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SECTION 000115

LIST OF DRAWING SHEETS

PART 1 - GENERAL

- A. The drawings listed below accompanying this specification form a part of the Contract.

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C101	CIVIL DETAILS	4
C102	CIVIL DETAILS	5
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AS201	EXTERIOR ELEVATIONS	8
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SECTION 010002

GENERAL REQUIREMENTS
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SECTION 010002
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing elements, and furnish labor, materials, equipment and services and perform and complete all work for converting the Administration Building to a Public Information Center as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Assistant Cemetery Director, 619-553-2085. Fort Rosecrans National Cemetery is located at Cabrillo Memorial Drive, San Diego, CA 92166.
- C. Offices of To Be Determined, as Architect-Engineers (A/E), may render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer's Representative (COR) or his duly authorized representative
- D. Before placement and installation of Work subject to tests by testing laboratory retained by the Contractor that meets the qualifications set forth by this Contract, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- E. All employees of general contractor and subcontractors shall comply with security requirements as established by the COR, be identified by name and employer. They shall be restricted from unauthorized access.
- F. 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.
- G. Training:
 - 1. All employees of general contractor or subcontractors shall, at the minimum, have successfully completed the 30-hour OSHA certified Construction Safety course and/or other relevant competency training, as determined by VA CP.
 - 2. Submit OSHA training records of all employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

- A. BID ITEM 1, GENERAL CONSTRUCTION: Installation of all work shown on the plans and described in the specifications including but not limited to: Providing accessibility upgrades, new finishes, new HVAC, new point-of-use water heaters.
- B. BID ITEM 2 [ALTERNATE 3]: Remove Nine (9) existing exterior windows and replace with new wood windows. See AS101, AS201, AE203 and AF101 for details.

ALTERNATE ADD ITEMS:

- C. ADD ITEM 3 [ALTERNATE 2]: Disconnect sewer lateral from (E) septic tank and connect to force main line. Work includes abandoning existing septic tank and connecting a 4" SS from the PIC down the West Portal Loop Drive to a new prepackaged grinder pump at Cabrillo Memorial Drive. From the grinder pump a new forced main will be provided in Cabrillo Memorial Drive north to connect into the Navy's existing sewer manhole. See CS101 and C101.
- D. ADD ITEM 4 [ALTERNATE 1]: Excavate and remove existing septic tank (in lieu of abandoning in place):
 - 1. Pump tank dry.
 - 2. Cut and remove sod and at least (2) headstones.
 - 3. Cut and remove concrete pavers.
 - 4. Excavate 15' x 20' tank area plus additional area to be able to sling and remove tank.
 - 5. Remove tank, haul to approved disposal site.
 - 6. Backfill void (15' x 20' x 10' d plus allowance for working room) with approved material and compact to 90% (vegetated areas) – 95% (paved areas).
 - 7. Form and place colored concrete to match existing; score/stamp to match existing; 4" PCC/6" AB.
 - 8. Re-set headstones; perform post-construction survey and photographing.
 - 9. Place and compact topsoil.
 - 10. Place sod; maintain during establishment period; warranty for VA's warranty period (1 year after acceptance; acceptable occurs after establishment period).
 - 11. Leach line to be capped, not removed.

A Single award will be made on Bid Item 1 and Bid Item 2 but in the event additional funds are available, then Add Item 3 [Alternate 2] will be added to the award. If additional funds are still available, then Add Item 4 [Alternate 1] will be added to the award..

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, one bond paper set of specifications and drawings will be furnished.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
3. Contractor shall submit the Security Plan to COR for review and approval prior to beginning on-site work.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without an appropriate badge not enter the site without following the procedures approved by the COR. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, the General Contractor shall give 3 days notice to the COR so that appropriate arrangements can be provided for the Cemetery employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the COR.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the COR.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes and parked machines, and to take any necessary emergency action.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the COR upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of COR.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

6. Notify COR immediately when there is a loss or compromise of “sensitive information”.
7. All electronic information shall be stored in a specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
 - b. “Sensitive information” including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

E. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.

1.5 FIRE SAFETY

- A. Applicable Publications: Publications listed below form part of this Article to the extent referenced. Publications are referenced in text by basic designations only.
- B. American Society for Testing and Materials (ASTM):
 1. E84-2009a Surface Burning Characteristics of Building Materials
- C. National Fire Protection Association (NFPA):
 1. 10-2010 Standard for Portable Fire Extinguishers
 2. 30-2008 Flammable and Combustible Liquids Code
 3. 51B-2009 Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 4. 70-2008 National Electrical Code
 5. 241-2009 Standard for Safeguarding Construction, Alteration, and Demolition Operations
- D. Occupational Safety and Health Administration (OSHA): Construction
- E. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR/Cemetery Director for review for compliance with contract requirements in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractor’s beginning work, they shall undergo a safety briefing provided by the General Contractor’s competent person per OSHA requirements. This briefing shall include information on the construction limits, safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of NCA equipment, etc.

Documentation shall be provided to the COR that individuals have undergone the Contractor's safety briefing.

- F. Site and Building Access: Maintain free and unobstructed access to emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- G. 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 20 feet exposing overall length, separate by 10 feet.
- H. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- I. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR/Cemetery Director.
- J. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- K. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- L. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- M. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. 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 COR.
- 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 and site weekly.
- Q. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COR. 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 trailers, office trailers) and utilities may be erected by the Contractor only with the approval of the COR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the COR, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the COR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COR. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the COR with agreement of the Cemetery. Contractor parking will be only in areas and on roadways designated and agreed to by the COR in agreement of the Cemetery.
- E. Workmen are subject to rules of the Cemetery applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Cemetery 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 Cemetery in quantities sufficient for not more than two work days. Provide unobstructed access to the Cemetery areas required to remain in operation.
 - 3. Where access by Cemetery personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements. All such actions shall be coordinated with the Utility Company involved:
 - a. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- G. Phasing: To insure such executions, the Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, the Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to the Cemetery Director, COR and Contractor, as follows:

1. Phasing shall be as indicated on the drawings
- H. Building will be vacated during performance of work. Refer to Section 015000, TEMPORARY FACILITIES AND CONTROLS for staff and visitor accommodations.
- I. Construction Fence: Before construction operations begin, the Contractor shall provide a chain link construction fence, seven feet minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 15 inches. Bottom of fences shall extend to one inch above grade. The temporary fencing shall encompass the construction work area(s) to serve as a pedestrian barrier to alert cemetery patrons of the construction site. Remove the fence when directed by COR.
- J. When a building is turned over to Contractor, Contractor shall accept entire responsibility therefore.
1. The Contractor shall maintain a minimum temperature of 40 degrees F at all times, except as otherwise specified.
- K. Utilities Services: Maintain existing utility services for the Cemetery at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the Utility Company involved.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the COR, and Cemetery Director's prior knowledge and written approval. Refer to specification Sections 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 270511 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 280511, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
 - a. Contact NAVFAC Base Utilities Duty Desk for Navy-owned utilities: (619) 556-7349.
 2. The Contractor shall submit a request to interrupt any such services to both COR and the Cemetery Director in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. The 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 Cemetery. Interruption time approved by the Cemetery and COR may occur at other than Contractor's normal working hours.

4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned 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 Cemetery traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
 - a. Comply with jurisdictional requirements for work in Cabrillo Monument Drive.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- N. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.
- O. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COR, in arranging construction schedule to cause the least possible interference with Cemetery activities in actual burial areas. Construction noise during the committal services shall not disturb the service. Trucks and workmen shall not pass through the service area during this period.
1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these dates.
 2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas in which alterations occur, areas which are anticipated routes of access, and furnish a signed report, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls, and other surfaces not required to be altered throughout affected areas.
 2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
 3. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by the Contractor with new items in accordance with specifications which will be furnished by the Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report.
1. Re-survey report shall also list any damage caused by the Contractor to such flooring and other surfaces, despite protection measures; and, will form the basis for determining extent of repair work required of the Contractor to restore damage caused by the Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 3. Protect the interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed on floor or any indicated surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 ENVIRONMENTAL CONTROLS

- A. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
 - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Block off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
- B. Vacuum and wet mop all transition areas from construction to the occupied Cemetery buildings at the end of each workday.
- C. Final Cleanup:
 - 1. Upon completion of the 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. All new air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

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

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

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of

equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the COR.

- 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 COR may have the necessary work performed and charge the cost to the Contractor.
 - 1. Prior to any excavation activities, Contractor shall contact NAVFAC base utilities mark-out and US Dig Alert to confirm location of existing utilities.
 - 2. In case of any utility-related emergencies, contact NAVFAC Utilities Duty Desk: (619) 556-7349.
- C. Refer to Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, water/irrigation or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, landscape stone, 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 the Contractor's own expense, the Contractor shall immediately restore to service and repair any damage caused by the Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services, communications systems including telephone, irrigation system control, and power which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
 - 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Jacobs.

1.13 AS-BUILT DRAWINGS

- A. The Contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, which will include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- C. The Contractor shall deliver two approved completed sets of as-built drawings to the COR within 15 calendar days after acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.14 USE OF ROADWAYS

- A. For hauling, use only established public roads and designated permanent roads on Cemetery property and, when indicated or authorized by the COR, such existing or Contractor constructed and/or modified temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed or modified by the Contractor at the Contractor's expense following approved plans that include: construction, operation, maintenance and restoration. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.15 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 COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR will withdraw permission for use of the equipment.
 - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, and their overload elements shall be properly sized, coordinated and

adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.16 TEMPORARY TOILETS

- A. Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections, or when approved by COR provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.
- B. Contractor may have for use of the Contractor's workmen, such toilet accommodations as may be assigned to the Contractor by the Cemetery. The Contractor shall keep such places clean and be responsible for any damage done thereto by the Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive the Contractor of the privilege to use such toilets.

1.17 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The 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 COR, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. The Contractor shall install meters at the Contractor's expense and furnish the Cemetery a monthly record of the Contractor's usage of electricity as hereinafter specified.
- 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 Cemetery 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. Where not available or not convenient to connect to the Cemetery distribution system, the contractor shall supply power via portable generators at own expense. Generators shall be acoustically screened so as not to disturb committal services and/or visitation to the adjacent columbarium.
- F. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Cemetery irrigation distribution system. Backflow preventer may not be required at connections to the irrigation system. Water is available at no cost to the Contractor.
 - 2. If potable water is required and convenient connection is available the contractor may connect to the Cemetery potable water distribution system. The contractor shall install reduced pressure backflow preventer at each connection at own expense.
 - 3. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from the Cemetery's system.
 - 4. Where not available or not convenient to connect to the Cemetery distribution system, the Contractor shall supply water via portable/temporary means at his own expense.
- G. Fuel: Natural and LP gas required for burner cleaning, normal initial burner-burner setup and adjusting, and for performing the specified burner tests will be furnished by the Government. Fuel required for prolonged burner setup, adjustments, or modifications due to improper design or operation of burner, or control devices shall be furnished by the Contractor at Contractor's expense.

1.18 TESTS

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

1.19 INSTRUCTIONS

- A. The Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

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

1.20 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on drawings.
- B. Materials furnished by the Government to be installed by the Contractor will be furnished to the Contractor at the Cemetery.
- C. Storage space for materials will be provided by the Contractor and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Cemetery.
- D. Notify COR in writing, 60 days in advance, of date on which Contractor will be prepared to receive materials furnished by Government. Arrangements will then be made by the Government for delivery of materials.
 - 1. Immediately upon delivery of materials, the Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of materials described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. The Contractor thereafter is responsible for such material until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.21 RELOCATED ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing 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 COR.
- C. Suitably cap existing service lines, such as water, drain, gas, air, and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.22 SAFETY SIGN

- A. Provide a Safety Sign where directed by COR. Signboard shall be three feet x four feet, 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.
- C. Maintain sign and remove it when directed by COR.
- D. See Detail Drawing Number B4 of safety sign showing required legend and other characteristics of sign is attached hereto and is made a part at the end of this section.
- E. Post the number of accident free days on a daily basis.

1.23 CONSTRUCTION DIGITAL IMAGES

- A. During construction period through completion, furnish Department of Veterans Affairs weekly color digital photographs of construction progress (8 to 10 images per week.) Photographs of the reinforcing steel shall be taken after all reinforcing steel, sleeves, inserts, etc. are in place but prior to setting of runways. Photographs must show distinctly, at as large a scale as possible, all parts of work embraced in picture.
- B. Photographs are to be taken with a high-resolution digital camera, minimum 6 megapixels, with good wide-angle capability. The images shall be recorded in JPEG format with a minimum of 24-bit color and no reduction in actual picture size.
 - 1. Compressed size of the file shall be no less than 80% of the original with no loss of information.
 - 2. File names shall contain the Project number, the date the image was taken, and a unique sequential identifier, for example: 101CM3202_10-01-2013_0001. Use underscore, not spaces in digital file names.
- C. The digital photo files shall become property of Government and will be both e-mailed and submitted on CD-ROM.
 - 1. The images shall be forwarded electronically to the COR/Project Manager via email to NAME@va.gov within 2 days of when the photo was taken. Identify the content of each picture by a caption incorporated in the photo.
 - 2. The digital photo files shall also be submitted on CD-ROM to the COR/Project Manager at the conclusion of the project. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.

