all of the work under this Section to be free of defects of any kind, whether due to workmanship or materials, for a minimum period of one year from the time of completion of the project. This one year warranty does not negate the various manufacturers warranties that are longer than one year.

## **PART 2 - PRODUCTS**

### **2.01 CONCRETE PAVERS**

- A. Concrete pavers shall be in accordance with the drawings, patterns, and details as shown on the plans and/or contained within these specifications.
- B. All pavers shall be produced by single source manufacturers.
- C. Pavers shall be sealed as recommended by manufacturer.
- D. Concrete pavers shall be made from 5000 psi (34,450 kPa) hardrock concrete using Type III cement.
- E. Materials used to manufacture concrete pavers shall conform to the following:
  - 1. Cement: ASTM C150 (Portland Cement)
  - 2. Aggregates: ASTM C33 (washed, graded sand and rock; no expanded shale or lightweight aggregates).
- F. Concrete Paver Types:
  - 1. Concrete Unit Paver: 3" x 18" x 4", "Granada White" #1401 (with Slag), "Light Sandblast", by Stepstone Inc. Gardena, CA (800) 572-9029; or approved equal.

### **2.02 STONE PAVERS**

- A. Concrete pavers shall be in accordance with the drawings, patterns, and details as shown on the plans and/or contained within these specifications.
- B. All pavers shall be produced by single source manufacturers.
- C. Pavers shall be sealed as recommended by manufacturer.
- D. Stone Paver Types:
  - 1. See drawings for stone types.

### **2.03 AGGREGATE BASE**

- A. Aggregate base shall be crushed aggregate, R-78 minimum, 3/4" maximum, conforming to Caltrans Standard Specifications 26.1.02A, Class 2, free from organic matter or other deleterious substances.

### **2.04 SAND LAYING COURSE**

- A. Sand laying course shall conform to ASTM C33 as follows:

<u>Sieve Size</u>	<u>3/8 in.</u>	<u>No. 4</u>	<u>No. 8</u>	<u>No. 16</u>	<u>No. 30</u>	<u>No. 50</u>	<u>No. 100</u>
% passing	100	95-100	80-100	1-12	25-60	10-30	2-10

- B. CALTRANS Department of Transportation Specifications 90-3.03, Fine Aggregate Gradings:
  - 1. Thickness of sand laying course nominal 1" and uniform to ensure an even surface.

2. The sand laying course shall be the responsibility of the paver installer.

## **2.05 MORTAR SETTING BED**

- A. Mortar bed shall be installed where shown on drawings
- B. Latex-Portland Cement Mortar Mortar setting bed, Type "N", 1 part cement, 1 part lime and 3 parts sand meeting the requirements of ASTM C270 Standard specification for Unit Masonry.
  1. Portland Cement: ASTM C150, Type II
  2. Lime ASTM C207, Type "S" hydrated lime.
  3. Sand: ASTM C144, clean, non-staining sand, white or light grey.
  4. Water: Fresh, clean, non-alkaline water, potable.
  5. Acrylic Latex Admixture: Sika latex as manufactured by Sika Corp. (415) 487-2294 or Anchor-it by Anti-Hydro Co. (202) 242-8000, or equal.
  6. Joint mortar: Mixture of white cement and pigment. Pigment to be a standard commercial brand of chemically inert coloring material. Color to match color of stone unless otherwise noted.
  7. Epoxy Tack Coat: Sikadur 32, Hi-Mod, Moisture insensitive epoxy adhesive as manufactured by Sika Corporation, Concrete 1001 LPL epoxy adhesive as manufactured by Adhesive Engineering Company or equal.
  8. Evaporation Control Liquid" That does not discolor the stone or harm the grout when worked into grout surface.
  9. Paint for Granite engraved letters: White lithochrome dye. Paint application technique for granite shall be as recommended by the granite supplier. Paint color shall be as noted on plans. Letters to receive two coats of paint.
  10. Sealer for granite and stone paver shall be as recommended by manufacturer. If manufacturer does not have a recommendation, submit stone sealer data sheets to Contracting Officer's Representative for approval.

## **2.06 SAND JOINT FILLER**

- A. Sand Joint Filler to be installed where shown on drawings
- B. Plaster sand.

## **2.07 SEALER:**

- A. Joint stabilizing Sealer, water-based, single component, epoxy-modified, penetrating sealer and joint sand stabilizer. Shall be VOC, EPA, OSHA and FDA compliant through 2007 as recommended by concrete paver manufacturer.

## **2.08 GROUT**

- A. Grout joints to be installed where shown on drawings
- B. Consist of 1 to 1 ½ parts dry Portland Cement and color. Submit colored samples for approval. Consist of 1 part Portland Cement and 4 parts sand. Add up to 10% lime. When the grout core is 2" or more wide, substitute part of the sand with 1 to 2 parts of pea gravel to the above grout mix. Add water to grout to cause it to flow without segregation into all voids intended to be filled, and to produce a 28-day strength

### **PART 3 - EXECUTION**

#### **3.01 SUBGRADE PREPARATION**

- A. Subgrade is that area on which pavement, surfacing, base, sub-base or layer of any other material that may be specified, is to be placed.
- B. Provide subgrade preparation and the base material installation complete, including clearing, grading, excavation, and filling and dewatering. Take every precaution to obtain a subgrade of uniform bearing power compacted to a minimum of 90% relative compaction as determined by the ASTM D1557 laboratory test procedure and in Sections 19, 25 and 26 of the Caltrans Standard Specifications.
- C. After clearing subgrade of all vegetation and debris in accordance with Section 16 of the Caltrans Standard Specifications, prepare the soil subgrade in accordance with the recommendations provided in the geotechnical report for concrete flatwork. Remove all boulders, hardened material or rock encountered. The earth shall be uniform for the full depth and width of the subgrade.

#### **3.02 AGGREGATE BASE**

- A. Deliver to site as a uniform mixture and spread each layer in one operation without segregation.
- B. Spread and compact Class 2 Aggregate Base to a minimum of 95% relative compaction with equipment that will provide a uniform layer conforming to the planned section, and as specified in Section 26 of the Standard Specifications.
- C. The elevation of the compacted surface shall not deviate more than  $\pm\frac{1}{2}$  inch over a 10 foot straightedge.

#### **3.03 SAND LAYING COURSE:**

- A. Install dry sand to uniform depth required for flush finish after pavers are installed. The designed nominal depth shall be one inch thick with no sand thickness less than  $\frac{3}{4}$ " or more than  $1\frac{1}{2}$ ". Sand is to remain undisturbed prior to the installation of pavers. Moisture content of sand to remain constant.

#### **3.04 CONCRETE SUB-SLAB:**

- A. Install as shown on Drawings and accepted by Contracting Officer's Representative.

#### **3.05 PAVER INSTALLATION**

- A. Before installing, clean pavers of all foreign material. Do not begin installation of pavers until subgrade and base have been prepared per Specifications.
- B. Start installation from a corner or straight edge, unless detailed otherwise, and proceed forward over the undisturbed sand bedding course with pavers as shown on Drawings.
- C. Cut pavers with a double bladed stone cutter or diamond blade masonry saw.
- D. Install pavers plumb and true to line and grade to coincide and align with adjacent work and elevations in accordance with Drawings. Use string lines to hold pattern lines true.
- E. All perimeter edges must be retained to secure the pavers. Provide retainer as required or as shown in drawings.
- F. No paver joint shall be greater than 1/4" inch.

- G. The final surface elevation of pavers shall not deviate more than 3/8 in. under a 10 ft long straightedge and 1/8 in. between individual pavers.
- H. The surface elevation of pavers shall be 1/8 to 1/4 inch above adjacent drainage inlets, concrete collars or channels.
- I. Sand Set Pavers
1. Install Sand Laying Course where shown on drawings.
  2. Set Screed sand bedding course or to recommended depth. Sand is to remain undisturbed prior to the installation of unit pavers. Maintain constant sand moisture content.
- J. Mortar Set Pavers
1. Install Mortar Setting Bed where shown on drawings.
  2. Mix mortar in small batches using clean water until it is thoroughly homogeneous, stiff and plastic. Use minimum amount of water consistent with workability. Add acrylic latex admixture per manufacturer's recommendations. After mixing, set mortar for no more than 2 hours before using.
  3. Setting: Clean all pavers of frost and dirt prior to setting on mortar base. Do not use wire brushes or implements which mark or damage the finish. Apply epoxy tack coat to underside of pavers per manufacturer's recommendations. Carefully set each piece in a full bed of mortar. Tap home with a wood mallet to a full and solid bearing. Keep all exposed surfaces free of mortar at all times. Provide anchors wherever required to hold work in alignment and per code requirements. Lay stone parallel to the base line where shown on the Drawings. Every course of stone shall be laid true and even and brought to finished grade shown on the Drawings.
  4. Use a plate vibrator to compact sand set pavers and to vibrate the sand up into the joints between the pavers. A plate type vibrating compactor capable of 3,000 to 5,000 lbs. centrifugal compaction force should be used to compact the unit pavers into the sand bedding course. 2 - 3 passes is recommended to insure an even elevation. Ensure paver surface is clear of debris prior to compaction. Do not use joint sand during this process. Avoid scuffing finished surface of pavers. Replace Scuffed pavers as directed by Contracting Officer's Representative.
  5. Profiled Pavers shall be protected from scuffing during compaction using a woven geotextile such as Mirafi 500X or other method. Scuffed pavers shall be replaced as directed by Contracting Officer's Representative.
- K. Grout Joints
1. Install Grout where shown on drawings.
  2. All grout joints shall be struck.
  3. After all pointing has been completed, carefully clean work of dirt, excess mortar, stains and other defacements. Do not use acids, harsh abrasive cleaners or steel wire brushes. Point open joints and replace defective work.
- L. Sand Joints
1. Install Joint Sand where shown on drawings.
  2. Spread plaster sand over the installed and approved pavers and vibrate into the joints between the pavers. Make several passes with the plate compactor, while sweeping the sand into the paver joints. Insure all joints are full before clean up. Excess sand should be swept up and removed from the completed unit paver installation. The completed paving installation shall be swept and washed down to provide a clean, finished paved surface
  3. Install grout material as shown on drawings. Insure all joints are full before clean up. Excess grout should be removed from the completed unit paver installation.

The completed paving installation shall be swept and washed down to provide a clean, finished paved surface.

- M. Protect paved areas from damage and stains during installation and throughout the remainder of the project until final project acceptance. The completed paver installation shall be swept and washed down to provide a clean, finished, workmanlike hardscape pavement.
- N. Apply paver sealer after final cleanup and wash down of paving surfaces. Prior to applying sealer, remove any stains and efflorescence using cleaners as recommended by manufacturer. During application, protect surrounding areas from over spray. All traffic, pedestrian or vehicular, shall be kept off of sealed pavers until initial cure time has been achieved.

### **3.06 FIELD QUALITY CONTROL**

- A. After sweeping the surface clean, check final elevations for conformance to the drawings.
- B. Lippage: No greater than 1/8 inch difference in height between adjacent pavers.
- C. The minimum slope of the finished pavement surface shall be 1%.