1.24 FINAL PHOTOGRAPHS

- A. Final photographs shall be taken by a commercial/professional photographer. They shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day at as large a scale as possible to obtain sufficient detail to show depth and to provide clear, sharp pictures. All images shall become property of the Government.
- B. Photographs shall be artistically composed showing full front elevations of new columbarium court(s), memorial wall, ossuary, bridge, site features and surrounding landscapes. A minimum of twenty-four (24) images shall be taken as per these specifications.
- C. Minimum digital photo file size for final photos is 20 mb un-interpolated, preferably 52 mb. Submit proofs, via e-mail or web photo gallery, from which the COR/Project Manager will select the final images for printing.
- D. Pictures selected by the COR/Project Manager for printing shall be printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Photographs shall have full picture print with no margin.

- E. Submit two (2) 16 x 20 framed prints and three (3) 8 x 10 prints of the final selected photos. Deliver to the COR/Project Manager, in boxes suitable for shipping,
- F. Submit a CD-ROM to the COR/Project Manager containing all (minimum 24) final digital photo files.
 - 1. Images on CD-ROM shall be recorded in JPEG format with a minimum of 24 bit color and no reduction in actual picture size. Compressed size of the file shall be no less than 80% of the original with no loss of information.
 - 2. File names shall contain the date the image was taken, the Project number and a unique sequential identifier.
 - 3. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.
- G. Each of the selected 16 x 20 prints shall be placed in a frame with a minimum 2 inches, maximum 3 inches, of appropriate matting as a border. Provide a selection of 3 different mats and 3 different frames from which the COR will select one mat and one frame style to frame both prints. Preferred frame style is wood molding, matte black finish, box frame, 1-1/8" wide x 7/8-inch deep.
- H. Place a typewritten self-adhesive identity label on the back of each final print without damage to photograph. PHOTO NUMBER shall be included in both the digital file name on the CD and on the photo print label.
- I. The following information shall be on the identity-label for photographs:
 - 1. PHOTO NUMBER;
 - 2. CEMETERY NAME
 - 3. LOCATION;
 - 4. PROJECT TITLE;
 - 5. PROJECT NUMBER;
 - 6. DATE TAKEN;
 - 7. CONSTRUCTION COMPANY;
 - 8. CONTRACT NUMBER.

1.25 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 COR verbally, and then with a written follow up.

1.26 PROJECT HEALTH AND SAFETY PLAN

- A. Prior to commencing any construction, the Contractor shall submit a site specific Project Health and Safety Plan (PHSP). At a minimum, the PHSP shall cover the following topics:

1. Organizational structure (including Responsible Persons)
2. Site Characterization and Job Hazard Identification
3. Site Control and Security
4. Training
5. PPE
6. Heat Stress
7. Spill Containment
8. Decontamination
9. Emergency Response
10. Trench Safety

END OF SECTION 010002



NO SCALE

SECTION 013217

NETWORK ANALYSIS SCHEDULES (MICROSOFT PROJECT GANTT CHART)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall develop a Microsoft Project 2003 (or later) Gantt Chart (bar chart) schedule demonstrating fulfillment of the contract requirements. The Contractor shall keep the network up-to-date in accordance with the requirements of this section. The Contractor shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). The Gantt Chart will be utilized to satisfy time applications.

1.2 CONTRACTOR'S REPRESENTATIVE

- A. The Contractor shall designate an in-house representative who will be responsible to prepare the schedule, review the schedule and report progress of the project to the Contracting Officer's Representative.
- B. The Contractor's in-house representative shall be given authority to act on behalf of the Contractor in fulfilling the requirements of this specification section. Such authority shall not be interrupted throughout the duration of the project.

1.3 COMPUTER PRODUCED SCHEDULES

- A. The contractor shall provide to VA monthly computer processing of all computer produced schedules generated from monthly project updates. The Contractor shall provide to VA two (2) copies of the updated Microsoft Project Gantt Chart and an electronic copy of this data. This must be submitted with and substantively support the contractor's monthly payment request.
- B. The Contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal of the updated project schedule.
- C. VA shall report errors in computer-produced reports to the Contractor's representative within ten (10) calendar days from receipt of reports. The Contractor shall reprocess the Gantt Chart and associated CDs, when requested by the Contracting Officers Representative, to correct errors that affect the schedule for the project.

1.4 THE COMPLETE PROJECT GANTT CHART SUBMITTAL

- A. The Complete Project Microsoft Project Gantt Chart will contain sufficient work activities/events as necessary to fully detail the project schedule.
- B. Within ten (10) calendar days after receipt of the Notice to Proceed, the Contractor shall submit for the COR's review, a Microsoft Project Gantt Chart and a CD. Each activity/event on the Gantt Chart schedule shall contain as a minimum, but not limited to, activity/event description, duration, start dates and finish dates. Activity constraints, not required by the contract, will not be accepted. Logic events (non-work) will be permitted where necessary to reflect proper sequence among work events, but must have zero duration.
- C. The complete working Gantt Chart shall reflect the Contractor's approach to scheduling the complete project. The final Gantt Chart in its original form shall contain no contract changes or delays that may have been incurred during the final Gantt Chart development period. It shall reflect the Contractors "AS BID" or "DAY 1" schedule. Changes and /or delays shall be entered at the first monthly update after the final Gantt Chart has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.
- D. Within ten (10) calendar days after receipt of the complete project Gantt Chart, the Contracting Officer or his representative, will do one or both of the following:
 - 1. Notify the Contractor concerning his actions, opinions, and objections.
 - 2. Schedule a meeting with the Contractor at, or near the job site, for joint review, correction or adjustment of the proposed plan. Within ten (10) calendar days after the joint review, the Contractor shall revise and shall submit two (2) copies of the revised Gantt Chart and a revised CD as specified to the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

1.5 WORK ACTIVITY/EVENT AND COST DATA INFORMATION

- A. The Contractor shall not be required to "cost load" the computerized Microsoft Project Gantt Chart. As part of this submission, the Contractor shall provide a separate Schedule of Costs on AIA document G703. This Schedule of Costs shall reflect and contain all the same activities/events identified on the Gantt Chart.
- B. The Contractor and the Contracting Officer shall use this Schedule of Costs for monthly payment purposes as referenced in the General Conditions of this agreement.
- C. The Contractor and Contracting Officer shall agree on percentages for monthly work accomplished. The cumulative total amount of all cost loaded activities/events (including alternates) shall equal the total contract price.

- D. Prorate overhead, profit and general conditions on all work activities/events for the entire project. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

1.6 GANTT CHART REQUIREMENTS:

- A. Show on the Gantt Chart the sequence and interdependence of work activities/events required for complete performance of all items of work. In preparing the Gantt Chart, the Contractor shall:
 - 1. Show the following on each work activity/event:
 - a. Concise description of the work represented by the activity/event.
 - b. Duration (in work days.)
 - 2. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 - b. Contracting Officer Representative's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of VA Cemetery utilities, delivery of Government furnished equipment, project phasing and any other specification requirements.
 - d. Test, balance and adjust various systems and pieces of equipment.
 - e. VA inspection and acceptance activity/event with a minimum duration of five (5) work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
 - 3. Break up the work into activities/events of durations no longer than thirty (30) work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than ten (10) workdays. The construction time as determined by the Gantt Chart schedule from start to finish for any sub-phase, phase or the entire project shall not exceed the total contract duration. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 - 4. Exterior Label Information: Provide the following information on an external label attached to each diskette(s):
 - a. VA project number and project location.
 - b. Name and telephone number of a point of contact, preferably the person who created the CD
 - c. The CD number and total number of CDs in the set
 - d. The project data status date.

1.7 PAYMENT TO THE CONTRACTOR:

- A. Monthly, the contractor shall submit the Gantt Chart updated for remaining activity durations and a Schedule of Costs updated for costs. AIA application and certification for payment documents G702 and G703 will be used. The payment request should reflect and be in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section GENERAL CONDITIONS. The Contractor is entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated Schedule of Costs unless, in special situations, the Contracting Officer permits an exception to this requirement. Monthly payment requests shall include: two (2) copies of the updated Microsoft Project Gantt Chart, a listing of all project schedule changes, and associated data, made at the update. These must be submitted with and substantively support the contractor's monthly application and certificate for payment request documents.
- B. When the Contractor fails or refuses to furnish to the Contracting Officer the information and the associated updated Gantt Chart data, which, in the sole judgment of the Contracting Officer, are necessary for validating the monthly progress payment, the Contractor shall not be deemed to have provided supporting schedule data upon which progress payment may be reasonably determined.

1.8 PAYMENT AND PROGRESS REPORTING:

- A. Monthly job site progress meetings shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's Representative) and the Contractor. Presence of subcontractors during the progress meeting is optional unless required by the Contracting Officer (or Contracting Officer's Representative). Job progress will be reviewed to verify:
 - 1. Actual start and/or finish dates for updated/completed activities/events.
 - 2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
 - 3. Time and cost data for change orders, and supplemental agreements that are to be incorporated into the Gantt Chart.
 - 4. Percentage for completed and partially completed activities/events.
 - 5. Logic and duration revisions required by this section of the specifications.
 - 6. Activity/event duration and percent complete shall be updated independently.
- B. The Contractor shall submit a narrative report as a part of his monthly review and update, in a form agreed upon by the Contracting Officer. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

- C. As part of the monthly jobsite progress meeting, the General Contractor, specifically requested subcontractors and the Contracting Officers Representative shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period.

1.9 RESPONSIBILITY FOR COMPLETION:

- A. Whenever it becomes apparent from the monthly progress review meeting or the monthly computer-produced Gantt Chart 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 for the proposed schedule changes. If such actions are approved, the revisions shall be incorporated by the Contractor into the Gantt Chart before the next update, at no additional cost to the Government.

1.10 CHANGES TO GANTT CHART SCHEDULE:

- A. Within ten (10) calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor shall submit a revised Gantt Chart, the associated CDs, and a list of any activity/event changes including predecessors and successors for any of the following reasons:
 - 1. Delay in completion of any activity/event or group of activities/events, which indicate an extension of the project completion by twenty (20) working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the Gantt Chart as the direct cause for delaying the project beyond the acceptable limits.
 - 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 - 3. The schedule does not represent the actual prosecution and progress of the project.
 - 4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.
- B. Revisions made under this paragraph, which affect the previously approved computer-produced schedules for Government furnished equipment, contract phase(s)

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

- C. Contracting Officer's approval for the revised Gantt Chart and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the Contracting Officer's Representative.
- D. The cost of revisions to the Gantt Chart resulting from contract changes will be included in the cost of the change.
- E. The cost of revisions to the Gantt Chart not resulting from contract changes is the responsibility of the Contractor.

1.11 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, Gantt Chart data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals.
- B. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced Gantt Chart schedule for the time period when the change took place and all other relevant information. The Contracting Officer will, within thirty (30) calendar days after receipt of such justification and supporting evidence, advise the Contractor in writing of his decision on the matter.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include, as a part of each change order proposal, a sketch showing all revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 013217

SECTION 013323

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- B. For the purposes of this contract, samples including laboratory samples to be tested, 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.

1.2 SUBMITTALS

- A. 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:
 - 1. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - 2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - 3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- B. 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.
- C. 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.
- D. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

- E. 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.
- F. 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.
- G. 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.
 - 1. Submit samples required by Section 090600, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
 - 2. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Cemetery, 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.
 - a. 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.
 - b. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Cemetery, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 - c. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- H. 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. Contractor shall forward a copy of transmittal letter to Resident Engineer simultaneously with submission to a commercial testing laboratory.
 6. Laboratory test reports shall be sent directly to Resident Engineer for appropriate action.
 7. 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.
 8. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- I. 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.
- J. 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.
- K. 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 Cemetery location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 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.
8. Samples except laboratory samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

To Be Determined

Address:

ATTN:

Phone:

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

Department of Veterans Affairs
National Cemetery Administration (43B)
425 I Street, NW, 5E425H
Washington, DC 20001
ATTN: Ms. Peggy Jensen
Phone: 202.632.5895

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 013323

SECTION 014219

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

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

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

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

United States Department of Veteran Affairs
Technical Information Library
<http://www.cfm.va.gov/til/>

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

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

AA	Aluminum Association, Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchq.com
AADM	American Association of Automatic Door Manufacturers http://www.aaadm.com
AATC	American Association of Textile Chemists and Colorist http://www.aatcc.org
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.transportation.org/Pages/default.aspx
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADA	American with Disabilities Act http://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org

AGC	Associated General Contractors of America http://www.agc.org
AHA	American Hardboard Association http://www.domensino.com/AHA/
AIHA	American National Standards Institute/American Industrial Hygiene Association http://www.aiha.org/Pages/default.aspx
AISC	American Institute of Steel Construction http://www.aisc.org
ISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
ALI	Automotive Lift Institute http://www.autolift.org/
AMCA	Air Movement and Control Association http://www.amca.org/
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	Architectural Precast Association http://www.archprecast.org/
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.lightindustries.com/ARI/
ARMA	Asphalt Roofing Manufacturers Association http://www.asphaltroofing.org/
ASAE	American Society of Agricultural Engineers http://www.asabe.org
ASCE	American Society of Civil Engineers http://www.asce.org

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWPA	American Wood Protection Association http://www.awpa.com
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	The Brick Industry Association http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CARB	California Environmental Protection Agency Air Resources Board http://arb.ca.gov/hompage.html/
CFR	Code of Federal Regulations http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CID	Commercial Item Description http://www.gsa.gov/portal/content/100847
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org

CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPA	Composite Panel Association http://www.compositepanel.org/
CRA	California Redwood Association http://www.calredwood.org
CRI	Carpet and Rug Institute http://www.carpet-rug.com
CRRC	Cool Roof Rating System http://coolroofs.org/
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CSI	Cast Stone Institute http://www.caststone.org
DASMA	Door and Access Systems Manufacturers Association http://www.dasma.com/
DHI	Door and Hardware Institute http://www.dhi.org
DOE	U.S. Department of Energy http://www.energy.gov/
EEI	Edison Electric Institute http://www.eei.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EIMA	Exterior Insulation Manufacturers Association http://www.eima.com/
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.envirotestinglabs.com/
FCC	Federal Communications Commission http://www.fcc.gov

FHA	Federal Highway Administration http://www.fhwa.dot.gov/
FM	FM Global http://www.fmglobal.com
FPS	The Forest Products Society http://www.forestprod.org
FSC	Forest Stewardship Council http://www.fscus.org
GA	Gypsum Association http://www.gypsum.org
GANA	Glass Association of North America http://www.glasswebsite.com
GBI	Green Building Initiative http://www.thegbi.org/
GS	Green Seal http://www.greenseal.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICC	The International Code Council http://www.iccsafe.org/Pages/default.aspx
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org\
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
ITS	Intertek Training Services http://www.intertek.com/
MBMA	Metal Buildings Manufacturers Association http://www.mbma.com

MHI	Material Handling Industry of America http://www.mhi.org/
MIA	Marble Institute of America http://www.marble-institute.com/
MIC	Masonry Industry Council
MPI	Master Painters Institute http://www.mpi.net/
MSJC	Masonry Standards Joint Committee http://www.masonrysociety.org/msjc/
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org/
NBS	National Bureau of Standards See - NIST
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NFRC	National Fenestration Rating Council http://www.nfrc.org/
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIOSH	The National Institute for Occupational Safety and Health http://www.cdc.gov/niosh/
NIST	National Institute of Standards and Technology http://www.nist.gov
NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org

NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NPCA	National Precast Concrete Association http://www.precast.org
NRCA	National Roofing Contractors Association http://www.nrca.net
NSF	National Sanitation Foundation http://www.nsf.org
NSF	NSF International http://www.nsf.org/
NTMA	National Terrazzo and Mosaic Association http://ntma.com/
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.cement.org/
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RCSC	Research Council of Structural Connections http://www.boltcouncil.org/
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA

RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCAQMD	South Coast Air Quality Management District http://www.aqmd.gov
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Deck Institute http://www.sdi.org
SDI	Steel Door Institute http://www.steeldoor.org
SEI	Structural Engineering Institute http://www.asce.org/SEI/
SJI	Steel Joist Institute http://www.steeljoist.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SPRI	Single Ply Roofing Industry http://www.spri.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
SWRI	Sealant Waterproofing and Restoration Institute http://www.swrionline.org/
TCNA	Tile Council of North America, Inc. http://www.tileusa.com
TPI	Truss Plate Institute, Inc. http://www.tpinst.org/
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca

USDA	U.S. Department of Agriculture http://www.usda.gov
USGBC	U.S. Green Building Council http://www.usgbc.org
WCLIB	West Coast Lumber Inspection Bureau http://www.wclib.org/
WDMA	Window and Door Manufacturers Association https://www.wdma.com/
WH	Warnock Hersey http://www.intertek.com/marks/wh/
WRCLA	Western Red Cedar Lumber Association http://www.wrcla.org/
WWPA	Western Wood Products Association http://www2.wwpa.org/

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 014219

SECTION 014529

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor. Refer to Section 010002, GENERAL REQUIREMENTS, for additional information.

1.2 RELATED DOCUMENTS

- A. Section 010002, GENERAL REQUIREMENTS.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. T27-11 Sieve Analysis of Fine and Coarse Aggregates
 - 2. T96-02(R2006) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - 3. T99-10 The Moisture-Density Relations of Soils Using a 5.5 lb. Rammer and a 12 in. Drop
 - 4. T104-99(R2007) Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - 5. T180-10 Moisture-Density Relations of Soils using a 10 lb. Rammer and a 18 in. Drop
 - 6. T191-02(R2006) Density of Soil In-Place by the Sand-Cone Method
- C. American Society for Testing and Materials (ASTM):
 - 1. A325-10 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 2. A370-12a Definitions for Mechanical Testing of Steel Products

3. A490-12 Heat Treated Steel Structural Bolts, 150 ksi
Minimum Tensile Strength
4. C31/C31M-12 Making and Curing Concrete Test Specimens in
the Field
5. C33/C33M-13 Concrete Aggregates
6. C39/C39M-12 Compressive Strength of Cylindrical Concrete
Specimens
7. C109/C109M-12 Compressive Strength of Hydraulic Cement
Mortars
8. C138/C138M-12a Unit Weight, Yield, and Air Content
(Gravimetric) of Concrete
9. C140-13 Sampling and Testing Concrete Masonry Units
and Related Units
10. C143/C143M-12 Slump of Hydraulic Cement Concrete
11. C172/C172M-10 Sampling Freshly Mixed Concrete
12. C173/C173M-12 Air Content of freshly Mixed Concrete by the
Volumetric Method
13. C330/C330M-09 Lightweight Aggregates for Structural Concrete
14. C567/C567M-11 Density Structural Lightweight Concrete
15. C780-12a Pre-construction and Construction Evaluation of
Mortars for Plain and Reinforced Unit Masonry
16. C1019-11 Sampling and Testing Grout
17. C1064/C1064M-12 Freshly Mixed Hydraulic Cement Concrete
18. C1077-13 Agencies Testing Concrete and Concrete
Aggregates for Use in Construction and Criteria
for Laboratory Evaluation
19. C1314-12 Compressive Strength of Masonry Prisms
20. C1364-10b Architectural Cast Stone
21. D698-12 Laboratory Compaction Characteristics of Soil
Using Standard Effort
22. D1143/D1143M-07 Deep Foundations Under Static Axial
Compressive Load
23. D1188-07 Bulk Specific Gravity and Density of Compacted
Bituminous Mixtures Using Paraffin-Coated
Specimens
24. D1556-07 Density and Unit Weight of Soil in Place by the
Sand-Cone Method
25. D1557-12 Laboratory Compaction Characteristics of Soil
Using Modified Effort
26. D2166-06 Unconfined Compressive Strength of Cohesive
Soil
27. D2167-08 Density and Unit Weight of Soil in Place by the
Rubber Balloon Method
28. D2216-10 Laboratory Determination of Water (Moisture)
Content of Soil and Rock by Mass
29. D2974-07 Moisture, Ash, and Organic Matter of Peat and
Other Organic Soils
30. D3666-11 Minimum Requirements for Agencies Testing
and Inspection Bituminous Paving Materials

- | | | |
|-----|----------------|---|
| 31. | D3740-12a | Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock |
| 32. | E94-04(2010) | Radiographic Examination |
| 33. | E164-08 | Contact Ultrasonic Testing of Weldments |
| 34. | E329-11c | Agencies Engaged in Construction Inspection, Testing, or Special Inspection |
| 35. | E543-13 | Agencies Performing Nondestructive Testing |
| 36. | E709-08 | Guide for Magnetic Particle Testing |
| 37. | E1155-96(2008) | Determining FF Floor Flatness and FL Floor Levelness Numbers |

D. American Welding Society (AWS):

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

1.4 REQUIREMENTS

- A. Accreditation Requirements: Testing Laboratory retained and paid for by Contractor must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to COR a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the COR for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.
1. Laboratories engaged in testing of construction materials must meet the requirements of ASTM E329.
 2. Laboratories engaged in testing of concrete and concrete aggregates must meet the requirements of ASTM C1077.
 3. Laboratories engaged in testing of bituminous paving materials must meet the requirements of ASTM D3666.
 4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, must meet the requirements of ASTM D3740.
 5. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
 6. Laboratories engaged in non-destructive testing (NDT) must meet the requirements of ASTM E543.
 7. Laboratories engaged in Hazardous Materials Testing must meet the requirements of OSHA and EPA.
- B. Inspection and Testing: Testing laboratory to inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory must direct attention of COR to such failure.

- C. Written Reports: Testing laboratory to submit test reports to COR, within 24 hours after each test is completed unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General: The Testing Laboratory is to provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The Work to be performed is as identified herein including, but not be limited to, the following:
 - 1. Observe fill and subgrades to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where earth moving was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe replaced areas until satisfactory results are obtained.
 - 2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 - 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
 - 1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D1557.
 - 2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 to be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they must provide satisfactory explanation to the COR before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 2000 square feet of building slab, but in no case fewer than three tests. In each

compacted fill layer, perform one test for every 2000 square feet of overlaying building slab, but in no case fewer than three tests.

- b. Pavement Subgrade: One test for each 400 square yards, but in no case fewer than two tests.
 - c. Curb, Gutter, and Sidewalk: One test for each 300 feet, but in no case fewer than two tests.
 - d. Trenches: One test at maximum 100 foot intervals per 4 foot of vertical lift and at changes in required density, but in no case fewer than two tests.
 - e. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 100 feet of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 LANDSCAPING

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
- 1. Test for organic material by using ASTM D2974.
 - 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to COR.
- C. Submit recommendations for soil amendments, from a regional soil conservation service or cooperative extension, to bring soil into compliance with minimum parameters in these specifications.

3.3 ASPHALT CONCRETE PAVING

- A. Aggregate Base Course:
- 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D.
 - 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
 - 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:

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

3.4 SITE WORK CONCRETE

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

3.5 CONCRETE

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make

- at least three cylinders for each 50 cubic yards or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
 5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 25 cubic yards thereafter each day. For concrete not required to be air-entrained, test every 100 cubic yards at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 9. Verify that specified mixing has been accomplished.
 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
 11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
 14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
 15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.

16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test to be the result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it must be discarded and strength of spare cylinder to be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in psi.
 - e. Weather conditions during placing.
 - f. Temperature of concrete in each test cylinder when test cylinder was molded.
 - g. Maximum and minimum ambient temperature during placing.
 - h. Ambient temperature when concrete sample in test cylinder was taken.
 - i. Date delivered to laboratory and date tested.

3.6 REINFORCEMENT

- A. Review mill test reports furnished by Contractor.
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

- C. Written report must include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.7 MASONRY

A. Mortar Tests:

- 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 2 inch, 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
- 2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

- 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 2500 square feet of masonry.

C. Masonry Unit Tests:

- 1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 460 m² (5000 square feet) of wall area.

E. Field Inspection and Materials Testing:

- 1. Verify the following prior to grouting:
 - a. Grout space is clean.
 - b. Type, spacing, and placement of reinforcement, connectors, and anchors comply with the contract requirements.

3.8 STRUCTURAL STEEL

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Conform to AWS D1.1 Structural Welding Code for welding.
- B. Prefabrication Inspection:

1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
2. Approve welding procedure qualifications by pre-qualification or by witnessing qualifications tests.
3. Approve welder qualifications by certification or retesting.
4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:

1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that rejected welds corrections are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:

- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR.