### **3.07 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

### **3.08 CLEANUP**

- A. Per Section 01 74 00.
- B. Perform the work under this Section so as to keep affected portions of the buildings and site neat, clean and orderly. Upon completion of the work under this Section, remove immediately all surplus materials, rubbish and equipment associated with or used in the performance of this work.
- C. Reset all disturbed pavers and brush joints with sand. Reseal individual pavers as required.

--- END OF SECTION ---

**SECTION 32 84 00  
PLANTING IRRIGATION**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Work includes an automatically-controlled irrigation system, complete, including piping, drip emitters, valves, controls, control wiring, fittings, electrical connections and necessary accessories.

**1.02 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT
- C. Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS
- D. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Division 26, ELECTRICAL: Power connection to controller
- F. Section 31 20 00, EARTHWORK
- G. Section 32 90 00, PLANTING

**1.03 ABBREVIATIONS**

- A. FPT: Female pipe thread
- B. HDPE: high-density polyethylene plastic
- C. PVC: Polyvinyl chloride plastic
- D. PE: Polyethylene
- E. O.D.: Outside diameter
- F. I.D.: Inside diameter
- G. GPH: Gallons per hour
- H. GPM: Gallons per minute
- I. IPS: Iron pipe size

**1.04 REFERENCE, CODES AND STANDARDS**

- A. All current International Building Code, state, local, federal, and VA codes, standards, regulations, and ADA requirements shall pertain to this project. These may include but not limited to, architectural, structural, mechanical, electrical, fire and life safety codes. The project shall follow the most stringent and current rules codes, standards, and regulations.
  - 1. AB1881 State of California Model Water Efficient Landscape Ordinance, California Code of Regulation
  - 2. Water Use Classification of Landscape Species (WUCOLS)
  - 3. America Society of Irrigation Consultant (ASIC) Design Guidelines
  - 4. California Landscape Standards, California Landscape Contractors Association (CLCA), Sacramento, California
  - 5. CAL-OSHA, Title 8, Subchapter 4-Construction Safety Orders, and Subchapter 7-General Industry Safety Orders
  - 6. NFPA 70, National Electrical Code (NEC)
  - 7. California Electrical Code
  - 8. Uniform Plumbing Code (UPC)
  - 9. California Plumbing Code (CPC)
  - 10. National Fire Protection Association (NFPA) 24, Section 10.4 Depth of Cover



11. Underwriters Laboratories (UL): Electrical wiring, controls, motors and devices, UL listed and so labeled.
12. American Society of Testing Materials (ASTM)

#### 1.05 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society Of Mechanical Engineers (ASME):
  - B16.18-2012 Cast Copper Alloy Solder Joint Pressure Fittings
  - B16.22-2012 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
  - B16.24-2011 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500
  - B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
  - B40.100-2005 Pressure Gauges and Gauge Attachments
- C. American Society Of Sanitary Engineering (ASSE):
  - 1013-2011 Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers
- D. American Society For Testing And Materials (ASTM):
  - A536-84 (R2009) Ductile Iron Castings
  - B32-08 Solder Metal
  - B61-08 Steam or Valve Bronze Castings
  - B62-09 Composition Bronze or Ounce Metal Castings
  - B88/B88M-09 Seamless Copper Water Tube
  - B813-10 Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
  - D1785-12 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120
  - D2241-09 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
  - D2464-13 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
  - D2466-06 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
  - D2467-13 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
  - D2564-12 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
  - D2609-02(2008) Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
  - D2683-10 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

- |    |  |  |
|----|--|--|
|    | D2855-96(2010)                               | Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings  |
|    | D3261-12                                     | Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing                              |
|    | F477-10                                      | Elastomeric Seals (Gaskets) for Joining Plastic Pipe   |
|    | F656-10                                      | Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings                               |
|    | F771-99(2005)                                | Polyethylene (PE) Thermoplastic High-Pressure Irrigation Pipeline Systems  |
| E. | American Water Works Association (AWWA):     |  |
|    | C500-09                                      | Metal-Seated Gate Valve for Water Supply Service   |
|    | C504-10                                      | Rubber-Seated Butterfly Valves   |
|    | C906-07                                      | Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1600 mm), for Water Distribution and Transmission |
| F. | American Welding Society (AWS):              |  |
|    | A5.8/A5.8M:2011                              | Filler Metals for Brazing and Braze Welding  |
| G. | Manufacturers Standardization Society (MSS): |  |
|    | SP-70-2011                                   | Gray Iron Gate Valves, Flanged and Thread Ends   |

## 1.06 QUALITY ASSURANCE

- A. Criteria:
1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
  2. There is a permanent service organization, maintained or trained by the manufacturer, which will render satisfactory service within eight hours of receipt of notification that service is requested.
  3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
- B. Products Criteria:
1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
  2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
    - a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
    - b. Components are compatible with each other and with the total assembly for the intended service.
  3. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- C. System Requirements:

1. Full and complete coverage is required. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout required to achieve full coverage of irrigated areas.
  2. This system is designed to work at 30 psi minimum available pressure. Notify Contracting Officer's Representative immediately of any discrepancies.
  3. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.
  4. Locations of remote control valves is schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads, or as shown.
  5. Irrigation lines and control wire shall run through designated utility lanes or beside roadways where most appropriate.
  6. Connect existing and new RCV wires to new controllers where shown and as specified as accepted by Contracting Officer's Representative.
  7. Contractor is responsible for installing all equipment indicated both on drawings and as recommended by the manufacturer for an operational and functioning drip system. This includes flushing end valves, check valves, and visual pop-up indicators.
  8. All irrigation components shall be commercial grade and carry a 5 year warranty.
- D. Maintenance and Operating Instructions: Prior to final acceptance, verbal instructions, for a period of not less than 8hours, shall be provided to the operating personnel. Provide manuals as specified in Section 01 00 00, GENERAL REQUIREMENTS.
- E. Completely program existing controller and satellites according to approved irrigation schedule. Contractor shall make continuous adjustments to the programming as required from irrigation installation completion to the end of the Maintenance Period, to provide adequate watering of new plant materials. Plants shall not be overwatered resulting in plant health issues, or drainage issues. Bring any irrigation issues immediately to the attention of the Contracting Officer's Representative.
- F. Follow manufacturer's instructions for installation.
- G. Manufacturer of Control Systems to certify Control System is complete, including all related components, and totally operational. Submit certificate to Contracting Officer's Representative.
- H. As-Built Record Drawings: Maintain a complete set of as-built drawings which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment. Valves shall be shown with dimensions to reference points.
- I. Controller Chart:
1. Consolidate information from existing system (to remain) with new system.
  2. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
  3. Provide one controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
  4. Chart shall be a blackline print with a different color used to show area of coverage for each station.
  5. Charts must be completed and approved prior to final inspection of the irrigation system.

## 1.07 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data:
  - 1. Piping.
  - 2. Jointing materials.
  - 3. Valves.
  - 4. Frames and covers.
  - 5. Strainers
  - 6. Pressure gauges.
  - 7. Automatic control equipment.
  - 8. Irrigation Emitters: Pop-up spray, Bubblers, Drip Emitters, etc
  - 9. Drip Emitters
  - 10. Quick couplers.
  - 11. Valve boxes.
  - 12. Drip pop-up indicator valve
- C. Name and address of a permanent service organization maintained or trained by the manufacturers that will render satisfactory service within eight hours of receipt of notification that service is requested.
- D. "As-built" drawings consisting of a hard copy in original scale, an electronic pdf file, and an electronic CAD file in conformance with the VA standards.
- E. After "as-built" drawings have been approved, submit print of controller chart.
- F. Submit controller timing schedule showing time settings for each automatic control valve.

## PART 2 - PRODUCTS

### 2.01 PIPING

- A. Main line pipe: 3" and smaller pipes shall be Schedule 40 solvent weld PVC pipe with Schedule 40 solvent weld fittings.
- B. Lateral line pipe: ¾" through 3" shall be Schedule 40 solvent weld PVC pipe with Schedule 40 solvent weld fittings
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- D. Above Grade and in Concrete Pit: AWWA C115, flanged joints and fittings working pressure 1025 kPa (150 psi).
- E. Fittings:
  - 1. Irrigation Mains (PVC Pipe): Schedule 40 solvent welded fittings.
  - 2. Irrigation Laterals: PVC, schedule 40, solvent welded socket type, ASTM D2466.
  - 3. Threaded Pipe: PVC, schedule 80, ASTM D2464.
  - 4. Swing Joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 1375 kPa (200 psig) working pressure.
  - 5. Schedule 80 fitting and nipples at connections to remote control valves
- F. Jointing Materials:
  - 1. Irrigation Laterals: Solvent cement, ASTM D2564.

### 2.02 SLEEVE MATERIAL

- A. Schedule 40 PVC, white color for water and grey color for wires.

### 2.03 VALVES (EXCEPT REMOTE CONTROL VALVES)

- A. Underground Isolation Valves:
  - 1. Gate Valves: 3" and smaller valves shall have a brass body with a threaded cross handle and non-rising stem.
  - 2. Ball valves (for isolation valves 1-1/2" and smaller): Full-port ball valves with threaded brass body, PTFE seats, and 90 degree on/off handle. Ball valves to have NPT female end connections. Schedule 80 PVC Ball Valves also acceptable.
- B. Operations:
  - 1. Underground: furnish valves with 50 mm (2 inch) nut for T-Handle socket wrench operation.
  - 2. Above ground and in pits: MSS SP-70, with handwheels.
  - 3. Ends of valves shall accommodate the type of pipe installed.
- C. Check: Swing.
  - 1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 850 kPa (125 pound) WSP, 235 psi ( 1620 kPa) minimum working pressure.
  - 2. One hundred mm (4 inches) and larger: Iron body, bronze trim, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG.
- D. Pressure Reducing Valve: cast bronze body with stainless steel seat. Pressure spring range shall be 10 to 125 psi. Flow passages and all parts designed to withstand high velocity applications, flange connected.

### 2.04 REMOTE CONTROL VALVES:

- A. Provide Isolation Valve upstream from each group of control valves.
- B. Each irrigation section shall be automatically operated by a remote control valve installed underground and operated by a 24-volt AC electric solenoid Valves shall be of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation. Install valves with union on one side to allow for easy removal. Valves shall have a minimum of 1025 kPa (150 psi) working pressure.
- C. Valve body shall be cast-iron with brass bonnet, trim and renewable seat and have two inlet tappings (furnished with one plugged) to allow installation as either a straight or angle pattern valve. Glass filled nylon body diaphragm type with manual bleed and flow control and pressure regulating capable is also acceptable.
- D. Valves shall be diaphragm type designed to operate in water containing sand and debris, without the use of scrubbers or filters. To ensure this, the flush rod shall be tapered to vary the size of the port opening as the diaphragm raises and lowers, thus allowing trapped material to escape. Rod to be finished with a serrated surface to help scrub trapped material out. The effective diaphragm working area/valve seating opening ratio must be a minimum of 3 to 1. Valves shall be completely serviceable from the top without removing valve body from the system. Furnish 2 750 mm (30 inch) long adjustment keys. Valves to operate at no more than 50 kPa (7 psi) pressure loss at manufacturers maximum recommended flow rate.

### 2.05 QUICK COUPLERS

- A. Shall be 1" and have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.
- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Furnish 2 hose swivels and operating keys for each size coupler to the Contracting Officer's Representative.