3.9 TYPE OF TEST

	Approximate Number of Tests Required
A. Earthwork: Laboratory Compaction Test, Soils: ASTM D1557 Field Density, Soils (AASHTO T191, T205, or T238) Penetration Test, Soils	_____ _____ _____
B. Landscaping: Topsoil Test	_____
C. Aggregate Base: Laboratory Compaction, ASTM D1557 Field Density, ASTM D1556	_____ _____
Aggregate, Base Course	
Gradation (AASHTO T27) Wear (AASHTO T96) Soundness (AASHTO T104)	_____ _____ _____
D. Asphalt Concrete: Field Density, (AASHTO T230) ASTM D1188	_____

Aggregate, Asphalt Concrete

Gradation (AASHTO T27) _____
Wear (AASHTO T96) _____
Soundness (AASHTO T104) _____

- E. Concrete:
Making and Curing Concrete Test Cylinders (ASTM C31) _____
Compressive Strength, Test Cylinders (ASTM C39) _____
Concrete Slump Test (ASTM C143) _____
Concrete Air Content Test (ASTM C173) _____

Aggregate, Normal Weight:

Gradation (ASTM C33) _____
Deleterious Substances (ASTM C33) _____
Soundness (ASTM C33) _____
Abrasion (ASTM C33) _____

- F. Reinforcing Steel:
Tensile Test (ASTM A370) _____
Bend Test (ASTM A370) _____

- H. Masonry:
Making and Curing Test Cubes (ASTM C109) _____
Compressive Strength, Test Cubes (ASTM C109) _____
Sampling and Testing Mortar, Comp. Strength (ASTM C780) _____
Sampling and Testing Grout, Comp. Strength (ASTM C1019) _____
Masonry Unit, Compressive Strength (ASTM C140) _____

- I. Structural Steel:
Ultrasonic Testing of Welds (ASTM E164) _____
Magnetic Particle Testing of Welds (ASTM E709) _____
Radiographic Testing of Welds (ASTM E94) _____

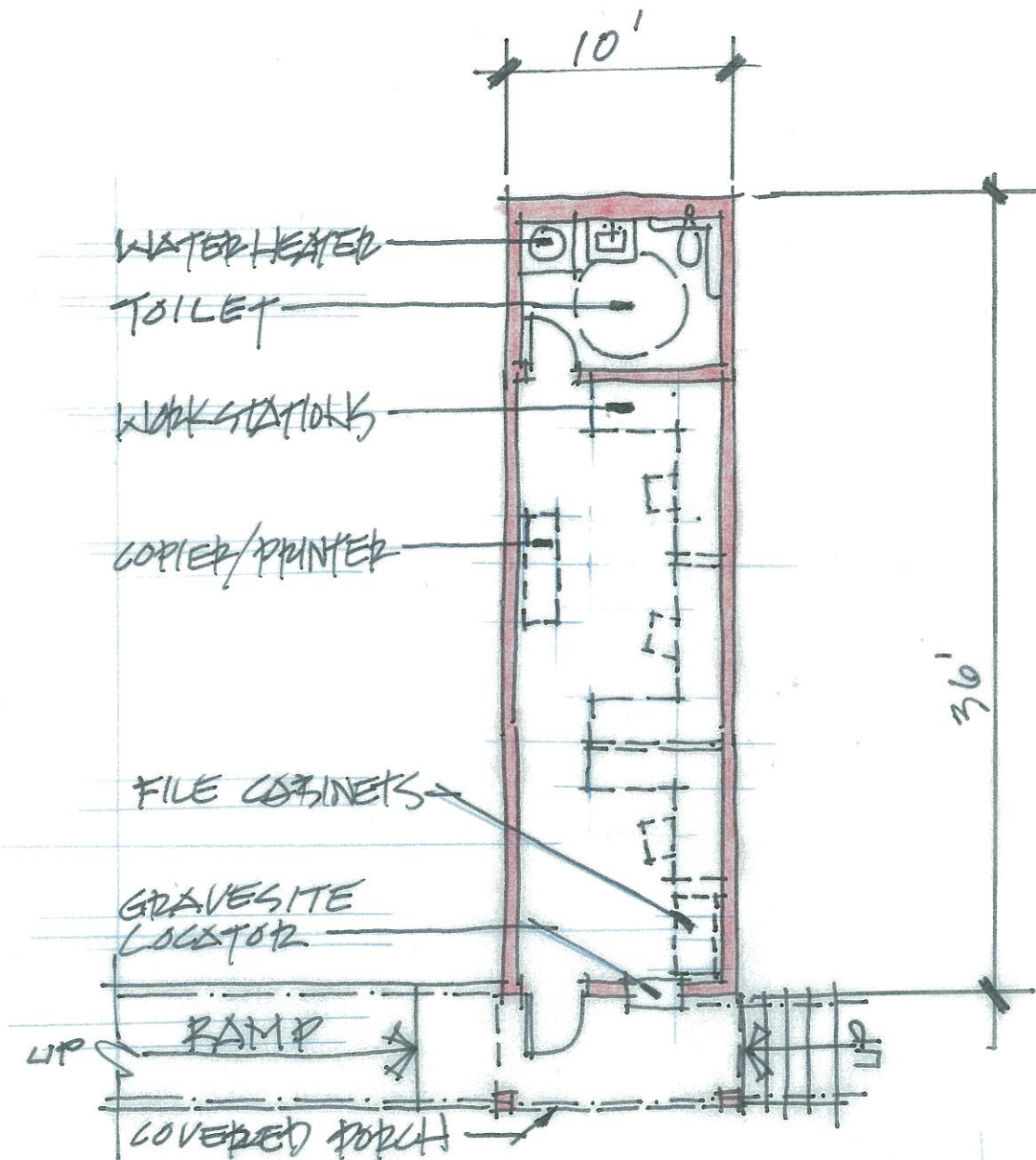
- J. Sprayed-On Fireproofing:
Thickness and Density Tests (ASTM E605) _____

- K. Inspection:
Technical Personnel (Man-days) _____

- L. Technical Personnel (Minimum _____ months)

1. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales, moisture ovens, slump cones, air meter, and all necessary equipment for compaction control.

END OF SECTION 014529



- * - OWNER TO MOVE AND INSTALL EXISTING 'GRAVESITE LOCATOR' FROM PIC TO TEMPORARY TRAILER. ONCE CONSTRUCTION COMPLETE, OWNER TO RELOCATE IT BACK TO ORIGINAL LOCATION. OWNER WILL COORDINATE PHASING WITH CONTRACTOR.

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TEMPORARY P.I.C.			NTS	015000

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities.
- B. Related Requirements:
 - 1. Section 010002 "General Requirements" for work restrictions and limitations on utility interruptions.
 - 2. Section 024110 "Demolition and Site Clearing."

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's Representative testing agencies, and authorities having jurisdiction.
- B. Water Service: Owner will pay water-service for water used by all entities for construction operations.
- C. Temporary Electric Power Service: Owner to will pay electric-power-service use charges for electricity used by all entities for construction operations.
- D. Temporary Telephone Service: Contractor to will pay telephone service use charges for telecommunications used by all entities for construction operations.
- E. Water Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Owner's Temporary Control House Trailer Unit: Provide wheel mounted in good condition displaying "California Commercial Coach" insignia, 10 feet by 36 feet size to accommodate needs of Owner. Furnish and equip offices as follows:
 - 1. Provide electrical power service and 120-V ac 20A duplex receptacles, with no fewer than two duplex receptacle on each wall of the Admin Area, two general duplex receptacle outlets and four counter-top duplex receptacles.
 - 2. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 3. Lighting fixtures capable of maintaining average illumination of 20 fc at floor area.
 - 4. See floor plan at end of this section for sample layout.
 - 5. Provide sanitary holding tank and tank cleaning service.
- C. Contractor's temporary office trailer: Contractor may provide field office(s) as desired. Coordinate locations with Owner's Representative.
- D. Temporary Electrical and Telephone Service: Provide all work including equipment fuel, maintenance and permits.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- B. HVAC Equipment: Provide vented, self-contained with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work as indicated on contract documents.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Electric Power Service: Provide temporary electric power service and distribution system of sufficient size, capacity, and power characteristics required for facility and construction operations.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION 015000

SECTION 015719

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, and solid waste, 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. Affect other species of importance to humankind.
 - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

1.2 DEFINITIONS OF POLLUTANTS

- A. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
- B. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
- C. Sediment: Soil and other debris that has been eroded and transported by runoff water.
- D. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from project construction activities.
- E. 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 "waters of the United States" and require a permit to discharge water from the governing agency.
- F. Rubbish: Combustible and noncombustible wastes such as, but not limited to, paper, plastic, metal and plastic containers and cans, boxes, metal and lumber scrap.

- G. Sanitary Wastes: Domestic Sanitary Sewage.

1.3 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, ordinances and note any corrective action taken.

1.4 REFERENCES

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. U.S. National Archives and Records Administration (NARA):
 - 1. 33 CFR 328 Definitions, Waters of the United States.
- C. Federal Environmental Regulatory Requirements: Comply with applicable regulations. The following is for Contractor's information only:
 - 1. Storm water permits; refer to The Office of Wastewater Management, NPDES Storm Water Program: <http://www.epa.gov/npdes/stormwater>
 - 2. Air quality requirements for construction activities; refer to EPA'S Air Program Mobile Sources Page: <http://www.epa.gov/ebtpages/airmobilesources.html>
 - 3. Asbestos requirements for construction activities; refer to EPA's Asbestos Management and Regulatory Requirements Website: <http://www.epa.gov/fedsite/cd/asbestos.html>
 - 4. National Environmental Policy Act (NEPA) requirements for construction activities
 - 5. Endangered Species Act; refer to The US Fish and Wildlife Service Endangered Species Program: <http://endangered.fws.gov/>
 - 6. National Historic Preservation Act
- D. State and Local Environmental Regulatory Requirements: Comply with applicable regulations. The following is for Contractor's information only:
 - 1. State Office/Department of Environmental Quality.
 - 2. Local Office/Department of Environmental Quality.
 - 3. The Construction Industry Compliance Assistance Center: <http://www.cicacenter.org/index.cfm>
 - 4. The National Environmental Compliance Assistance Clearinghouse: <http://cfpub.epa.gov/clearinghouse/>

1.5 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, low-emitting materials, recycled content, and certified wood requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.6 SUBMITTALS

- A. In accordance with Section, 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the Contractor shall furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, meet with the COR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, prepare and submit to the COR, for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) and qualifications of person(s) within the Contractor's organization who is (are) responsible for:
 - 1) Ensuring adherence to the Environmental Protection Plan.
 - 2) Manifesting hazardous waste to be removed from the site.
 - 3) Training the Contractor's environmental protection personnel.
 - b. Description of the Contractor's environmental protection personnel training program.
 - c. 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.
 - d. 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, historical, and archeological and cultural resources.
 - e. Procedures to provide environmental protection that complies 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.
 - f. Permits, licenses, and the location of the solid waste disposal area.

- g. 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.
 - h. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - i. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of construction limits or protected areas. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Within 20 days after the date of its submittal, the COR shall approve the Contractor's Comprehensive Environmental Protection Plan, or respond with an explanation for its rejection and resubmittal.
- C. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.7 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 and after the project is complete, based upon leaving the site that has yet to mature of turf lawn. Confine construction activities to areas defined by construction limits, the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, or land forms without prior approval from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or dictated by special emergency use.
 - 1. Work Area Limits: Prior to any construction, mark/fence/protect the areas that require work to be performed under this contract. Prior to construction, mark/fence/protect monuments, works of art, and any other markers to remain. Convey to all personnel the purpose of marking and protecting all marked and protected objects.
 - 2. Protection of Specific Regulated Elements: Landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved protective techniques.
 - a. Protect trees and shrubs to remain on site to protect from damage per contract details.
 - b. All damage to existing trees and shrubs shall be immediately repaired by trimming, cleaning, and painting with antiseptic tree paint. See Section 024119.
 - 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 only as needed to use to work the area to be developed. Form earthwork to final grade as shown as quickly as possible to minimize potential erosion damage. Immediately protect side slopes and back slopes upon completion of rough grading or clearing with appropriate material as defined in the Sediment and Erosion Control Plan.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, check dams and berms to retard and divert runoff from the construction site to protected drainage areas as intended under paragraph 208 of the Clean Water Act.
 - a. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 312000, EARTH MOVING.
 5. Erosion and Sedimentation Control Devices: Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan to avoid violating water quality in accordance with federal and state regulations. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, grassing, and mulching, straw waddles, fiber rolls, until permanent erosion control facilities are completed and operative.
 6. Manage and control borrow and spoil areas on Government property to minimize erosion and to prevent soil and/or sediment from entering nearby water courses.
 7. Protect adjacent areas from despoilment by temporary excavations and embankments.
 8. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in covered 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.
 9. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 10. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
11. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in sediment basins prior to entering retention/detention ponds, allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 12. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or

damage to fish and wildlife. Prior to beginning construction operations, list protected species that require specific attention along with measures for their protection.

- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California, San Diego Air Pollution Control District 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 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, 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, or other methods are permitted to control particulates in the work area as approved in the Environmental Protection Plan.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Noise Control: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 7:00 a.m. and 5:00 p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following Decibel A-scale (dBA) limitations:

Time Duration of Impact Noise	Sound Level in dBA
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 as measured with an A-scale decibel measuring device at 50 feet (dBA):

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

- b. Provide soundproof housings or enclosures for noise-producing machinery.
 - c. Use efficient silencers on equipment air intakes.
 - d. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - e. Line hoppers and storage bins with sound deadening material.
 - f. 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 75 dB(A) noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighted sound level of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 3 to 6 feet in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean

condition as approved by the COR. The site shall be left meeting the requirements of the local and state environmental requirements associated with the Construction General Permit. Cleaning shall include off-cemetery 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, clearing, logging and general construction in accordance with state and local regulations and the contract.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 015719

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Section 010002, GENERAL REQUIREMENTS.
- B. Section 024100, DEMOLITION.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.
 - 3. Poor planning and/or layout.
 - 4. Construction error.
 - 5. Over ordering.
 - 6. Weather damage.
 - 7. Contamination.
 - 8. Mishandling.
 - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the Contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

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

Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

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

1.5 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
 - 1. Procedures to be used for debris management.
 - 2. Techniques to be used to minimize waste generation.
 - 3. Analysis of the estimated job site waste to be generated:
 - a. List of each material and quantity to be salvaged, reused, recycled.
 - b. List of each material and quantity proposed to be taken to a landfill.
 - 4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.

- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the Work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

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

1.7 RECORDS

- A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.
 - 1. Project is not seeking LEED certification. Documentation shall be submitted to the COR for Government's use.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

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

3.2 DISPOSAL

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

3.3 REPORT

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

END OF SECTION 017419

SECTION 018111

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section describes general requirements and procedures to comply with various federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable design, including the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings required by Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005); and the Energy Independence and Security Act of 2007 (EISA 2007).

1.2 OBJECTIVES

A. General:

1. Maximize resource efficiency and reduce the environmental impacts of construction and operation.
2. 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.
3. Include environmental considerations as part of the normal purchasing process.
4. Emphasize pollution prevention early in the purchasing process.
5. Examine multiple environmental attributes throughout a product's or service's life cycle.
6. Compare relevant environmental impacts when selecting products and services.
7. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
8. Control sources of potential Indoor Air Quality (IAQ) pollutants and decrease toxicity levels, by controlled selection of materials and processes used in project construction, in order to attain superior IAQ. Manage construction site and storage of materials to ensure no negative impact on the indoor environmental quality of the building.
9. Use building practices that ensure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.
10. Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize offsite environmental impact.
11. Reduce construction waste through reuse, recycling, and supplier take-back.
12. Optimize operational performance (through commissioning efforts) in order to ensure equipment operates as intended.
13. Consider the durability, maintainability, and flexibility of building systems.

- B. Conform to the Federal Guiding Principles for Federal Leadership in High Performance and Sustainable Building as per the Memorandum of Understanding, as follows:
1. Employing integrated design: As specified and as follows:
 - a. ASTM E2348, Standard Guide for Framework for a Consensus-based Environmental Decision making Process.
 - b. ASTM E2432 Standard Guide for General Principles of Sustainability Relative to Buildings.
 2. Optimizing energy performance: As specified and as follows:
 - a. Energy Efficiency: EO 13423, EO 13514 and Energy Policy Act of 2005; 10 CFR 435 - Energy Performance Standards for New Buildings; and, FAR Part 23, 48 CFR 23 - building equipment and lighting.
 - b. ENERGY STAR.
 - c. Federal Energy Management Program (FEMP).
 3. Protecting and conserving water: As specified and as follows:
 - a. Water stewardship: EPA WaterSense, and FEMP Best Management Practices for Water Conservation.
 4. Enhancing indoor environmental quality: As specified and as follows:
 - a. Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction.
 5. Reducing the environmental impact of materials: As specified and as follows:
 - a. Recycled Content Products: EPA Comprehensive Procurement guidelines.
 - b. Biobased Content Products: USDA Biopreferred.
 - c. Electronics stewardship: Federal Electronics Challenge; Electronic Product Environmental Assessment Tool (EPEAT).
 - d. Environmental Management System protocols: ISO 14001 or equivalent.
- C. The Design Professional has selected materials and utilized design processes that achieve the above objectives to the extent currently possible and practical. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work and in proposing product substitutions and/or changes to specified processes. By submitting a change or substitution of materials or processes, the Contractor must demonstrate its diligence in performing the level of investigation and comparison encouraged under the Federal mandates and VA policies.

1.3 RELATED DOCUMENTS

- A. Section 017419, CONSTRUCTION WASTE MANAGEMENT.

1.4 DEFINITIONS

- A. Agrifiber Products: Composite panel products derived from agricultural fiber.
- B. Biobased Product: As defined in the Farm Security and Rural Investment Act, 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. Certification(s) for Sustainable Forestry: 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 an approved sustainable forest 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 (C&D) 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 017419.
- G. 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.
- H. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock.
- I. 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.
- J. 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.
- K. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured.
- L. Sealant: Any material that fills and seals gaps between other materials.
- M. 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.

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

1.5 SUBMITTALS

A. Sustainability Action Plan:

- 1. Within 30 days of after Preconstruction Meeting, the General Contractor must provide a narrative plan for complying with the objectives, product requirements and construction operations' environmental controls stipulated within this section.
- 2. The plan must make reference to the following sustainable design submittals defined by this section and either attached to report or provided within time periods allowed:
 - a. Project Materials Cost Data spreadsheet.
 - b. Construction Waste Management Plan.
 - c. Construction IAQ Management Plan.

B. Sustainable Design Submittals:

- 1. 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; provide cut sheets for all pervious paving materials.
- 2. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates.
 - a. Include cut sheets for any automatic faucet-control devices.
 - b. Provide copy of certification for any WaterSense-labeled products.
- 3. 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.
- 4. Elimination of CFCs/HCFCs and Reduction of HFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all

- polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
5. Appliances and Equipment: Provide copies of manufacturer's product data for all ENERGY STAR qualified equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's ENERGY STAR program.
 6. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
 7. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation: Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product.
 - a. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. Submit this spreadsheet every third month with the Contractor's Certificate and Application for Payment. 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.
 8. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
 - a. Provide additional manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
 9. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
 10. 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.
 11. 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.
 12. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
 - a. If air handlers must be used during construction, use filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 at each return air grill, as determined by ASHRAE 52.2-2007.

- b. Replace all filtration media immediately prior to occupancy. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-2007 for media installed at the end of construction.
 - 13. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.
 - 14. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.
 - 15. Refer to technical specifications for additional submittal requirements related to sustainability goals.
- C. Construction Waste Management: See Section 017419, CONSTRUCTION WASTE MANAGEMENT for submittal requirements.
- D. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
 - 1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and Owner's approval, an electronic copy of the draft Construction IAQ Management Plan (CIAQMP) in an electronic file including, but not limited to, descriptions of the following:
 - 2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2008, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
 - a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
 - b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
 - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
 - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
 - 3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
 - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.

- b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
 - 4. Not more than 14 days after Substantial Completion provide the following:
 - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
 - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance with IAQ testing procedures and requirements.
- E. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
 - 1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 017419, CONSTRUCTION WASTE MANAGEMENT.
 - 2. Construction IAQ Management: Refer to Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

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

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with

applicable provisions and recommendations of the following, except as otherwise shown or specified.

- B. American Society for Testing and Materials (ASTM):
 - 1. E2348-06(2010) Framework for a Consensus-based Environmental Decision-making Process
 - 2. E2432 General Principles of Sustainability Relative to Buildings
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - 1. Standard 52.2 - 2007 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
- D. Business Institutional Furniture Manufacturers Association (BIFMA):
 - 1. ANSI/Standard X7.1-2011 Standard for Formaldehyde and TVOC Emissions
 - 2. ANSI/BIFMA method M7.1-2011 Standard Test Method for Determining VOC Emissions
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - 1. ANSI/SMACNA 008-2008 The SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition
- F. South Coast Air Quality Management District (SCAQMD):
 - 1. SCAQMD Rule 403 (1976; R2005) Fugitive Dust

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Site Clearing: Topsoil to 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 such material legally in accordance with Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- C. Herbicides and Pest Control: Herbicides are not permitted; pest control measures must utilize EPA-registered biopesticides only.

- D. Water-Conserving Fixtures: Plumbing fixtures must meet or exceed requirements of the EPA WaterSense program categories.
- E. Reduction of Ozone-Depleting Compounds and Generation of Greenhouse Gases:
 - 1. Ozone Protection and Greenhouse Gas Reduction: Provide base building cooling equipment containing only the following refrigerants: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
 - 2. Fire suppression systems cannot contain ozone-depleting substances such as halon 1301 and 1211.
 - 3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation cannot be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- 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 refrigerators, motors, laundry equipment, office equipment and more. Refer to each program's website for a complete list.
- G. HVAC Distribution Efficiency:
 - 1. Construct duct systems of aluminum, stainless steel or galvanized sheet metal, as deemed appropriate based on the application requirements. Fiberglass duct board is not permitted.
 - 2. Provide medium- and high-pressure ductwork systems that have been pressure-tested in accordance with the current SMACNA standards.
 - 3. Provide externally-insulated ductwork; interior duct liner is not permitted.
 - 4. Provide air terminal connections hard-connected with sheet metal ductwork, where possible. If flexible ductwork is used, flexible duct extension cannot exceed 1830 mm (6 feet) in length.
 - 5. Isolate HVAC equipment from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
 - 6. Include the appropriate style of volume damper with supply and return air branch ducts. Balance air terminal devices such as grilles, registers, and diffusers at duct branch dampers - not at terminal face.
- H. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions in 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.
- I. 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 percent of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. Make all attempts to maximize the procurement of materials with recycled content.

- a. Determine the post-consumer recycled content value of a material 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 is 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.
2. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserve/tools/cpg/products/>.
 - a. Complying with the mandate requirements may exceed the minimum limits set by this section; otherwise, additional product and material selections with recycled content must be provided, as determined by Contractor's Sustainability Action Plan.
 - b. The EPA website includes lists prepared for the Federal Comprehensive Procurement Guidelines; the website also provides tools such as a Product Supplier Directory search engine and product resource guides.
 - c. EPA Categories include, but not limited to:
 - 1) Building insulation.
 - 2) Carpet (polyester).
 - 3) Carpet cushion.
 - 4) Cement and concrete.
 - 5) Consolidated and reprocessed latex paint.
 - 6) Floor tiles.
 - 7) Flowable fill.
 - 8) Nonpressure pipe.
 - 9) Shower and restroom dividers/partitions.

J. Biobased Content:

1. Subject to conformance with drawings and specifications, provide products designated by the USDA's BioPreferred program; provide other products and material made from biobased materials to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the National Cemetery Administration. Supplies and materials must be of a type and quality that conform to applicable specifications and standards.
2. Biobased products that are designated for preferred procurement under USDA's BioPreferred program must meet the required minimum biobased content. Refer to <Http://www.biopreferred.gov/ProductCategories.aspx> for the product categories and <http://www.biopreferred.gov/bioPreferredCatalog/faces/jsp/catalogLanding.jsp> for

- the BioPreferred Catalog. Submit data for the biobased products to include biobased content and source of biobased material; indicating the name of the manufacturer, cost of each material, and the intended use of each of the materials that are to be used in carrying out the requirements of the contract.
3. Provide biobased products to the greatest extent possible.
- K. Construction Operations' Environmental Aspects, Impacts and Controls: Monitor environmental aspects and impacts of Contractor's operations (including identification and pursuit of controls on and mitigation of adverse impacts) and as follows:
4. Climate Change and Air Pollution Control: Environmental aspects of and controls on Contractor operations related to climate change include Greenhouse Gas (GHG) emissions associated with construction equipment. Environmental aspects of and controls on Contractor operations related to criteria air pollutants include particulate matter (PM) and nitrogen oxides (NOx) emissions associated with construction equipment.
 - a. Documentation: Maintain the following records for review on request basis.
 - 1) For diesel powered equipment, indicate number and type of construction equipment that utilizes emission control technologies complying with 2008 pollution requirements for new diesel engines.
 - 2) GHG emissions: Document estimated GHG emissions of equipment used on the project. Calculate GHG emissions from mobile combustion in accordance with the EPA Climate Leaders protocols <http://www.epa.gov/climateleaders/resources/> Indicate quantity of fuel by type used and provide estimate for comparison to industry standard.
 - 3) Air Pollution Control: Document the current emissions of the equipment. Calculate the emissions reduced with the selected option applied to the equipment in accordance with the Diesel Emissions Quantifier (www.epa.gov/cleandiesel) protocols. Indicate the change in emissions.
 5. Water Stewardship: Environmental aspects of and controls on Contractor operations related to water stewardship include quantity and quality of discharges to surface water and ground water. Refer to soil and erosion control requirements within the drawings and specifications.
 6. Noise Control: Perform operations to minimize noise; perform noise-producing work with heavy equipment during less sensitive hours of the day or week.
 - a. The noise source cannot exceed 60 dBA from 7:00 a.m. to 6:00 p.m.
 - b. Operations in other times must be performed under the constraints established at the need of each occurrence.
 7. Air Resources:
 - a. Prevent creation of dust, air pollution, and odors.
 - b. Sequence construction to avoid disturbance to site to the greatest extent possible.

- c. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
- d. Store volatile liquids, including fuels and solvents, in closed containers.
- e. Properly maintain equipment to reduce gaseous pollutant emissions.
- f. Dust Suppressants:
 - 1) Products formulated to reduce or eliminate the spread of dust associated with gravel roads, dirt parking lots, or similar sources of dust, including products used in equivalent indoor applications.
 - 2) If employing these materials, products must include minimum 85 percent biobased content.
- g. Provide construction dust control to comply with SCAQMD Rule 403.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 018111

SECTION 022100

SITE SURVEYS

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 DEFINITIONS

- A. Professional Land Surveyor ("Surveyor"): One who possesses a valid state license as a "Professional Land Surveyor" from the state in which the Project occurs.
- B. Professional Civil Engineer: One who possesses a valid state license as a "Professional Civil Engineer" from the state in which the Project occurs. For this section, the term "Surveyor" shall also include Professional Civil Engineers licensed in the state in which the Project occurs.