## 2.06 VALVE BOX

- A. Valve boxes shall not be placed in pavement.
- B. Valve boxes to have bolt down lids. Provide tamper proof bolts for all lids.
- C. Gate Valve: Valve boxes shall be HDPE box, black in color. Box shall be of such length to be adapted to depth of cover required over pipe at valve location. Mark box cover to differentiate between lawn irrigation system and domestic water supply system and set flush with finished grade. Provide 2 "T" handle socket wrenches of 15 mm (5/8 inch) round stock with sufficient length to extend 600 mm (2 feet) above top of deepest valve box cover.
- D. Remote Control Valves: Valve boxes shall be HDPE structural foam Type A, Class III, black in color. Box shall be minimum 475 mm (19 inches) long by 350 mm (14 inches) deep with key-lockable hinged cast iron cover.
  - 1. Permanently mark valve box lid with 2" white valve number and controller letter or with numbered metal tag inside box as approved by Contracting Officer's Representative.
  - 2. Furnish 2 750 mm (30 inch) long valve adjustment keys.
- E. Drip zone Lateral Flush Cap Assembly: Round reinforced plastic valve box and lid constructed from HDPE structural foam Type A, Class III, black in color. Opening at top of access box to be 14.5 cm (5-3/4") diameter, minimum. Height of access box to be 23cm (9-1/16"), minimum. Lid to have lift-hole for opening.

## 2.07 SPRAY HEADS

- A. Shall be of make, type and performance as indicated on drawings. The entire internal assembly including filter screen, to be capable of removal from the top without removing the sprinkler case from the riser.
- B. Rotator Pop-up Sprays:
  - 1. Rotator to have multi-trajectory rotating stream delivery system. Body shall be pressure compensating at 50 psi and constructed of corrosion and UV resistant heavy-duty ABS. Body to have factory installed drain check valve capable of checking up to 14 feet in elevation change. Nozzles are shall have fully adjustable arcs and radius reduction up to 25%. Provide head-to-head coverage.
  - 2. 15' - 20' radius  
1/2" body pop-up stream sprinkler; 12" pop-up in shrubs, grasses and groundcovers; 6" pop-up in turf; Operate at 50 psi; 0.40" to 0.65" precipitation rate nozzles with a minimum 80% Distribution Uniformity; Precipitation rate to match, if heads are on the same zone; Adjustable from 45 to 360 degrees.
- C. Pop Up Spray/Sprinklers:
  - 1. Bodies to have an internal flow regulation in the pop-up stems at 30 PSI. The pop-up stem to have a shutoff device restricting water loss by 99% if the nozzle is removed or damaged. The body shall include a check valve to prevent low head drainage up to 10 feet in elevation change. The nozzles shall be match precipitation rate within each size and with other sizes sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated co-molded wiper seal for cleaning debris from the pop-up stem.
  - 2. 8' - 15' radius; 1/2" body pop-up spray sprinkler; 12" pop-up in shrubs, grasses and groundcovers; 6" pop-up in turf; Operate at 30 - 60 psi; 1.0" to 1.6" precipitation rate nozzles with a minimum 70% Distribution Uniformity; Precipitation to match, if heads are on same zone; Adjustable nozzle arcs from 45 to 360 degrees.

## 2.08 SUBSURFACE DRIP

- A. Drip Emitter Tubing (at tree drip rings):

- B. Tubing shall be a minimum of 5/8 inch polyethelene tubing with a minimum wall thickness of 0.045 inch.
- C. Drip Emitters
  - 1. Emitters shall be of the pressure compensating emitters with self piercing barb inlet permitting one-step insertion into drip tubing.
  - 2. Emitter distribution (spaghetti) tubing shall be constructed of UV resistant vinyl material with a minimum of 0.22 inch (5.5 mm) O.D. and a minimum 0.16 inch (4mm) I.D. Tubing shall be manufactured by the same manufacturer as the drip emitters.
- D. Dripline (In Line Drip)
  - 1. Dripline tubing shall be made of UV resistant material with impregnated emitters. Tubing shall be linear low-density 5/8 inch (16 mm or 17 mm) polyethylene with a minimum wall thickness of 0.045 inch (0.1 mm).
  - 2. Emitter shall have dual discharge ports on opposing sides of the tubing.
  - 3. The tubing shall have the emitters spaced every 12 or 18, and flow rate of 0.4 and 1.0 GPH.
  - 4. The emitters shall be continuously self-flushing and pressure-compensating.
  - 5. The dripline tubing row spacing shall be 12 or 18 inches on center or as shown in plans.
  - 6. The dripline tubing with emitters shall be manufactured with root intrusion technology.
- E. Drip Flush Valve:
  - 1. UV resistant polyethylene materials with a minimum pressure rating of 50
- F. Drip system operation indicator
  - 1. Drip system operation indicator to be a visual pop-up indicator. Install one indicator per drip circuit and per manufacturer's recommendation.
- G. Drip Accessories: Provide a dripline flush valve, air relief valve and operation indicator as required and detailed. Accessories shall be manufactured by the same manufacturer as the dripline tubing.

## **2.09 AUTOMATIC CONTROL EQUIPMENT—INDEPENDENT ELECTRIC CONTROLLERS**

- A. Model: WeatherTRAK ET Pro2 Smart Water Manager WTPRO2S-C-24-SPH, CIM-5YA Product as manufactured by Hydpoint and conforming to this specification is acceptable.
- B. Irrigation controller shall be a self-adjusting type, receiving weather data wirelessly on a daily basis.
- C. Controller shall be mounted in a stainless steel enclosure. Enclosure shall be pedestal type.
- D. Overall Control Concept. Irrigation controller shall be a self-adjusting type, receiving weather data wirelessly on a daily basis. The electric automatic control system shall consist of one or more independent controllers which operate individual remote control valves in accordance with timing schedules programmed into the independent units. The number of units and location of the installations are shown on the drawings. The system shall have two-way, central Internet management with remote programming; monitoring and real-time notification of field alerts anywhere Internet access can be obtained. Whether data shall be collected from over 40,000 government regulated and privately owned weather stations across the US to combine with local wind, temperature, solar radiation and humidity variables to model a virtual on-site weather station.
- E. The Control System consists of an Independent controller. All components and software shall be a standard package
- F. Independent controller shall have the following characteristics:
  - 1. Each controller shall be programmed automatically, daily over the Internet, based upon an ET micro zone representing approximately one square kilometer that is associated with the controllers exact longitude and latitude coordinates.
  - 2. Station base watering time shall be developed by user selection of various sprinkler, soil, slope, and plant factors. Controller will develop watering station

- from the input factors. The controller will automatically decide whether to irrigate or not based upon the current day's ET and the depletion of each station independent of one another
3. The stations shall allow for a rapid programming of a block of stations with the same watering time.
  4. The controller shall have four programs with seven independent water day patterns and schedules. Each program has to start times with up to 20 cycles, with one water window per program. A second start time shall be available for high ET requirements in "auto mode" only.
  5. The controller shall have independent station watering and watering day adjustment from -50% to +25% in 5% increments. Able to communicate with normally closed wired or wireless rain and rain/freeze switches, flow sensors and normally open or normally closed master valves.
  6. Continuous flow monitoring and alert notification at the individual station and mainline levels. Preview mode that displays flow data and irrigation schedules for each station.
  7. Report menu providing accumulated totals of flow usage and station runtime on a daily, weekly and monthly basis. Valve wire diagnostic circuit that identifies field wiring issues such as valve shorts or valve no-connects.
  8. The ability to extend watering to following days when water window maximum has been reached. Coordinate a minimum of two flow monitors and master valves.
  9. The controller shall be UL and C-UL approved.
  10. Daily up dated ET irrigation schedules with an eight week go forward schedule for observing schedules for low-water use or other deep-rooted plant materials The controller shall have direct compatibility with hand-held remotes by simply connecting to a 32 pin connector.
  11. The controller shall monitor the flow rate and be furnished with the following features: main line break flow detection, unscheduled flow detection, station upper limit flow detection, programmable flow check delay from one (1) to six (6) minutes, monitor and display measured flow in GPM, automatic flow learn mode for setting individual station limits or manual entry or semi-automatic monitor/set mode, global percentage adjust to automatically factor upper flow limits for stations, automatic station advancement for station overflow, audible and visual alert for all flow violations, intelligent upper-limit processing for concurrent station operation, automatic closure of normally open master valve on main line breaks or unscheduled overflow.
  12. The controller shall be furnished with a feature for tracking water consumption in gallons to pinpoint specific water savings and conservation efforts. The controller shall be furnished with the following:
    - a. Programmable master valve either normally open or normally closed.
    - b. Programmable pump.
    - c. Programmable stacking or no stacking.
    - d. Programmable timer delay.
    - e. Programmable security code.
    - f. Programmable alarm to either enable or disable an audible alarm in the event of a flow violation.
    - g. Programmable flow check delay to set up a delay after any station changes, from one (1) minute to six (6) minutes, during which time no flow limits are checked.
    - h. View and clear accumulated gallons.



## **2.10 LOW VOLTAGE CONTROL VALVE WIRE**

- A. Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than No. 14.
- B. Multi-strand cable, Underwriters Laboratories Inc. approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer's recommendations.

## **2.11 SPLICING MATERIALS**

- A. Epoxy waterproof sealing packet. Low voltage controller cable.

## **2.12 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable blue with black letters and imprinted with "CAUTION BURIED IRRIGATION WATER LINE BELOW".

## **2.13 TRACER WIRES**

- A. No. 14, Green, Type TW plastic-coated copper tracer wire shall be installed with non-metallic irrigation main lines.

# **PART 3 - EXECUTION**

## **3.01 PREPARATION**

- A. Examine proposed irrigation areas for compliance with requirements and conditions affecting installation and performance.
- B. Set flags to identify locations of proposed irrigation system – main line routing, valves and sprinklers. Obtain approval of the layout by the Contracting Officer's Representative before excavation.

## **3.02 PIPE LAYING - GENERAL**

- A. Minimize trenching in areas with slopes greater than 3:1, in locations that may conflict with new and existing utilities, and new and existing trees
- B. Locate main line trenches at the bottom of slopes, and next to roadways and walkways where possible and applicable.
- C. Do not lay pipe on unstable material, in wet trench or when, in the opinion of Contracting Officer's Representative, trench or weather conditions are unsuitable for the work.
- D. Allow a minimum of 80 mm (4 inches) between parallel pipes in the same trench.
- E. Hold pipe securely in place while joint is being made.
- F. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- G. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- H. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- I. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.

- J. Minimum cover over main lines shall be 450 mm (18 inches). Control valves shall never be less than 80 mm (3 inches) below finished grade. Cover laterals to minimum depth of 300 mm (12 inches).
- K. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the warranty period.
- L. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- M. Warning tape shall be continuously placed 75 mm (3 inches) above sprinkler system water mains and laterals.

### **3.03 LAYING PLASTIC PIPE**

- A. Shall be snaked in trench at least 1 meter to 100 meters (1 foot per 100 feet) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints
  - 1. Solvent Welded Socket Type: ASTM D2855.
  - 2. Threaded Type: Apply liquid teflon thread lubricant of teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to one half additional full turn.

### **3.04 EXISTING TREES**

- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall comply with the provision of Section 01 00 00 General Requirements for the protection of existing vegetation.
- B. Excavation in areas where 2 inch (50 mm) or larger roots occur shall be done by hand. All roots 2 inch (50mm) and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap, to prevent scarring or excessive drying.
- C. Where a ditching machine is run close to trees having roots smaller than 2 inch (50 mm) in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through.
- D. Where Irrigation is shown within the drip line of existing trees, Contractor shall determine in the field where irrigation can be installed without impacting or damaging existing roots. Contractor shall layout exact proposed trench locations or equipment and review locations with the Contracting Officer's Representative. Adjust the system as required to avoid damage to tree roots and as directed by the Contracting Officer's Representative.
- E. Excavation within the drip line shall be done by hand only, with no exceptions unless approved or directed by the Contracting Officer's Representative.

### **3.05 SLEEVING**

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeving to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 300 mm (12 inches) beyond edges of paving or construction.
  - 1. Bed sleeves with a minimum of 100 mm (4 inches) of sand backfill above top of pipe.

### **3.06 INSTALLATION OF QUICK COUPLERS**

- A. Install irrigation and quick couplers at ground surface as detailed.

- B. Provide and install quick coupling valves every 150 feet along main line and at the end of main line runs.

### **3.07 INSTALLATION OF VALVES**

- A. Provide and install gate valves at the point of connection, before road crossings and as necessary to isolate legs of the main line.
- B. Provide and install gate valves at manifolds of remote control valve groupings.
- C. Provide and install filters and 40 psi pressure regulators at remote control valves serving drip zones.
- D. Permanently label valve box lid by heat branding the designated controller and station number or valve type onto the lid. Letters to be 2 inch size
- E. Provide and install wire mesh at the bottom of valve boxes to prevent gopher intrusion.
- F. Provide and install pea gravel or drain rock layer on top of the wire mesh at the bottom of the valve box.

### **3.08 INSTALLATION OF POP-UP SPRINKLERS & DRIP IRRIGATION**

- A. Install 6" pop-up sprinklers in turf. Install sprinklers 1" from edge of paving to minimize overspray. Set all sprinkler heads in turf to allow for settlement. Adjust as required after settlement.
- B. All sprinklers on a zone shall have matched precipitation rate nozzles.
- C. Drip Emitter Tubing Installation
  1. Thoroughly flush all lateral lines before installing drip emitter tubing.
  2. Install as per manufacturer's recommendations.
  3. Install drip emitter tubing with direct-attached emitters 2 to 4 inches (50 to 100 mm) below grade, stake down every four (4) feet and at every fitting. Cover with a minimum 2 inches (50 mm) of mulch.
  4. Install pressure regulators and filter units in control valve boxes
  5. Adaptation from PVC Schedule 40 fittings to flex vinyl hose shall be line size by 3/8 inch (10 mm) insert bushings.
  6. Tape all ends during installation and do not allow dirt or debris to enter tubing.
  7. Use fittings at sharp bends and do not allow dripper line to kink.
  8. Install a minimum two (2) manual flush valves per zone at the low points and ends of the zone.
  9. Use manufacturer recommended fittings for all changes in direction.
- D. Installation of sub-surface in-line drip in shrub, grass, and groundcover planting areas
  1. Install dripline at 2" to 4" below finish grade and staple down every 4 feet
  2. Install air relief valves (ARV) at the high points of sub-surface in-line drip zones and one ARV per every 7 gallons per minute of the zone
  3. Install a flush valve at the exhaust header of each drip zone
  4. Install a drip operation indicator at the end of each zone
  5. Dripline emitter spacing shall be equal to the row spacing. Install dripline tubing in parallel rows, while staggering the emitters between rows to form a triangular pattern with the emitters. Complete and uniform watering pattern is required

### **3.09 INSTALLATION OF CONTROL WIRING**

- A. Wiring from master controllers to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.
- B. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire,

i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.

- C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
- D. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
- E. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.
- F. Provide red control wire quantities equal to controller station count. Provide one (1) white common wire and three (3) yellow spare wires.

### **3.10 TRACER WIRE INSTALLATION**

- A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.
- B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a Dymo-Tape type plastic label with designation "Tracer Wire."
- C. Record locations of tracer wires and their terminations on project record documents.

### **3.11 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

### **3.12 TEST AND FLUSHING**

- A. Pressure Test: Pressure test lines before joint areas are backfilled. Backfill a minimum of 300 mm (12 inches) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 1025 kPa (150 psi) for two hours. Maximum loss shall be 3 L/25 mm pipe diameter/300 m (0.8 gallons/inch pipe diameter/1000-feet). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
- B. Flushing: After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.
- C. Operation Test: Upon completion of the final adjustment of the sprinkler heads to permanent level at ground surface, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate the entire installation to demonstrate the complete and successful operation of all equipment. Demonstrate to Contracting Officer's Representative that irrigation scheduling programmed into controller is adequate for plant requirements without causing runoff, and that scheduling capacities of controller are utilized.
- D. Adjustments:
  - 1. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways and buildings. Adjust the arc and radius as applicable.

2. Include as a part of the work any nozzle changes or arc adjustments necessary due to daytime windy conditions during grass establishment period. After grass has been established and watering can be performed during calm early morning or evening hours, make any required adjustments to nozzles and arcs.
  3. Set all sprinkler heads perpendicular to finished grades unless otherwise noted on the drawings.
- E. Drip emitters system (on surface and sub surface): Prior to burying drip lines, Contractor shall coordinate with the Contracting Officer's Representative and drip system manufacturer to schedule a coverage review of the drip system to ensure proper operation. Contractor must correct any drip irrigation issues determined, and receive approval from the Contracting Officer's Representative in writing prior to final burial of the lines.

### **3.13 MAINTENANCE AND WARRANTIES**

- A. The entire sprinkler irrigation system shall be under full automatic operation for a period of 2 days prior to any planting.
- B. The Contracting Officer's Representative reserves the right to waive or shorten the operation period.
- C. Maintain/repair system for full duration of plant establishment and maintenance period.
- D. Include one year contractor's warranty from the date of Final Project Acceptance, to remedy any defect due to faulty material or workmanship, and pay for any damage to other work resulting there from.
- E. The Contractor shall be required to provide As-Built Drawings in print and electronic files (AutoCAD and PDF) upon completion of the project.
- F. The Contractor shall be required to provide a Controller Chart, consisting of a laminated zone coverage map with station numbers and correlated color-coded zones. Place the map at in the controller enclosure.
- G. The Contractor shall be required to provide copies of the Operation and Maintenance Manual to the VA upon completion of the project.

**--- END OF SECTION ---**

**SECTION 32 90 00  
PLANTING**

**PART 1 - GENERAL**

**1.01. DESCRIPTION**

- A. This work consists of furnishing and installing all planting materials required for landscaping hereinafter specified in locations as shown.

**1.02. TESTING LABORATORY SERVICES**

- A. Materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.
- B. In accordance with Section **01 45 29**, TESTING LABORATORY SERVICES

**1.03. EQUIPMENT**

- A. Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

**1.04. RELATED WORK**

- A. Section **32 84 00**, PLANTING IRRIGATION.
- B. Sustainable design requirements and procedures including submittal requirements: Section **01 81 11**, SUSTAINABLE DESIGN REQUIREMENTS.
- C. Procedures and requirements for managing and disposing construction and demolition waste: Section **01 74 19**, CONSTRUCTION WASTE MANAGEMENT.

**1.05. SUBMITTALS**

- A. In accordance with Section **01 33 23**, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Product Data: Manufacturer's current catalog cuts and specifications of the following:
  - 1. Fertilizers
  - 2. Tree Tie and Stake
  - 3. Tree Root Barrier
  - 4. Iron Sulfate
  - 5. Filter Fabric
  - 6. Perforated Drain Pipe
- C. Samples:
  - 1. Submit following samples along with certificates of compliance / analytical data from approved laboratory for degree of compliance: Plants: Submit typical

- sample of each variety or entire quantity to site for approval by Contracting Officer's Representative.
2. Organic Mulch: Submit 1-pint sample with list of ingredients.
  3. Organic (Soil) Amendment: Submit 1-pint sample with Technical Data Sheet and STA certification.
  4. Permeable Backfill (Filter Rock): Submit 1-pint sample.
  5. Imported Planting Soil: Submit 1-pint sample
  6. Raised Planter Backfill Mix: Submit 1-pint sample
  7. Lava Rock Aggregate: Submit 1-pint sample with product technical data sheet and lab analysis report demonstrating compliance with specified qualities
  8. Imported Planting Sand: Submit 1-pint sample with product technical data sheet and lab analysis report demonstrating compliance with specified qualities
- D. Delivery Receipts
1. Provide delivery receipts for quantities of organic soil amendments delivered to the site.
- E. Topsoil Analysis (Soil Management) Report
1. After approval of rough grading and topsoil placement, obtain minimum of four representative one quart samples of topsoil taken from accepted site locations at depth of 4" to 6" below finish grade and submit to an accredited Soils Laboratory for evaluation of physical and chemical properties of soil including all major nutrients; pH, salinity, boron, sodium, micronutrients, copper, zinc, manganese and iron; and infiltration rate, soil texture and organic content, along with a summary describing the degree of compliance with the specified requirements. The report shall also include recommendations for modification of the soil for agricultural suitability.
  2. Upon request by Contracting Officer's Representative, submit documentation verifying implementation of soil analysis report recommendations to the local agency with Certificate of Completion as required by the State of California Model Water Ordinance
- F. Subsoil Analysis
1. Besides the above required soil samples, take one representative sample of any subgrade soil that is to receive a layer of imported planting soil over it. The laboratory report shall include the subgrade soil's total combined silt and clay content for determining the total desirable combined silt and clay content of the final imported planting soil cover specified herein.
- G. Imported Planting Soil Analysis
1. See Imported Planting Soil Analysis requirements elsewhere in this specification for comparison to existing soil analysis.
- H. Approval of Laboratory Report
1. Upon approval of the Laboratory's report by the Contracting Officer's Representative, the recommendations in the report shall become a part of the Specifications and the quantities of soil amendment, fertilizer and other additives shall be adjusted to conform with the report at no additional cost to the

Contracting Officer's Representative. Request Testing Laboratory to send one copy of test results directly to Contracting Officer's Representative. Note that there is a minimum quantity of organic amendment specified elsewhere in this specification section.

**1.06. PROJECT/SITE CONDITIONS**

- A. Site Visit: At beginning of work, visit and walk the site with the Contracting Officer's Representative to clarify scope of work and understand existing project/site conditions.

**1.07. WARRANTY AND REPLACEMENT**

- A. Pre-Emergence Weed Killer: Warrant the work against weed growth for a period of four (4) months after application.
- B. Warrant all plants and planting to be in a healthy, thriving condition until the end of the maintenance period, and deciduous trees beyond that time until active growth is evident.
- C. Replace all dead plants and plants not in a vigorous condition immediately upon discovery and as directed by the Contracting Officer's Representative at Contractor's expense. Install replacement plants before the final acceptance at the size specified.
- D. Warrant all plant material for a period of one year after final acceptance of the maintenance period against plant materials with defects at the time of installation.
- E. Warrant plant installation and maintenance by Contractor against defects for a period of one year.