PART 2 - EXECUTION

2.1 REQUIREMENTS

- A. The Surveyor shall research available public records for all mapping, monumentation, plats, governmental surveys, etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, forced sewer mains, storm drains, water lines, electrical conduits, gas mains, telephone, etc.
 - 1. Contact NAVFAC Base Utilities Duty Desk for Navy-owned utilities: (619) 556-7349.
- B. The survey shall be performed on the ground in accordance with the current "Accuracy Standards for Land Title Surveys" as adopted, from time to time, by the American Congress on Surveying and Mapping, the National Society of Professional Surveyors, and the American Land Title Association.
- C. The Surveyor, when applicable, shall consult with the COR to determine scale of plat or map and size of drawings.
- D. The Surveyor shall furnish two sets of prints of the plat or map of survey and an electronic CADD file. If the plat or map of survey consists of more than one sheet, the

sheets shall be numbered, the total number of sheets indicated and the match lines be shown on each sheet.

1. Sheet naming, layering, styles, etc. shall conform to the National CAD Standard.
- E. On the plat or map, the survey boundary shall be drawn to a convenient scale, or the scale designated by the COR, with the scale clearly indicated. A graphic scale, shown in feet or both feet and meters, shall be included. A north arrow shall be shown and, when practicable, the plat or map of survey shall be oriented so that north is at the top of the drawing. Symbols or abbreviations used shall be identified on the face of the plat or map by use of a legend or other means. Supplementary or exaggerated diagrams shall be presented accurately on the plat or map where dimensional data is too small to be shown clearly at full scale. The plat or map shall be 30 inches by 42 inches.
- F. The survey shall contain the following applicable information:
1. The name, address, telephone number, and signature of the Professional Land Surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.
 2. The survey drawing(s) submitted shall bear the following certification adjacent to the Surveyor's and/or Engineer's official seal:
 - a. "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to furnish complete and accurate information."
 3. Vicinity map showing the property surveyed in reference to nearby highways or major street intersections.
 4. Flood zone designation (with proper annotation based on Federal Flood Insurance Rate Maps or the state or local equivalent, by scaled map location and graphic plotting only).
 5. Land area as defined by the boundaries of the legal description of the surveyed premises.
 6. All data necessary to indicate the mathematical dimensions and relationships of the boundary represented by bearings and distances, and the length and radius of each curve, together with elements necessary to mathematically define each curve. The point of beginning of the Surveyor's description and the basis of bearings shall also be shown.
 7. When record bearings or angles or distances differ from measured bearings, angles or distances, both record and measured bearings, angles, and distances shall be clearly indicated. If the record description fails to form a mathematically closed figure, the Surveyor shall so indicate.
 8. Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets in urban or suburban areas, together with recovered lot corners and evidence of lot corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of streets and highways abutting the property surveyed and widths of rights of way shall be given. Observable evidence of access (or lack thereof) to such abutting streets or highways shall be indicated. Observable evidence of private roads

- shall be so indicated. Streets abutting the premises, which have been described in Record Documents, but not physically opened, shall be shown and so noted.
9. The identifying titles of all recorded plats, filed maps, right of way maps, or similar documents which the survey represents, wholly or in part, with their appropriate recording data. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document which has been delivered to the Surveyor. Contiguity, gores, and overlaps along the exterior boundaries of the survey premises, where ascertainable from field evidence or Record Documents, or interior to those exterior boundaries, shall be clearly indicated or noted. Where only a part of a recorded lot or parcel is included in the survey, the balance of the lot or parcel shall be indicated.
 10. All evidence of found monuments shall be shown and noted. All evidence of monuments found beyond the surveyed premises on which establishment of the corners of the survey premises are dependent, and their application related to the survey shall be indicated.
 11. The character of any and all evidence of possession shall be stated and the location of such evidence carefully given in relation to both the measured boundary lines and those established by the record. An absence of notation on the survey shall be presumptive of no observable evidence of possession. The term "possession" does not imply "ownership".
 12. The location of all buildings upon the plot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. If there are no buildings, so state. Proper street numbers shall be shown where available.
 13. All easements evidenced by a Record Document which have been delivered to the Surveyor shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this affect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads, rights-of-ways, water courses, drains, telephone, telegraph, or electric lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.
 14. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of all encroaching structural appurtenances and projections, such as fire escapes, bay windows, windows and doors that open out, flue pipes, stoops, eaves, cornices, areaways, trip, etc., by or on adjoining property or on abutting streets, on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.
 15. Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the Surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the Surveyor must so indicate on the plat or map with appropriate measurements.
 16. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the

- points of curvature and tangency by station. Include all curve data as well a location of radius and vertex points. Elevations on 50 foot centers on centerline of roads, edges of roads and top and bottom of curbs.
17. As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.
 18. Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown. When a property surveyed contains a natural water boundary, the Surveyor shall measure the location of the boundary according to appropriate surveying methods and note on the plat or map the date of the measurement and the caveat that the boundary is subject to change due to natural causes and that it may or may not represent the actual location of the limit of title. When the Surveyor is aware of changes in such boundaries, the extent of those changes shall be identified.
 19. Contours at a minimum interval of 1 foot. Base vertical control on the permanent (not assumed) National Geodetic Survey (NGS). Note location, description and datum. Indicate permanent National Geodetic Survey (NGS) Bench Mark within the property used for this survey. Provide notes indicating points used as the basis for the coordinate system indicated on the CADD survey drawings. Unless specifically noted otherwise, provide CADD drawing of the survey, in DWG format in a version no older than two versions earlier than the most recent version of the software.
 20. Identify and show if possible, setback, height, and floor space area restrictions of record or disclosed by applicable zoning or building codes (in addition to those recorded in subdivision maps). If none, so state.
 21. Show exterior dimensions and square footage of exterior footprint of all buildings at ground level and gross floor area of all buildings.
 22. Measured height of all buildings above grade at a defined location. If no defined location is provided, the point of measurement shall be shown.
 23. Elevations at each entrance to buildings, service docks, building corners, steps, ramps and grade slabs.
 24. Substantial, visible improvements (in addition to buildings) such as signs, parking areas, plazas, planter beds, benches, walls, etc.
 25. Parking areas and, if striped, the striping and the type (eg. accessible, motorcycle, regular, etc.) and number of parking spaces.
 26. Indication of access to a public way such as curb cuts and driveways.
 27. Location of utilities existing on or serving the surveyed property as determined by observed evidence together with plans and markings provided by utility companies, and other appropriate sources with references as to the source of information. Locate and show all fire hydrants located within 500 feet of the subject property.
 28. Railroad tracks and sidings.
 29. Manholes, catch basins, valve vaults or other surface indications of subterranean uses.
 30. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.
 31. Utility company installations on the surveyed premises.
 32. Names of adjoining owners of platted lands.

33. Observable evidence of earth moving work, building construction or building additions within recent months.
34. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction. Observable evidence of recent street or sidewalk construction or repairs.
35. Observable evidence of site use as a solid waste dump, sump or sanitary landfill.
36. All trees with a minimum diameter of 6 inches measured at 48 inches above the base of the tree. Perimeter outline only of thickly wooded areas with description of predominant vegetation.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 022100

SECTION 024110

DEMOLITION AND SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies all site preparation Work, demolition and removal of portions of buildings, utilities, other structures, and debris as indicated on the Construction Documents.

1.2 RELATED WORK

- A. Safety Requirements: Section 010002, GENERAL REQUIREMENTS Article 1.5, FIRE SAFETY.
- B. Disconnecting utility services prior to demolition: Section 010002, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 010002, GENERAL REQUIREMENTS.
- D. Environmental Protection: Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS.
- E. Waste Management: Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- F. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 312000, EARTH MOVING.

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 010000, 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.
 - 1. Excavations shall not remain open at the conclusion of the work day. Trench plate may be used over open trench if requested in writing and if approved in writing by the COR; if approved, appropriate guards shall be in place to protect the public (i.e. fencing, signage, etc). In this case, trench plate will only be permitted on a single-day basis.
- D. Provide enclosed dust chutes with control gates to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to ice, flooding, or pollution. Vacuum and dust the Work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of Work, include following:
 - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
 - 2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 15 feet of fire hydrants.
- G. Before beginning any demolition Work, survey the site and examine the Drawings and Specifications to determine the extent of the Work. Take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Cemetery. Any damaged items shall be repaired or replaced as approved by the Contracting Officer's Representative (COR). Coordinate the Work of this Section with all other Work and construct and maintain bypasses, shoring, bracing, and supports as required. Ensure that structural elements are not overloaded and increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition Work performed under this Contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal Work. Repairs, reinforcement, or structural replacement must have COR's approval.
- H. The Work shall comply with the requirements of Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS.

1.4 UTILITY SERVICES

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

1. Prior to any excavation activities, contact NAVFAC base utilities mark-out and US Dig Alert to confirm location of existing utilities.
 2. In case of any utility-related emergency, contact Navy Utilities Duty Desk: (619) 556-7349.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.
- C. Do not shut down irrigation system. Temporary shut-downs of specific sections must be requested in writing and must be coordinated with and approved, in writing, by the COR.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, pavements, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- B. Erosion Control: Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Install silt fence and inlet protection as shown and as per requirements of the State Water Resources Control Board (SWRCB), prior to any soil disturbance activities.
- C. Maintain site controls in accordance with the state of California Construction General Permit (CGP) and repair as directed by COR to sustain compliance with the State of California National Pollutant Elimination Discharge System (NPDES) permit.
- D. Topsoil - On-site: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free and/or screened of subsoil, clay lumps, stones, and other objects over 1 inch in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

- a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
 2. Stockpile topsoil in storage piles in areas directed. Construct storage piles to provide free drainage of surface water. Cover storage piles to prevent wind erosion in accordance with the CGP. Refer to Section 329000, PLANTING for soil amendments required prior to spreading topsoil.
 - a. Stockpile shall be contained with erosion and sediment controls (silt fence or perimeter fiber roll) and stabilized in accordance with the CGP.
 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material only after approval of the COR.
 - E. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground, or to 90% if adjacent ground is undetermined.
 - F. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
 - G. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical Drawings and is included under Work of related Division 23 and 26 Sections. Removing abandoned underground piping or conduits interfering with construction is included under this Section, except as indicated to be abandoned in-place.
 - H. Continue maintenance of erosion controls in compliance with the CGP until the Work is completed and the threat of erosion is gone by either ground surface stabilizer or when lawn "grow-in" is at 85% complete. Temporary erosion control devices shall not be removed until the area is certified as being stabilized by the COR.
- 3.2 DEMOLITION
- A. Completely demolish and remove portions of buildings and structures, including all appurtenances related or connected thereto, as noted below:
 1. As required for installation of new utility service lines.
 2. As indicated.

- 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 Cemetery Property, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
 - 1. Permits required for hauling and/or disposal are the responsibility of the Contractor.
- C. The removal of hazardous material shall be referred to Appendix "A" of this Specification – Hazardous Materials Survey.
- D. Burning is not permitted on the property.
- E. Remove existing utilities as indicated or uncovered by Work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When utility lines are encountered that are not indicated on the Drawings, the COR shall be notified prior to further Work in that area.

3.3 CLEAN-UP

- A. On completion of Work of this Section and after removal of all debris, leave site in clean condition satisfactory to COR. Clean-up shall include off the Cemetery Property 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.

END OF SECTION 024110

SECTION 033053
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 014529, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 320523, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TOLERANCES

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

1.4 REGULATORY REQUIREMENTS

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings:
 - 1. Submit Steel Reinforcement Shop Drawings and Product Data to include all information necessary for fabrication and placement of reinforcement.
 - 2. Indicate grades of reinforcing steel.

3. Clearly indicate the splice length for every size and type of bar used.
 4. Indicate the type, size and location of all accessories required for the proper assembly, placement and support of the reinforcement.
 5. Provide layout drawings of all floor slabs and formed concrete indicating control and expansion joints.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Concrete Institute (ACI):
- | | | |
|----|-----------------|---|
| 1. | 117-10 | Tolerances for Concrete Construction and Materials and Commentary |
| 2. | 211.1-91(R2009) | Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| 3. | 211.2-98(R2004) | Selecting Proportions for Structural Lightweight Concrete |
| 4. | 301-10 | Structural Concrete |
| 5. | 305R-10 | Guide to Hot Weather Concreting |
| 6. | 306R-10 | Guide to Cold Weather Concreting |
| 7. | SP-66-04 | ACI Detailing Manual |
| 8. | 318/318M-11 | Building Code Requirements for Structural Concrete and Commentary |
| 9. | 347R-04 | Guide to Formwork for Concrete |
- C. American Society for Testing and Materials (ASTM):
- | | | |
|-----|----------------|--|
| 1. | A185/A185M-07 | Steel Welded Wire Reinforcement, Plain, for Concrete |
| 2. | A615/A615M-12 | Deformed and Plain Carbon Steel Bars for Concrete Reinforcement |
| 3. | A996/A996M-09b | Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement |
| 4. | C31/C31M-12 | Making and Curing Concrete Test Specimens in the Field |
| 5. | C33/C33M-13 | Concrete Aggregates |
| 6. | C39/C39M-12a | Compressive Strength of Cylindrical Concrete Specimens |
| 7. | C94/C94M-13 | Ready Mixed Concrete |
| 8. | C143/C143M-12 | Slump of Hydraulic Cement Concrete |
| 9. | C150/C150M-12 | Portland Cement |
| 10. | C171-07 | Sheet Materials for Curing Concrete |

- | | | |
|-----|-----------------|--|
| 11. | C172/C172M-10 | Sampling Freshly Mixed Concrete |
| 12. | C173/C173M-12 | Air Content of Freshly Mixed Concrete by the Volumetric Method |
| 13. | C192/C192M-12a | Making and Curing Concrete Test Specimens in the Laboratory |
| 14. | C231/C231M-10 | Air Content of Freshly Mixed Concrete by the Pressure Method |
| 15. | C260/C260M-10a | Air-Entraining Admixtures for Concrete |
| 16. | C330/C330M-09 | Lightweight Aggregates for Structural Concrete |
| 17. | C494/C494M-13 | Chemical Admixtures for Concrete |
| 18. | C618-12a | Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete |
| 19. | D1751-04(R2008) | Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| 20. | E1155-96(2008) | Determining FF Floor Flatness and FL Floor Levelness Numbers |

PART 2 - PRODUCTS

2.1 FORMS

- A. Wood, plywood, metal, or other materials, approved by RE/COR, of grade or type suitable to obtain type of finish specified.
- B. Form releasing agents to be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents must not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. If special form liners are to be used, follow the recommendation of the form coating manufacturer. Submit manufacturer's recommendation on method and rate of application of form releasing agents.

2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 12 inches thick. Provide Size 7 coarse aggregate for applied topping and metal pan stair fill.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1

- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Vapor Barrier: ASTM E1745, 0.38 mm (15 mil).
- J. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- K. Welded Wire Fabric: ASTM A185.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.
- O. Grout, Non-Shrinking: Premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout cannot show settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement. Grout must produce a compressive strength of minimum 2500 psi at 3 days and minimum 5000 psi at 28 days.

2.3 CONCRETE MIXES

- A. Design of concrete mixes using materials specified as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days: Minimum 4000 psi.
- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Maximum slump for vibrated concrete is 4 inches tested in accordance with ASTM C143.
- E. Cement and water factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. psi	Min. Cement Lbs./c. yd.	Max. Water Cement Ratio	Min. Cement Lbs./c. yd.	Max. Water Cement Ratio
4000 ^{1,3}	550	0.45	570	0.45

1. If trial mixes are used, the proposed mix design must achieve a compressive strength 1200 psi in excess of f'_c . For concrete strengths above 5000 psi, the proposed mix design must achieve a compressive strength 1400 psi in excess of f'_c .
 2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
- * Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- F. Air-entrainment is required for all exterior concrete and as required for Section 320523, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. Air content must conform with ACI 318 Table 4.4.1.

2.4 BATCHING AND MIXING

- A. Store, batch, and mix materials as specified in ASTM C94.
1. Job-Mixed: Mix in a batch mixer in manner specified for stationary mixers in ASTM C94.
 2. Ready-Mixed: 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 must furnish, in duplicate, certification as required by ASTM C94.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Installation conforms to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection while remaining within allowable construction tolerances, all dead and live loads to which they may be subjected.
- 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. Inserts, sleeves, and similar items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications are required to be in their final position at time concrete is placed - properly located, accurately positioned, built into construction, and maintained securely in place.

D. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials.
2. Properly brace the forms so the set concrete is correct within the allowable construction tolerances when the forms are removed.
3. Remedial work necessary for correcting installations that is in excess of allowable tolerances are the responsibility of the Contractor.
4. Erected work that exceeds specified tolerance limits must be remedied or removed and replaced, at no additional cost to the Government.
5. Any remediation work is subject to approval of the COR in advance of the work.
6. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 REINFORCEMENT

- A. Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 VAPOR BARRIER

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
- B. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
- C. Lap joints 6 inches and seal with a compatible pressure-sensitive tape.
- D. Patch punctures and tears.

3.4 PLACING CONCRETE

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of COR before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Roughen and clean set concrete free from laitance, foreign matter, and loose particles, before placing new concrete on or against concrete which has set.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow

concrete to drop freely more than 5 feet in unexposed work nor more than 3 feet in exposed work. Place and consolidate concrete in horizontal layers not exceeding 12 inches in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Provide vibration continuously with placing of concrete.

- D. 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.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 12 inches and to permit concrete to gain strength properly, except that use of calcium chloride cannot be used without written approval from COR.

3.5 PROTECTION AND CURING

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

3.6 FORM REMOVAL

- A. Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

3.7 SURFACE PREPARATION

- A. Immediately remove loose materials, after forms have been removed and work has been examined and approved by COR, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

3.8 FINISHES

- A. Slab Finishes:
 - 1. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application must be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to roughen surface and ensure a permanent bond between base slab and applied cementitious materials.
 - 2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
 - 3. Float Finish: Screen and float ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials,

except as specified, to a smooth dense finish. Check for alignment using a straightedge or template after first floating and while surface is still soft. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.

4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and all monolithic concrete floor slabs exposed in finished work and for which no other finish is shown or specified must be steel troweled. Delay final steel troweling to secure a smooth, dense surface as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface must be free of trowel marks, uniform in texture and appearance.
5. Finished slab flatness (FF) and levelness (FL) values must comply with the following minimum requirements:

Slab On Grade
Specified overall value F_F 25/ F_L 20
Minimum local value F_F 17/ F_L 15

3.9 SURFACE TREATMENTS

- A. Mix and apply surface treatments in accordance with manufacturer's printed instructions.
- B. Liquid Densifier/Sealer: Use on all exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of all concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub the treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.10 APPLIED TOPPING

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

3.11 RESURFACING FLOORS

- A. Remove existing flooring, in areas to receive resurfacing, to expose existing structural slab and to extend not less than 1 inch below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, wetting, and grouting. Apply topping as specified.

END OF SECTION 033053

SECTION 040513
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies mortar materials and mixes.

1.2 RELATED WORK

- A. Mortar used in Section:
 - 1. Section 040516, MASONRY GROUTING.
 - 2. Section 042000, UNIT MASONRY.
 - 3. Section 047200, CAST STONE MASONRY.
- B. Mortar Color: Section 090600, SCHEDULE FOR FINISHES.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

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

1.4 TESTS

- A. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
- B. Mortar:
 - 1. Test for compressive strength and water retention; ASTM C270.
 - 2. Mortar compressive strengths 28 days as follows:
 - a. Type M: Minimum 2500 psi at 28 days.
 - b. Type S: Minimum 1800 psi at 28 days.
- C. Cement:
 - 1. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - 2. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.

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

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 1. Testing laboratory's facilities and qualifications of its technical personnel.
 - 2. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Mortar cement.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Color admixture.
- C. Laboratory Test Reports:
 - 1. Mortar, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - 1. C40-11 Organic Impurities in Fine Aggregates for Concrete

- | | | |
|-----|---------------|--|
| 2. | C91-12 | Masonry Cement |
| 3. | C109-11 | Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens) |
| 4. | C144-04 | Aggregate for Masonry Mortar |
| 5. | C150-12 | Portland Cement |
| 6. | C207-06(2011) | Hydrated Lime for Masonry Purposes |
| 7. | C270-12 | Mortar for Unit Masonry |
| 8. | C595-13 | Blended Hydraulic Cement |
| 9. | C780-10 | Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry |
| 10. | C979-10 | Pigments for Integrally Colored Concrete |
| 11. | C1329-12 | Mortar Cement |

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

- A. ASTM C144 and as follows:
 - 1. Light colored sand for mortar for laying face brick.
 - 2. White plastering sand meeting sieve analysis for mortar joints for pointing.
- B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 PORTLAND CEMENT

- A. ASTM C150, Type I.

2.4 LIQUID ACRYLIC RESIN

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

2.5 WATER

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

2.6 MASONRY MORTAR

- A. Conform to ASTM C270.
- B. Admixtures:
 - 1. Do not use mortar admixtures, except color admixtures if approved by Resident Engineer.
 - 2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
 - 3. Do not use antifreeze compounds.
- C. Colored Mortar:
 - 1. Maintain uniform mortar color for exposed work throughout.
 - 2. Match mortar color in approved sample.
 - 3. Color of mortar for exposed work in alteration work to match color of existing mortar unless specified otherwise in section 090600, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION

3.1 MIXING

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

3.2 MORTAR USE LOCATION

- A. Use Type M mortar waterproof parging below grade.
- B. Use Type S mortar for engineered reinforced unit masonry work.

END OF SECTION 040513

SECTION 040516
MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies grout materials and mixes.

1.2 RELATED WORK

- A. Grout used in Section:
 - 1. Section 042000, UNIT MASONRY.
- B. Grout Color: Section 090600, SCHEDULE FOR FINISHES.

1.3 TESTS

- A. Certified test reports for grout and materials specified.
- B. Identify materials by type, brand name and manufacturer or by origin.
- C. After tests have been made and materials approved, do not change without additional test and approval of COR.
- D. Testing:
 - 1. Grout:
 - a. Test for compressive strength; ASTM C1019.
 - b. Grout compressive strength of 2000 psi at 28 days.
 - 2. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.
 - 3. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 1. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Grout.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Coarse aggregate for grout.
 - g. Color admixture.
- C. Laboratory Test Reports:
 - 1. Grout, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - 1. C40-11 Organic Impurities in Fine Aggregates for Concrete
 - 2. C91-12 Masonry Cement
 - 3. C150-12 Portland Cement
 - 4. C207-06(2011) Hydrated Lime for Masonry Purposes

- | | | |
|----|----------|--|
| 5. | C404-11 | Aggregate for Masonry Grout |
| 6. | C476-10 | Grout for Masonry |
| 7. | C595-13 | Blended Hydraulic Cement |
| 8. | C979-10 | Pigments for Integrally Colored Concrete |
| 9. | C1019-11 | Sampling and Testing Grout |

PART 2 - PRODUCTS

2.1 HYDRATED LIME

- A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT:

- A. ASTM C404, Size 8.

2.3 PORTLAND CEMENT

- A. ASTM C150, Type I.
- B. Use white Portland cement wherever white mortar is specified.

2.4 LIQUID ACRYLIC RESIN

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

2.5 WATER

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

2.6 GROUT

- A. Conform to ASTM C476 except as specified.
- B. Grout type proportioned by volume as follows:
 - 1. Fine Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.

2. Coarse Grout:
 - a. Portland cement or blended hydraulic cement: one part.
 - b. Hydrated lime: 0 to 1/10 part.
 - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
 - d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

2.7 COLOR ADMIXTURE

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

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

3.2 GROUT USE LOCATIONS

- A. Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 2 inches or less.
- B. Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 2 inches.

- C. Do not use grout for filling bond beam or lintel units.

END OF SECTION 040516

SECTION 042000

UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

- A. Mortars and Grouts: Section 040513, MASONRY MORTARING, Section 040516, MASONRY GROUTING.
- B. Steel Lintels and Shelf Angles: Section 055000, METAL FABRICATIONS.
- C. Cavity Insulation: Section 072113, THERMAL INSULATION.
- E. Sealants and Sealant Installation: Section 079200, JOINT SEALANTS.
- F. Color and Texture of Masonry Units: Section 090600, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
 - 1. Concrete masonry units, when exposed in finish work.
 - 2. Anchors, and ties, one each and joint reinforcing 12 inches long.
- C. Shop Drawings:
 - 1. Indicate special masonry shapes.
 - 2. Indicate reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
 - 3. Submit shop drawings for fabrication, bending, and placement of reinforcing bars prepared in accordance with ACI 315.
- D. Certificates:

1. Submit certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
2. Indicate that the following items meet specification requirements:
 - a. Solid and load-bearing concrete masonry units.
3. Identify testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Manufacturer's Literature and Data:

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

1.4 WARRANTY

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

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
- | | | |
|----|----------------------|---|
| 1. | A615/A615M-12 | Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| 2. | A675/A675M-03 (2009) | Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties |
| 3. | A951/A951M-11 | Steel Wire for Masonry Joint Reinforcement |
| 4. | C67-12 | Sampling and Testing Brick and Structural Clay Tile |
| 5. | C90-12 | Load bearing Concrete Masonry Units |
| 6. | C216-12a | Facing Brick (Solid Masonry Units Made From Clay or Shale) |
| 7. | C476-10 | Grout for Masonry |
| 8. | C612-10 | Mineral Fiber Block and Board Thermal Insulation |
| 9. | D1056-07 | Flexible Cellular Materials - Sponge or Expanded Rubber |
- C. American Welding Society (AWS):

1. D1.4/D1.4M-11 Structural Welding Code – Reinforcing Steel

D. Brick Industry Association - Technical Notes on Brick Construction (BIA):

1. 11-2001 Brick Masonry, Part I
2. 11A-1988 Brick Masonry, Part II
3. 11B-1988 Brick Masonry, Part III Execution
4. 11C-1998 for Brick Masonry Engineered Brick Masonry, Part IV
5. 11D-1988 Brick Masonry Engineered Brick Masonry, Part IV continued
6. 11E-1991 Brick Masonry, Part V

E. Masonry Industry Council:

1. Hot and Cold Weather Masonry Construction Manual, 1999

F. Masonry Standards Joint Committee; Specifications for Masonry Structures (TMS 602-11/ACI 530.1-11/ASCE 6-11) (MSJC)

G. American Concrete Institute (ACI):

1. SP-66(2004) ACI Detailing Manual

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COR and all parties whose work is effected or related to the work of this section.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.