**1.08. DELIVERY AND STORAGE**

- A. Delivery:
  - 1. Notify the Contracting Officer's Representative of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant material from the job site immediately.
  - 2. Protect plants during delivery to prevent damage to root balls or desiccation of leaves. Protect trees during transport by tying in the branches and covering all exposed branches.
  - 3. Deliver fertilizer to the site in the original, unopened containers bearing the manufacturer's warranted chemical analysis, name, trade name or trademark, and in conformance to state and federal law.
  - 4. During delivery: Protect seed from contamination.
- B. Storage:
  - 1. Keep fertilizer in dry storage away from contaminants.
  - 2. Store plants not installed on the day of arrival at the site as follows:
    - a. Shade and protect plants from the wind when stored outside
- C. Keep plants in a moist condition until planted.



**1.09. Lime Treatment of subsoil**

1. Refer to PART 3 -EXECUTION for mitigation of any lime treatment of soils.

**1.10. PLANTING INSTALLATION CONDITIONS**

- A. Perform planting operations after the irrigation system is installed, tested, and approved.
- B. No work shall be done when the ground is too wet or in an otherwise unsuitable condition for planting. Special conditions may exist that warrants a variance. Submit a written request to the Contracting Officer's Representative stating the special conditions and proposal variance.

**1.11. PLANT AND TURF ESTABLISHMENT PERIOD**

- A. The Establishment Period for plants and turf shall begin immediately after installation, with the approval of the Contracting Officer's Representative, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Plant and Turf Establishment Period the Contractor shall:
  1. Water all plants and turf to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 25 mm (1 inch) of absorbed water per week either through natural rainfall or augmented by periodic watering. Apply water at a moderate rate so as not to displace the mulch or flood the plants and turf.
  2. Turf receiving sub surface drip shall require 21 days minimum supplemental hand watering until the sod is established.
  3. Prune plants and replace mulch as required.
  4. Replace and restore stakes and eroded plant saucers as required.
  5. In all planting areas including hydroseeded areas, remove grass, weeds, and other undesired vegetation, including the root growth, before they reach a height of 75 mm (3 inches).
  6. Spray with approved insecticides and fungicides to control pests and ensure plant survival in a healthy growing condition, as directed by the Contracting Officer's Representative.
  7. Provide the following turf establishments and maintenance:
    - a. Mow the new lawn at least three times prior to the final inspection. Begin mowing when grass is 100 mm (4 inches) high. Mow to a 65 mm (2-1/2 inch) height.
    - b. Maintain turf height during the entire establishment period. Cut as frequently as growth of grass requires. Cut to a height of two inches (2"), unless otherwise directed by the Landscape Architect.
    - c. Maintain constant moisture to a depth of eight inches (8").
    - d. Trim edges of turf at paving and header-boards at time of second cutting, and at each later cutting.
    - e. Keep turf areas free of undesirable weeds and grasses by the application of suitable selective weed killers or hand pulling.
    - f. Repair all damaged areas as soon as evident.
    - g. Repair any hollow, settled or eroded areas by filling, rolling and resodding.

8. Remove plants that die during this period and replace each plant with one of the same size and species.
9. Check irrigation systems at each watering. Adjust coverage and clean and repair non-functioning heads immediately. Adjust timing of irrigation controller to prevent oversaturation, run-off, or flooding.
10. Keep Contract areas free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds over 1-inch high at all times.
11. Plant Protection and Replacement
  - a. Protect all areas against damage, including erosion, trespass, insects, rodents, deer, disease, etc. and provide proper safeguards, including trapping of rodent and applying protective sprays and fencing to discourage deer browsing. Maintain and keep all temporary barriers erected to prevent trespass.
  - b. Repair all damaged planted areas. Replace plants and reseed or resod turf immediately upon discovery of damage or loss, including damage from Deer and Rodents.
12. Fertilizing:
  - a. Upon approval and after submitting fertilizer delivery tags, maintenance fertilization shall begin 30 days after planting is complete. Fertilize all turf and ground cover areas by broad-casting Type C (21-7-14) fertilizer at the rate of 5 lbs. per 1,000 square feet evenly throughout. Reapply every forty-five (45) days until acceptable.
  - b. During the winter, for quick turf greening effect, calcium nitrate (15.5-0-0) may be applied at the rate of 6 lbs. per 1,000 square feet.
  - c. Early spring and fall substitute a complete fertilizer such as 15-15-15 applied at the rate of 6 lbs. per 1,000 square feet, to help insure continuing adequate phosphorus and potassium.
  - d. Apply ammonium sulfate fertilizer as necessary to maintain vigorous, green grass between fertilizings mentioned above.
  - e. Observe plant's color, and if a soil pH imbalance is suspected, take soil samples and obtain laboratory analysis for confirmation. Take necessary action recommended in laboratory analysis such as top dressing with soil sulfur, leaching soil, etc.

#### **1.12. PLANT AND TURF WARRANTY**

- A. All work shall be in accordance with the terms of the Paragraph, "Warranty" of FAR clause 52.246-21, including the following supplements:
  1. A One Year Plant and Turf Warranty will begin on the date that the Government accepts the project or phase for beneficial use and occupancy. The Contractor shall have completed, located, and installed all plants according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.
  2. The Contractor will replace any dead plant material and any areas void of turf immediately. A one year warranty for the plants and turf that was replaced, will begin on the day the work is completed.
  3. Replacement of relocated plants, that the Contractor did not supply, is not required unless they die from improper handling and care during transplanting.

Loss through Contractor negligence requires replacement in kind and size.

4. The Government will reinspect all plants and turf at the end of the One Year Warranty. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty will end on the date of this inspection provided the Contractor has complied with the work required by this specification. The Contractor shall also comply with the following requirements:
  - a. Replace dead, missing or defective plant material prior to final inspection.
  - b. Mulch and weed plant beds and saucers. Just prior to this inspection, treat these areas to a second application of approved pre-emergent herbicide.
  - c. From plants having been installed for one year, remove stakes, guy wires and any required tree wrappings.
  - d. Complete remedial measures directed by the Contracting Officer's Representative to ensure plant and turf survival.
  - e. Repair damage caused while making plant or turf replacements.

#### **1.13. PLANT MAINTENANCE PERIOD**

- A. Contractor shall begin a 90 day Maintenance Period after Complete Project acceptance by the Government. Contractor shall provide a CLIN on the bid documents and approved schedule of values for this Period after acceptance, to be reviewed and approved by the Contracting Officer's Representative.
- B. Replace all dead and damaged plants and plants not in a vigorous condition immediately upon discovery and as directed by the Contracting Officer's Representative. Install replacement plants before the end of the Maintenance Period.
- C. Keep all walks and paved areas clean. Keep the site clear of debris resulting from landscape work and maintenance operations.
- D. Check irrigation systems at each watering; adjust coverage and clean and repair non-functioning heads immediately. Adjust timing of sprinkler controller to prevent runoff and flooding.
- E. Maintain adequate moisture depth in soil to ensure vigorous growth, without overwatering. Check rootball of trees and shrubs independent of surrounding soils and hand water as required.
- F. Keep Contract areas free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds over 1-inch high at all times.
- G. Protect all areas against damage, including erosion, trespass, insects, rodents, deer, disease, etc. and provide proper safeguards, including trapping of rodent and applying protective sprays and fencing to discourage deer browsing. Maintain and keep all temporary barriers erected to prevent trespass.
- H. Repair all damaged planted areas. Replace plants and reseed or resod turf immediately upon discovery of damage or loss, including damage from Deer and Rodents.
- I. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the

Contracting Officer's Representative.

- J. Keep watering basins in good condition and weed-free at all times.
- K. Replace all damaged, unhealthy or dead trees, shrubs, and ground covers with new stock immediately; size as indicated on the drawings.
- L. Upon approval and after submitting fertilizer delivery tags, maintenance fertilization shall begin 30 days after planting is complete. Fertilize all ground cover areas by broadcasting Type C (21-7-14) fertilizer at the rate of 5 lbs. per 1,000 square feet evenly throughout. Reapply every forty-five (45) days until acceptable.
- M. Early spring and fall substitute a complete fertilizer such as 15-15-15 applied at the rate of 6 lbs. per 1,000 square feet, to help insure continuing adequate phosphorus and potassium.
- N. Apply ammonium sulfate fertilizer as necessary to maintain vigorous, green grass between fertilizings mentioned above.
- O. Observe plant's color, and if a soil pH imbalance is suspected, take soil samples and obtain laboratory analysis for confirmation. Take necessary action recommended in laboratory analysis such as top dressing with soil sulfur, leaching soil, etc.
- P. At the conclusion of the Maintenance Period, schedule a final review with the Contracting Officer's Representative. On such date, all project improvements and all corrective work shall have been completed.
- Q. Submit written notice requesting review at least 10 days before the anticipated review.
- R. Prior to review, weed and rake all planted areas, repair plant basins, mow and edge turf, plumb tree stakes, clear the site of all debris and present in a neat, orderly manner.

#### **1.14. APPLICABLE PUBLICATIONS**

- A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Ordinances and Regulations: All local, municipal and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the herein listed codes, regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard than is required by the above mentioned codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations
- C. American National Standards Institute (ANSI) Publications:
  - 1. Z60.1-04 Nursery Stock
  - 2. Z133.1-06 Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush- Safety Requirements
- D. Hortus Third, A Concise Dictionary of Plants Cultivated in the U.S. and Canada.

- E. Contractor shall be familiar with and follow the State of California Model Water Ordinance, California Code of Regulations, Title 23 Waters, Division 2, Department of Water Resources, Chapter 2.7. Also, the Contractor is responsible to follow all local water ordinances and the Soil Management/Analysis Report with verifying implementation.
- F. American Society for Testing and Materials (ASTM) Publications:
  - 1. C136-06 Sieve Analysis of Fine and Coarse Aggregates
- G. Turfgrass Producers International:
  - 1. Turfgrass Sodding.
- H. U. S. Department of Agriculture Federal Seed Act.
  - 1. Rules and Regulations
- I. American Wood Protection Association (AWPA):
  - 1. C2-02 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
- J. "Sunset Western Garden Book," Lane Publishing Co., Menlo Park, California; current edition.
- K. Alameda Countywide Clean Water Program (ACCWP) or member agency having jurisdiction over the project work
- L. US Composting Council Compost analysis Program (CAP)
- M. Test Methods for the Evaluation of Composting and Compost (TMECC)
- N. International Society of Arboriculture, Guide for Plant Appraisal, latest version.
- O. United States Composting Council (USCC) Seal of Testing Assurance (STA) program.
- P. TMECC: Refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC)
- Q. References to "Caltrans Standard Specifications" shall mean the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.
- R. Manufacturer's recommendations

## **PART 2 - PRODUCTS**

### **2.01. GENERAL**

- A. All plant material shall conform to the varieties specified or shown in the plant list and be true to botanical name as listed in Hortus Third.

## 2.02. PLANTS

- A. Plants shall be nursery grown in containers and in accordance with ANSI Z60.1, except as otherwise stated in the specifications or shown on the plans. Where the drawings or specifications are in conflict with ANSI Z60.1, the drawings and specification shall prevail.
- B. Plant the variety, quantity and size indicated. The total quantity tabulated on the drawings are considered approximate and furnished for convenience only. Contractor shall perform his/her own plant quantity calculations and shall provide all plants shown on the Drawings.
- C. Tag plants of the type or name indicated and in accordance with the standard practice recommended by the American Association of Nurserymen.
- D. Install healthy, shapely and well rooted plants with no evidence of having been root-bound, restricted or deformed.
- E. Take precautions to ensure that the plants will arrive at the site in proper condition for successful growth. Protect plants in transit from windburn and sunburn. Protect and maintain plants on site by proper storage and watering.
- F. Substitutions will not be permitted, except as follows:
  - 1. If proof is submitted to the Contracting Officer's Representative that any plant specified is not obtainable, a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price.
  - 2. Substantiate and submit proof of plant availability in writing to the Contracting Officer's Representative within 10 days after the effective date of Notice to Proceed.
- G. Tree Form: Trees shall have a symmetrical form as typical for the species/cultivar and growth form.
  - 1. Central Leader for Single Trunk Trees: Trees shall have a single, relatively straight central leader and tapered trunk, free of co dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the central leader should not have been headed; however, in cases where the original leader has been remove, an upright branch at least  $\frac{1}{2}$  the diameter of the original leader just below the pruning point shall be present.
  - 2. Potential Main Branches: Braches shall be evenly distributed radially around and appropriately spaced vertically along the trunk, forming a generally symmetrical crown typical for the species.
  - 3. Headed temporary branches should be distributed around and along the trunk as noted above and shall be no greater than  $\frac{3}{8}$ " diameter, and no greater than  $\frac{1}{2}$  diameter of the trunk at point of attachment.
- H. Tree Trunk
  - 1. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.
  - 2. Trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.

3. Tree trunk diameter at 6" above the soil surface shall be within the diameter range shown for each container size below, except where shown otherwise:

4.

Container	Trunk Diam. in inches	Soil level from Container Top
5 gallon	0.5" to 0.75"	1.25 to 2"
15 gallon	0.75" to 1.0"	1.75 to 2.75"
24" Box	1.5" to 2. 5"	2.25 to 3"

5. Tree trunks shall be undamaged and uncut with all old abrasions and cuts completely callused over. Do not prune plants prior to delivery.

I. Tree Roots

1. Trunk root collar (root crown) and large roots shall be free of circling and/or kinked roots. Contractor may be required to remove soil near the root collar in order to verify that circling and/or kinked roots are not present.
2. The tree shall be well rooted in the container. When the trunk is lifted the trunk and root system shall move as one and the rootball shall remain intact.
3. The top-most roots or root collar shall be within 1" above or below the soil surface. The soil level in the container shall be within the limits shown in above table.
4. The rootball periphery shall be free of large circling and bottom-matted roots.
5. On grafted or budded trees, there shall be no suckers from the root stock.

J. Shrubs

1. Each shrub must stand upright without support.
2. All container shrubs shall be free of girdling roots, defined as those roots greater than 1/8" diameter circling the periphery of the rootball. The top of the rootball shall be free of "Knees" (roots) protruding above the soil, and the bottom shall be free of matted roots.

- K. Measure trees and shrubs with branches in normal position. Height and spread dimensions indicated refer to the main body of the plant, and not from branch tip to tip.

- L. Make substitutions only when a plant (or its alternates as specified) is not obtainable and the Contracting Officer's Representative authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics with an equitable adjustment of the contract price.

**2.03. GRASS (TURF)**

A. Turf Sod

1. Blends as follows
2. Tall Fescue Sod Mix (Grown on Sand)  
80% ti 90% Dwarf-type Fescue and Tall-type Fescue  
10% to 20% Blue Grass  
Available from Delta bluegrass (800) 637-8873
3. Machine cut sod to a uniform thickness of 3/4-inch excluding top growth and

thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends, in vigorous condition, dark green in color, free of disease, weeds and harmful insects. Broken pads, irregularly shaped pieces, and torn and uneven ends will be rejected.

**2.04. FERTILIZERS**

- A. Commercial fertilizer, pelleted or granular form, conform to the requirements of Chapter 7, Article 2, of the Agricultural Code of the State of California for fertilizing materials as follows:
  - 1. Type A:  
6% Nitrogen, 20% Phosphorus Acid and 20% Potash, (6-20-20).
  - 2. Type B:  
21 gram planting tablets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Agriform or 10gm BestPacks packets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Best Fertilizer Co.
  - 3. Type C:  
Complete fertilizer 21% Nitrogen, 7% Phosphoric Acid and 14% Potash (21-7-14).
  - 4. If commercial fertilizer having this analysis is not obtainable, other similar commercial fertilizer may be used providing it meets the approval of the Contracting Officer's Representative.
- B. Maintenance Fertilizer: Type C

**2.05. ORGANIC AMENDMENT FOR IN SITU SOILS (ON-GRADE):**

- A. Ground Redwood or Ground Fir Bark with the following properties:

<u>Percent Passing</u>	<u>Sieve Designation</u>	
100	9.51 mm	3/8"
50-60	6.35 mm	1/4"
20-40	4.76 mm	No. 4
0-20	2.38 mm	No. 8 8 mesh

Redwood Sawdust

Dry bulk density, lbs. per cu. yd., 260-280  
Nitrogen stabilized - dry weight basis, min. 0.4%  
Salinity (ECe): 4.0 maximum  
Organic Content: 90% minimum  
Reaction (pH): 4.0 minimum

Ground Fir and/or Pine Bark

Dry bulk density, lbs. per cu. yd., Min. 350  
Nitrogen stabilized - dry weight basis, min. 0.5%  
Salinity (ECe): 4.0 maximum  
Organic Content: 90% minimum  
Reaction (pH): 4.0 minimum

- B. Submit sample along with analytical data from an approved laboratory for degree of compliance to the Contracting Officer's Representative within two weeks after award of Contract.



**2.06. IRON SULFATE**

- A. Type: Dry form.

**2.07. PLANT BACKFILL**

- A. Except for acid loving plants (Azaleas, Rhododendrons, Ferns, Camellias, etc.), use a mixture of 2 parts soil from the hole, and 1 part amendment with iron added at the following rates:

<u>Size</u>	<u>Rate</u>
1 gallon can plants	iron, 1/4 cup
5 gallon can plants	iron, 1/3 cup
15 gallon can plants	iron, 1/2 cup
24" box and larger	iron, 1 cup

- B. Mix the iron, amendment and soil thoroughly for use only in the top 8 inches of backfill around plants. For acid loving plants, mixture to be 1/2 soil from the hole and 1/2 amendment only in the top 8 inches.

**2.08. RAISED PLANTER BACKFILL MIX**

- A. "Raised Planter Backfill Mix" is a mixture 35% Tree & Shrub Planter/Plaster Sand, 35% lava rock, and 30% nitrolized Fir Bark Organic Amendment, and fertilizer ingredients listed below.
- B. Raised Planter Backfill Mix shall be delivered to the site in a damp condition and installed immediately to prevent losing the humus due to wind blow.
- C. Include the fertilizer ingredients as follows:
  - 0.75 pound Potassium Nitrate 13-0-44
  - 0.5 pound Calcium Nitrate 15.5-0-0
  - 0.5 pound Urea Formaldehyde 38-0-0
  - 2.5 pounds Single Superphosphate 0-25-0
  - 4.0 pounds Calcium Carbonate Lime
  - 4.0 pounds Kaiser 65 Dolomite
  - 1.0 pounds Iron Sulfate (min. 20% Fe)

**2.09. LAVA ROCK AGGREGATE**

- A. Lava Rock Aggregate, Required Properties:

- 1. Grain Size Distribution

<u>U.S. Std. Sieve Size</u>	<u>% Retained per Screen</u>	<u>% Weight Passing-Cumulative</u>
12.5mm	0	95-100
8 mm	1	90-100
4.75 mm (#4)	58	35-50
1.18 mm (#16)	34	0-20
.850 mm (#20)	.9	0-20
.500 mm (#35)	.1	0-20
.212 mm (#70)	.6	0-20
.150 mm (#100)	1	0-15
.075 mm (#200)	3	0-5

.053 mm (#270)	1	0-5
.045 mm (#325)	.3	0-5

2. Sieve Analysis by ASTM 136
3. PH - 6.0 to 7.8
4. Chloride ppm 9.5 to 19
5. Sulfate ppm .4 to 1.1
6. Absorption 15 to 30%
7. Loose Unit Weight 43 Lbs PCF (ASTM C 29)
8. Absorption: Lava Rock aggregate shall retain a minimum of 18% of its weight in absorbed water and shall be free of toxic materials, insects, diseases, weed seeds and other pests.
9. The sieve analysis shall be as shown above and with not more than 5% passing the #200 sieve. Lava Rock Aggregate meeting the above specification is available from American Soil Products, Richmond, CA (510) 292-3000 and TMT Enterprises, San Jose, CA (408) 432-9040.

**2.10. IMPORTED PLANTING SAND**

- A. 100% medium/coarse, washed, sharp, angular, silt-free sand
- B. Sieve analysis:

Component	size	Sieve #	% Retained	% Passing
Gravel	4.76 mm	4	0%	100%
Fine Gravel	2.00 mm	10	0-5%	95-100%
Very Coarse Sand	1.00 mm	18	0-10%	90-100%
Coarse Sand	500 micron	35	0-35%	65-100%
Medium Sand	250 micron	60	50-100%	0-50%
Fine Sand	105 micron	140	0-30%	0-20%
Very Fine Sand	53 micron	270	0-15%	0-5%
Silt and Clay		Pan	0-5%	

- C. Reaction (pH) of the saturated sand shall be between 6.0-8.0 as determined on the saturation extract solution:
- D. Permissible range of Salinity, Boron and Sodium as follows:
  1. Salinity (Ece) 0-3.0 dS/m
  2. Boron 0.1.0 ppm
  3. Sodium 0-20 meq/L

**2.11. MULCH**

- A. Organic Mulch: Natural Fir bark mulch; 3/4-inch to 1-inch size.
- B. Gravel Mulch: Sierra Ginger Pathway Stone Gravel or approved equal to match color of Stone Pavers
- C. Submit samples of organic mulches to the Contracting Officer's Representative for

approval within two weeks of award of Contract. Resubmit until acceptable to Contracting Officer's Representative, at no extra cost.

## **2.12. TREE SUPPORT POLES**

- A. Support Poles for trees up to 36" box size.
- B. Type: Peeled lodge pole pine logs, clean, smooth, new, and sized as follows:
  - 1. Two-inch (2") diameter by eight feet (8') long for trees less than 8' high and 1" caliper.
  - 2. Three-inch (3") diameter by eight to ten feet (8' - 10') long for trees greater than 8' high and 1" caliper.

## **2.13. TIES**

- A. Rubber strap, 24-inch minimum length without sharp edges adjacent to trunk.

## **2.14. PLANTING SOIL (TOPSOIL):**

- A. Planting soil is defined as screened imported soil. Satisfactory planting soil shall be free of subsoil, clay, lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

## **2.15. IMPORTED PLANTING SOIL (TOPSOIL):**

- A. Imported planting soil shall be fertile, friable, natural, productive soil containing a normal amount of humus, and shall be capable of sustaining healthy plant life. Planting soil shall be free of subsoil, heavy or stiff clay, rocks, gravel, brush, roots, weeds, noxious seeds, sticks, trash, and other deleterious substances. Soil shall not be infested with nematodes or with other noxious animal life or toxic substances. Soil shall be obtained from well-drained, arable land, and shall be of an even texture. Soil shall not be taken from areas on which are growing any noxious weeds such as Morning Glory, Sorrel, or Bermuda Grass.
- B. Imported planting soil shall have a pH value of between 6.0 and 7.5, a boron concentration of the saturation extract of less than 1 ppm, salinity of the saturation extract at 25 degrees C. of less than 4.0 millimoles, and a sodium absorption rate (SAR) of less than 8.
- C. The silt and clay content of imported planting soil shall not exceed that of the existing soil it is to be placed over. It shall be a "Sandy Loam" as classified in accordance with USDA Standards with a combined total of between 25% to 40% Clay and Silt. Provide existing site soil sample analysis report for comparison with the imported soil report.
- D. Make the site of the source of supply of planting soil available to the Contracting Officer's Representative for observation and approval prior to any hauling or placing of soil. In addition, submit for approval a 1-quart sample of soil, together with a standard soil analysis report by an accredited soils analyst showing chemical analysis stating source, fertility, agricultural suitability and particle size distribution of the soil. Deliver the sample to the Contracting Officer's Representative two weeks before starting the contemplated hauling of the soil. Following approval of the sample, provide a one-half cubic yard sample, which shall be stored at the site of work for comparison with subsequent loads of soil. The comparison sample shall be protected by a cover until the furnishing of all soil

has been completed and accepted. Should the soil submittal lack certain requirements which can be added to the soil, the Contracting Officer's Representative will consider a request by the Contractor to amend the soil as recommended by the Soils Analyst at the Contractor's expense.

**2.16. PRE-EMERGENCE WEED KILLER**

- A. Clean non-staining as recommended by a licensed pest control specialist.

**2.17. FILTER FABRIC**

- A. Needle punched nonwoven geotextile Filter Fabric composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids weighing 18 grams per square meter. Meets Aashto M288-06 Class 3 for elongation > 50%.

**2.18. PIPE:**

- A. Polyvinyl Chloride (PVC) pipe and pipe fittings shall meet extra strength minimum of SDR-35 of the requirements of ASTM Specification D3034.
- B. Perforated and non-perforated corrugated polyethylene pipe, 3- to 10-inch diameter, shall meet the requirements of ASTM D883 and ASTM F412, and shall conform to Section 68 of the Standard Specifications.
  - 1. Corrugated polyethylene pipe fittings shall comply with all requirements of AASHTO M-252-85I for 3- to 10-inch diameter pipe. Couplings shall be split or snap-on type for perforated pipe and split couplings with gaskets for non-perforated pipe. Cutting pipe with integral couplings will not be allowed.
  - 2. Corrugated polyethylene pipe and fittings manufactured by Advanced Drainage Systems, Inc., shall be considered the standard to determine compliance to this specification.

**2.19. PERMEABLE BACKFILL (FILTER ROCK)**

- A. Permeable backfill used in subsurface drain installations to be Class 2 permeable material in conformance with Section 68 "Subsurface Drains" of the Caltrans Standard Specifications; gradation to 3/4" maximum size. Submit Sample for approval.

**2.20. ALUMINUM EDGING (METAL HEADER)**

- A. 1/8" X 4" by 8' black anodized finish with 12" min long stakes set 1/2" below grade at each joint and maximum 4' spacing, in-line joints without offset or double thickness, Proline by Permaloc, Inc. or approved equal.

**PART 3 - EXECUTION**

**3.01. FINE GRADING AND SOIL PREPARATION**

- A. General:
  - 1. Soil in all planting areas shall be moist, but not so moist that it sticks to a hand shovel, and loose and friable to a minimum depth of 12 inches with a relative

maximum compaction of 85%. Rip and scarify and dry any areas that do not meet this requirement.

2. Prior to excavating for plant pits and bed, verify the location of any underground utilities. Damage to utility lines shall be repaired at the Contractor's expense. Where lawns have been established prior to planting operation, cover the surrounding turf before excavations are made in a manner that will protect turf areas. Barricade existing trees, shrubbery, and beds that are to be preserved in a manner that will effectively protect them during the project construction
3. No work shall be done when the ground is too wet or in an otherwise unsuitable condition for earthwork and planting. Special conditions may exist that warrants a variance. Submit a written request to the Contracting Officer's Representative stating the special conditions and proposal variance.
4. Before proceeding with the work: Carefully inspect all areas and verify all dimensions and quantities. Immediately inform the Contracting Officer's Representative of any discrepancy between the drawings and specifications and actual conditions and secure approval to proceed.

B. Lime Treated Soil Removal:

1. Any Lime treated soils shall be removed full depth of treated soil from planting areas and replaced with approved planting soil as accepted by Contracting Officer's Representative. Contractor shall field measure and record all lime treated areas on As Built Drawings showing both depth and areas.
2. Following removal of lime treated material, scarify subgrade to a minimum depth of 6 inches prior to backfilling.
3. Test subgrade in all planting areas for drainage by flooding with 4 inch depth of water puddle and verify complete absorption of standing water within two hours. If standing water is still present after two hours, provide perforated pipe and drain rock "French Drain" system in bottom of non-draining planters and connect to storm drainage system, as accepted by Contracting Officer's Representative.

C. Planting Soil Placement:

1. Inspect planting areas and remove all base rock and other foreign material. Verify placement of planting soil within dripline of trees with Contracting Officer's Representative. Except within tree driplines, rip all planting areas in two directions full depth of compacted fill (to a minimum of 12 inches) into undisturbed native soil prior to backfilling. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Contracting Officer's Representative to the specified depth to ensure proper percolation/drainage.
2. Prior to placing planting soil secure the Contracting Officer's Representatives acceptance of the planting areas subgrade condition. Test depth of loose soil with hand shovel in presence of Contracting Officer's Representative in several locations as directed. After acceptance of the planting areas subgrade condition, uniformly distribute and spread planting soil backfill over scarified subgrade in planting areas as specified and compact to a maximum of 85% relative compaction.
3. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.
4. Water settling, puddling, and jetting of fill and backfill materials as a compaction method is not acceptable.

5. Provide a minimum of 12" depth in planting areas, or more where shown or specified otherwise.
- D. Planting Soil Placement in Planting Islands and Adjacent to Pavement Areas:
1. Provide planting soil as a final lift in all planting areas within and adjacent to paved areas and other construction where native site soil has been covered by engineered fill and/or base rock. Remove all engineered fill, base rock and compacted subgrade full depth of compaction and replace with approved planting soil, a minimum lift of [ 12" ]. Unless shown otherwise, finish grade in planting islands shall be crowned with a minimum 2 % pitch to the edges.
- E. All planting areas soil shall be loose and friable prior to planting. Rip any overly compacted and re-compacted planting areas in two directions full depth of compacted soil prior to planting.
- F. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.
- G. Thoroughly wet down the planting areas to settle the soil and confirm irrigation coverage and operation. Allow soil to dry so as to be workable as described herein.
- H. Drag to a smooth, even surface. Grade to form all swales. Pitch grade with uniform slope to catch basins, streets, curb, etc., to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly sloped between finish elevations. Slope surface away from walls so water will not stand against walls or buildings. Control surface water to avoid damage to adjoining properties or to finished work on the site. Take required remedial measures to prevent erosion of freshly graded areas and until such time as permanent drainage and erosion control features have been installed. Refer to Erosion Control Netting below for treatment of slopes 3:1 and steeper.
- I. Finish Grade: Hold finish grade and/or mulch surface in planting areas 1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc. The subgrade of the mulch in mulched planting areas shall be a minus 2 inches for a distance of 12 to 18 inch from the edge of pavement. The remainder of the planting area shall be graded to receive the required 3 inch layer of mulch.
- J. In Situ Soil Preparation:
1. Spread organic amendment, iron and Type A fertilizer evenly over installed and rough graded topsoil in all planting areas including ground cover and shrub areas at the following rates:
    - a. Organic Amendment: 6 cubic yards per 1,000 square feet
    - b. Fertilizer: Type A (6-20-20) at 20 lbs. per 1,000 square feet.
    - c. Iron Sulfate: 10 lbs. per 1,000 square feet
  2. Rototill above additives into soil 6 to 8 inches deep. Keep iron sulfate off pavement and other surfaces to prevent rust staining. Correct all rust damage to work.
  3. Planting soil shall have a pH range of 6.5 to 7.5.
- K. After the rototill work, float areas to a smooth, uniform grade as indicated on the drawings. Slope all planting areas to drain. Roll, scarify, rake and level as necessary to obtain true, even planting surfaces. Remove rocks, sticks and debris 2 inches or larger in

shrub and ground cover areas. Secure approval of the grade by the Contracting Officer's Representative before any planting.

- L. Contractor shall notify Contracting Officer's Representative immediately if any planting soil areas have standing water or fail to drain properly prior to plant installation. Review on site with the Contracting Officer's Representative.

**3.02. ALUMINUM EDGING**

- A. Install in continuous strips as indicated and in accordance with manufacturer's recommendations with stakes spaced 48 inches on center maximum and at all joints.

**3.03. TREE AND SHRUB PLANTING**

- A. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the Contracting Officer's Representative before plant holes are dug. Review location of plants in relationship to irrigation heads and adjust location(s) that interfere with the function of the spray heads as accepted by the Contracting Officer's Representative prior to planting. If Subsurface drip is installed, adjust plant locations in relation to the subsurface emitter as required to ensure that the plant roots receive the proper amount of water in order for it to thrive.
- B. Test drainage of plant pits by filling with water (minimum 6"). The retention of water in planting beds and plant pits for more than two (2) hours shall be brought to the attention of the Contracting Officer's Representative. If rock, underground construction work, tree roots, poor drainage, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Contracting Officer's Representative.
- C. Break and loosen the sides and bottom of the pit to ensure root penetration and water test hole for drainage as required above.
- D. Backfill plant holes with mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement. Backfill remainder of the hole with soil mix and place plant tablets or packets (Type B fertilizer) 3 inches below finish grade and 1/2-inch from roots at the following rates:

1.	Size		Rate
	1 gallon can plant	-	1 tablet or packet
	5 gallon can plant	-	3 tablets or packet
	15 gallon can plant	-	6 tablets or packet
	24-inch box plant	-	6 tablets or packet
	36-inch box plant	-	8 tablets or packet

- E. Carefully remove and set plants without damaging the rootball. Superficially cut edge roots vertically on three sides. Remove bottom of plant boxes before planting. Remove sides of boxes after positioning the plant and partially backfilling.
- F. Set plants in backfill with top of the rootball 2 inches above finished grade. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole.
- G. Build 6" high watering basin berms around trees and shrubs to drain through rootball. Stake and/or guy trees as detailed and noted herein. Drive stake(s) until solid (at least 12" beyond bottom of rootball) and remove excess stake protruding above top tree tie to

prevent rubbing against branches. Avoid driving stakes through rootball. If subgrade does not accept stakes to a stable degree, delete stakes and guy the trees as specified herein and as detailed. Locate tree ties to avoid contact with tree branches. Locate top tie at tree flex point.

- H. Remove any soil from top of plant rootballs and secure Contracting Officer's Representative's approval of rootball height prior to mulching.
- I. After approval of rootball height, install mulch as required below.
- J. Trees damaged during installation, including broken branches, shall be brought to the attention of the Contracting Officer's Representative. Contractor shall replace damaged tree as determined by the Contracting Officer's Representative. If replacement is not necessary, Contractor shall prune damaged branches as directed by the Contracting Officer's Representative and under the direct supervision of a foreman certified by Western Chapter of International Arboriculture Society (WCIAS) and in accordance with WCIAS standards. See 3.7 Tree, Shrub and Vine Pruning.
- K. Coordinate planting and irrigation and provide hand watering of emitter irrigated areas as required to maintain moist root zones throughout the plant establishment period.

#### **3.04. TREE, SHRUB AND VINE PRUNING**

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Contracting Officer's Representative, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- C. Do not apply pruning paint to wounds.

#### **3.05. GROUND COVER PLANTING**

- A. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.

#### **3.06. SODDED TURF**

- A. Lightly roll surface and re-shape to level humps and hollows. Secure Landscape Architect's approval prior to sodding. Do not sod on dry soil.
- B. Lay first strip of sod along a straight line (use a string in irregular areas). Butt joints tightly, do not overlap edges. On second strip, stagger joints. Use a sharp knife to cut sod to fit curves, edges and sprinkler heads.
- C. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to sod and to water until installation is complete.
- D. After laying all sod, roll lightly to eliminate irregularities and to form good contact between sod and soil. Avoid a heavy roller and excessive initial watering.



- E. Thoroughly water the completed sod surface to at least 8 inches deep. Repeat sprinkling at regular intervals to keep sod moist at all times until rooted. After sod is established, decrease frequency and increase amount of water per application.
- F. Turf with subsurface drip irrigation shall require 21 days minimum supplemental hand watering until sod is established.
- G. Protect turf areas by erecting fences, barriers and signs necessary to prevent trespass. Keep barriers neat and well maintained.

### **3.07. MULCH**

- A. Except where rock mulch is required, mulch all tree, shrub and ground cover areas with organic mulch to a 3-inch depth, except adjacent to walkways where soil grade is 2 inches below top of pavement, mulch shall be 2 inches deep, and 2-inches deep where planting ground cover plants from flats. Hold bark mulch away from base (trunk) of plant 4" or as directed by the Contracting Officer's Representative. Individual trees and/or shrubs planted in non-irrigated areas shall, at minimum, receive bark mulch over their watering basin and berm. No mulch is required around trees in bioswales or biodetention basins.
- B. Install rock mulch to a minimum 3-inch depth where shown.

### **3.08. ROOT BARRIER**

- A. Install in linear fashion along and adjacent to the edges of the planting area as detailed or, if not shown, in accordance with manufacturer's recommendations.

### **3.09. PRE-EMERGENCE WEED KILLER**

- A. Apply pre-emergence weed killer in all areas to receive ground cover planting. Work shall be done under the supervision of a person licensed by the State of California as a pest control applicator and holding a qualified applicator license or a Qualified Applicator Certificate. Obtain approval of the finish grades prior to applying weed killer and coordinate planting and watering with the pest control specialist prior to planting. Take care to keep weed killer off areas to be seeded.

### **3.10. PLANT AND TURF ESTABLISHMENT PERIOD, WARRANTY, AND MAINTENANCE PERIOD**

- A. Refer to Section 1 above

### **3.11. WATERING**

- A. Water trees, shrubs and ground cover immediately after planting. Apply water to plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Do supplemental hand watering of trees and shrubs during the first 3 weeks of plant establishment.

### **3.12. RESTORATION AND CLEAN-UP**

- A. Where existing or new turf areas have been damaged or scarred during planting and construction operations, restore disturbed area to their original condition. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. In areas where planting work have been completed, clear the

area of all debris, spoil piles, and containers. Clear all other paved areas when work in adjacent areas is completed. Remove all debris, rubbish and excess material from the station.

**3.13. ENVIRONMENTAL PROTECTION**

- A. All work and Contractor operations shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**3.14. CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

**3.15. FINAL PLANTING REVIEW AND ACCEPTANCE, per Section 01 77 00.**

- A. At the conclusion of the Maintenance Period, schedule a final review with the Contracting Officer's Representative, the Contracting Officer's Representative's maintenance person, and the Landscape Architect. On such date, all project improvements and all corrective work shall have been completed. If all project improvements and corrective work are not completed, continue the planting establishment, at no additional cost to the Contracting Officer's Representative, until all work has been completed. This condition will be waived by the Contracting Officer's Representative under such circumstances wherein the Contracting Officer's Representative has granted an extension of time to permit the completion of a particular portion of the work beyond the time of completion set forth in the Agreement.
- B. Submit written notice requesting review at least 10 days before the anticipated review.
- C. Prior to review, weed and rake all planted areas, repair plant basins, mow and edge turf, plumb tree stakes, clear the site of all debris and present in a neat, orderly manner.

**--- END OF SECTION ---**

**Section 33 40 00  
STORM DRAINAGE UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

**1.2 RELATED WORK**

- A. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: section 31 20 00, EARTH MOVING.
- B. Concrete work, reinforcing, placement and finishing: section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Fabrication of steel ladders: section 05 50 00, METAL FABRICATIONS.
- D. Materials and testing report submittals: section 01 33 23, shop drawings, PRODUCT DATA AND SAMPLES.
- E. Erosion and sediment control: section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.3 ABBREVIATIONS**

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle catch basins according to manufacturer's written rigging instructions.

**1.5 QUALITY ASSURANCE**

- A. Products Criteria
  - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

**1.6 SUBMITTALS**

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A185/A185M-07 ..... Steel Welded Wire Reinforcement, Plain, for Concrete
  - A242/A242M-04(2009)..... High-Strength Low-Alloy Structural Steel
  - A536-84(2009) ..... Ductile Iron Castings
  - A615/A615M-09b ..... Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - A760/A760M-10 ..... Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
  - A798/A798M-07 ..... Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
  - A849-10..... Post-Applied Coatings, Paving, and Linings for Corrugated Steel Sewer and Drainage Pipe
  - A929/A929M-01(2007)..... Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
  - B745/B745M-97(2005)..... Corrugated Aluminum Pipe for Sewers and Drains
  - B788/B788M-09 ..... Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe
  - C14-07..... Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe
  - C33/C33M-08..... Concrete Aggregates
  - C76-11..... Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
  - C139-10 ..... Concrete Masonry Units for Construction of Catch Basins and Manholes
  - C150/C150M-11 ..... Portland Cement
  - C443-10 ..... Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
  - C478-09 ..... Precast Reinforced Concrete Manhole Sections
  - C506-10b ..... Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
  - C507-10b ..... Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
  - C655-09 ..... Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
  - C857-07 ..... Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

- C891-09 ..... Installation of Underground Precast Concrete Utility Structures
- C913-08 ..... Precast Concrete Water and Wastewater Structures
- C923-08 ..... Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
- C924-02(2009) ..... Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
- C990-09 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- C1103-03(2009) ..... Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
- C1173-08 ..... Flexible Transition Couplings for Underground Piping Systems
- C1433-10 ..... Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
- C1479-10 ..... Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
- D448-08 ..... Sizes of Aggregate for Road and Bridge Construction
- D698-07e1 ..... Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
- D1056-07 ..... Flexible Cellular Materials—Sponge or Expanded Rubber
- D1785-06 ..... Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D2321-11 ..... Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D2751-05 ..... Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
- D2774-08 ..... Underground Installation of Thermoplastic Pressure Piping
- D3034-08 ..... Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3350-10 ..... Polyethylene Plastics Pipe and Fittings Materials
- D3753-05e1 ..... Glass-Fiber-Reinforced Polyester Manholes and Wetwells
- D4101-11 ..... Polypropylene Injection and Extrusion Materials
- D5926-09 ..... Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
- F477-10 ..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679-08 ..... Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

- F714-10 ..... Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- F794-03(2009) ..... Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- F891-10 ..... Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
- F894-07 ..... Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
- F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
- F1417-11 ..... Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- F1668-08 ..... Construction Procedures for Buried Plastic Pipe
- C. American Association of State Highway and Transportation Officials (AASHTO)
  - M190-04 ..... Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
  - M198-10 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
  - M252-09 ..... Corrugated Polyethylene Drainage Pipe
  - M294-10 ..... Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter
- D. American Concrete Institute (ACI)
  - 318-05 ..... Structural Commentary
  - 350/350M-06 ..... Environmental Engineering Concrete Structures and Commentary
- E. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

**1.8 WARRANTY**

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace

elements of the assemblies as required to deliver specified performance of the complete assembly.

## 2.2 PE PIPE AND FITTINGS

- A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
  - 1. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
- B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S, with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
  - 1. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
  - 2. Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to requirements in AASHTO HB-17, Division II, for soil tightness and shall be as recommended by the manufacturer.

### ~~2.72.3 PVC Type PSM Sewer Piping~~

~~Ø. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell and spigot ends.~~

~~Ø. Fittings: ASTM D3034, PVC with bell ends.~~

~~Ø. Gaskets: ASTM F477, elastomeric seals.~~

## 2.72.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials
  - 1. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  - 2. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.82.4 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Concrete: Concrete for precast sections shall have a minimum compressive strength of 35 MPa (5,000 psi) at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C-857.
3. Size: As noted on the plans.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M-198B.
7. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into walls, for each pipe connection.
8. Frame and Cover for Gratings:
  - a. Galvanized steel: conforming to ASTM A123.
  - b. Cast iron: conforming to ASTM A48
  - c. Weight, shape, size, and waterway openings for grates shall be as indicated on the drawings.

#### 2-92.5 AREA DRAINS

##### A. Area Drains:

1. 6" diameter structurally foamed polyolefin or high density polyethylene round, flat grate with U.V. inhibitors. Color of drain shall be black. Directly connect to 6" riser pipe and tee connection with storm drain lateral. Open surface area shall be at least 9 square inches. Maximum flow rating shall be at least 10 gallons per minute.

#### 2-102.6 SLOT DRAINS

##### A. General requirements: Modular system of slot drains and appurtenances; designed so slot drains fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

##### B. Slot Drain:

- a. 11-gauge galvanized steel with 7/16" nominal width vertical opening and an overall nominal base width of 4.84". Slot drain shall be secured on polymer concrete channel drain with a boltless locking system, yet be able to be removed for channel drain maintenance.
- b. Install per manufacturer's recommendations.



**2.112.7 CLEANOUTS**

- A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  - 1. Top-Loading Classification(s): Light Duty
  - 2. Pipe fitting and riser to cleanout shall be same material as main pipe line.
- B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.

**2.122.8 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

**PART 3 - EXECUTION**

**3.1 PIPE BEDDING**

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material.

**3.2 PIPING INSTALLATION**

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
  - 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
  - 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
  - 4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
  - 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
  7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
  2. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
  3. Install PVC sewer piping according to ASTM D2321 and ASTM F1668.

### **3.3 CONNECTIONS TO EXISTING VA-OWNED MANHOLES**

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

### **3.4 CATCH BASIN INSTALLATION**

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### **3.5 CONNECTIONS**

- A. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
  2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
  3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
  - a. Unshielded flexible couplings for same or minor difference OD pipes.
  - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
  - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

### **3.6 IDENTIFICATION**

- A. Install green warning tape directly over piping and at outside edge of underground structures.

### **3.7 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred.
  1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.

### **3.8 TESTING OF STORM SEWERS:**

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
  4. Submit separate report for each test.

5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
  6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
    - a. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
  - C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- 3.9 CLEANING**
- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

--- E N D ---