1. Unit Weight: Medium weight.
2. Sizes: 8" x 8" x 16".

2.2 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, Grade 60 for bars No. 3 to No. 18, except as otherwise indicated.

2.3 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1.
- C. Non-Combustible Type: ASTM C612, Type V, 1800 degrees F.

2.4 ACCESSORIES

- A. Weeps: Glass fiber ropes, 3/8 inch minimum diameter, 12 inches long.
- B. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- E. Masonry Cleaner:
 - 1. Detergent type cleaner selected for each type of masonry used.
 - 2. Acid cleaners are not acceptable.
 - 3. Use soap-less type specially prepared for cleaning brick or concrete masonry as appropriate.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

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

3.2 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
 - 1. In 10 feet - 1/4 inch.
 - 2. In 20 feet - 3/8 inch.
- C. Maximum variation from level:
 - 1. In any bay or up to 20 feet - 1/4 inch.
 - 2. In 40 feet or more - 1/2 inch.
- D. Maximum variation from linear building lines:
 - 1. In any bay or up to 20 feet - 1/2 inch.
 - 2. In 40 feet or more - 3/4 inch.
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
 - 1. Minus 1/4 inch.
 - 2. Plus 1/2 inch.
- F. Maximum variation in prepared opening dimensions:
 - 1. Accurate to minus 0 inch.
 - 2. Plus 1/4 inch.

3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Tooling Joints:
 - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 - 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- C. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- D. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

E. Wetting and Wetting Test:

1. Test and wet brick in accordance with BIA 11B.
2. Do not wet concrete masonry units before laying.

3.4 REINFORCEMENT

A. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.

3.5 BRICK EXPANSION AND CMU CONTROL JOINTS

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls:
1. Install preformed compressible joint filler in brick wythe.
 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 3. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
- E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 079200, JOINT SEALANTS.

3.6 CONCRETE MASONRY UNITS

A. Kind and Users:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.

B. Laying:

1. Lay concrete masonry units with 3/8 inch joints, with a bond overlap of not less than 1/4 of the unit length.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide 1/4 inch open joint for caulking between and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar.
10. Do not wedge the masonry against the steel reinforcing. Minimum 1/2 inch clear distance between reinforcing and masonry units.
11. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacing noted.
12. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.

3.7 GROUTING

A. Preparation:

1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.

B. Placing:

1. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
2. Interruptions: When grouting must be stopped for more than an hour, top off grout 1-1/2 inch below top of last masonry course.

3.8 PLACING REINFORCEMENT

- #### A. General:
- Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- #### B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.

- C. Splice reinforcement bars where shown; do not splice at other places unless accepted by the COR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- E. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations.
- F. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8 inch on exterior face of walls and 1/2 inch at other locations. Lap joint reinforcement not less than 6 inches at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.

3.9 CLEANING AND REPAIR

- A. General:
 - 1. Clean exposed masonry surfaces on completion.
 - 2. Protect adjoining construction materials and landscaping during cleaning operations.
 - 3. Cut out defective exposed new joints to depth of approximately 3/4 inch and repoint.
 - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- C. Concrete Masonry Units:
 - 1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
 - 2. Allow mud to dry before brushing.

END OF SECTION 042000

SECTION 047200
CAST STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies concrete units manufactured and installed to simulate natural cut stone. Cast Stone is made from fine and coarse aggregates, portland cement, mineral oxide color pigments, chemical admixtures and water to simulate a natural stone.
- B. Unless specifically indicated otherwise, cast stone provided for this project is to be wet-cast type.

1.2 RELATED WORK

- A. Cast-in-place concrete: Section 033053, CAST-IN-PLACE CONCRETE.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this Section may contribute towards Contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content, and any other requirements.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Provide cast stone sample panel, minimum size 7 1/2 by 7 1/2 by 12 inches, for each color and each finish.
 - 2. Show finish on two 7 1/2 inch edges and 12 inch surface.
- C. Shop Drawings:
 - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
 - 2. Setting drawings with setting mark.
 - 3. Lifting Devices:

- a. Submit design details for lifting devices (not straps or slings) that will support the pieces at vertical lifting points using protective pads of materials that won't damage the stone.
- D. Certificates: Test results indicating that the cast stone meets Specification requirements and proof of plant certification. Certification documents must be current within one year of preconstruction meeting.
- E. Submit manufacturer's test results of cast stone previously made by manufacturer indicating compliance with ASTM C1364.
- F. Laboratory Qualifications: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.
- H. Installer Qualifications: Provide documentation of requirements specified herein.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.
- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide packaging and lifting devices from the manufacturer that are designed to permit the installer easy removal for inspection, or to handle the cast stone for installation without causing damage to the units.
- F. Provide an itemized list of product to support the bill of lading.

1.6 WARRANTY

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

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Concrete Institute (ACI):

1. 318/318M-11 Building Code Requirements for Structural Concrete and Commentary
- C. Architectural Precast Association; certification program.
- D. American Society for Testing and Materials (ASTM):
 1. A167-99 (2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 2. A185/A185M-07 Steel, Welded Wire Reinforcement, Plain, for Concrete
 3. A240/A240M-13a Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 4. A276-13 Stainless Steel Bars and Shapes
 5. A615/A615M-12 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 6. A666 Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 7. C33/C33M-13 Concrete Aggregates
 8. C123 Standard Test Method for Lightweight Particles in Aggregate
 9. C150/C150M-12 Portland Cement
 10. C231 Standard Test Method for Air Content of Freshly Mixed Concrete
 11. C260/C260M-10a Air-Entraining Admixtures for Concrete
 12. C426-10 Linear Drying Shrinkage of Concrete Masonry Units
 13. C494/C494M-13 Chemical Admixtures for Concrete
 14. C503/C503M-10 Marble Dimension Stone
 15. C568/C568M-10 Limestone Dimension Stone
 16. C615/C615M-11 Granite Dimension Stone
 17. C616/C616M-10 Quartz-Based Dimension Stone
 18. C618-12a Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 19. C979/C979M-10 Pigments for Integrally Colored Concrete
 20. C989/C989M-13 Slag Cement for Use in Concrete and Mortars
 21. C1194-03(2011) Compressive Strength of Architectural Cast Stone
 22. C1195-03(2011) Absorption of Architectural Cast Stone
 23. C1364-10b Architectural Cast Stone
 24. D2244-11 Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- E. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.

1.8 QUALITY ASSURANCE

A. Manufacturer:

1. Must have five years minimum continuous operating experience, and have facilities for producing cast stone of the shapes, quantities and size required for this project.
2. Must be a producer certified by the Cast Stone Institute or the Architectural Precast Association.
3. Producer assumes responsibility for engineering units to comply with performance requirements and use indicated, including a comprehensive engineering analysis by a qualified Professional Engineer who is licensed in the state where the project occurs and who is experienced in providing engineering services of the kind indicated.
4. Shop drawings to bear seal and signature of Professional Engineer responsible for the design and preparation.

B. Installer:

1. Must provide documentation demonstrating that they have a minimum of five years experience setting cast or natural building stone.
2. Provide written handling and installation procedures that will be followed for the installation of the Work for cast stones lifted, moved, adjusted in any way, other than by hand. Describe procedure starting at the inspection of the products once delivered to the site, and continue through the final setting of the cast stone units with them being secured into place in the Work. Include procedures with description of the equipment that will be used, as well as all protection procedures to be followed, to ensure that no exposed surfaces or edges of the cast stone are damaged during handling or installation.
3. Provide written procedures for removal and replacement of cast stone units that have been damaged on any edges or faces that will be visible in the final installation, including drip slots.
4. Provide procedures for inspection and identification of any exposed damage, with procedures for immediate marking of the units to be removed and replaced prior to grouting or sealing of joints.

C. Testing:

1. Follow the procedures in ASTM C1364.
2. One (1) sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job:
 - a. Three (3) field cut cube specimens from each of these sample to have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
 - b. Three (3) field cut cube specimens from each of these samples to have an average maximum cold-water absorption of 6 percent.
 - c. Test field specimens in accordance with ASTM C1194 and C1195.

- d. Manufacturer to submit a written list of projects similar and at least three (3) years of age, along with owner, architect and Contractor references.
- D. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any Work, to review Drawings and Specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COR and all parties whose Work is effected or related to the Work of this Section.

1.9 MANUFACTURING TOLERANCES

- A. Cross section dimensions must not deviate by more than + 1/8 inch from approved dimension.
- B. Length of units must not deviate by more than length + 1/8 inch, not to exceed + 1/4 inch. Maximum length of any unit must not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units must not exceed length + 1/8 inch.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features:
 - 1. On formed sides of unit: 1/8 inch.
 - 2. On unformed sides of unit: 3/8 inch maximum deviation.

1.10 MOCK-UP

- A. Provide full size unit(s) for use in construction; the mockup(s) becomes the standard of workmanship for the project.
- B. Coordinate the size and location for the mockup with the COR; mockup may become part of the final project; to be discussed, coordinated and approved in advance by the COR and subject to approval of the mockup after installation.
- C. Demonstrate the construction tolerances for the construction of the foundations, as well as the quality of the exposed edges and the finish of the final exposed surfaces.
- D. Demonstrate the options for color selection for stain, paint, sealant, grout, etc. on the mockups so they can be judged against the various possible materials and their colors and finishes.
- F. Install surface treatment, as indicated in the Drawings, like veneer, brick, stone, exposed concrete, stucco, etc.
- H. When there are options or selections to be made for the final installation, the mockup must demonstrate the multiple options available for selection as the final product and installation.

1.11 PROJECT CONDITIONS

- A. Field Measurements: Verify actual conditions to receive cast stone components by field measurements before production.
- B. Dimensions on shop drawings to be based upon field measurements.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

- A. Comply with ASTM C1364.
- B. Physical Properties: Provide the following:
 - 1. Compressive Strength – ASTM C1194: 6,500 psi minimum for products at 28 days.
 - 2. Absorption – ASTM C1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
 - 3. Air Content for Wet Cast Product – ASTM C173 or C231: 4 percent.
 - 4. Freeze Thaw - ASTM C1364: The cumulative percent weight loss (CPWL) less than 5 percent after 300 cycles of freezing and thawing.
 - 5. Linear Shrinkage - ASTM C426: Maximum 0.065 percent.
- C. Job Site Testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job site:
 - 1. Three (3) field cut cube specimens from each of these samples must have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.
 - 2. Three (3) field cut cube specimens from each of these samples must have an average maximum cold-water absorption of 6 percent.
 - 3. Test field specimens in accordance with ASTM C1194 and C1195.

2.2 RAW MATERIALS

- A. Portland Cement: Type I or Type III, white and/or grey, ASTM C150.
- B. Coarse Aggregates: Granite, quartz or limestone, ASTM C33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine Aggregates: Manufactured or natural sands, ASTM C33, except for gradation.
- D. Colors: Inorganic iron oxide pigments, ASTM C979 except that carbon black pigments cannot be used.
- E. Admixtures: Comply with the following:

1. ASTM C260 for air-entraining admixtures.
2. ASTM C494 Types A-G for water reducing, retarding, accelerating and high range admixtures.
3. Other Admixtures: Integral water repellents and other chemicals, for which no ASTM Standard exists, must be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
 - a. Produce units with water repellent accepted by fabricator within mix design; product for mix design and setting mortar to be from same source.
4. ASTM C618; do not use mineral admixtures of dark and variable colors in surfaces intended to be exposed to view.
5. ASTM C989; granulated blast furnace slag may be used to improve physical properties, as verified by testing documentation.

F. Water: Potable.

G. Reinforcing Bars:

1. ASTM A615/A615M, Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inches.

H. Provide anchors, dowels and other anchoring devices and shims that are standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

- B. Provide fine-grained texture similar to natural stone, for surfaces intended to be exposed to view. Air voids are not permitted in excess of 1/32 inch, and the density of such voids must be less than 3 occurrences per any 1 inch². Air voids are not permitted when obvious under direct daylight illumination at a 5 feet distance.
- C. Units must exhibit a texture of no less quality than the approved sample when viewed under direct daylight illumination at a 10 feet distance.
- D. Units to comply with ASTM D2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
 1. Total color difference – not greater than 6 units.
 2. Total hue difference – not greater than 2 units.
- E. Chipping on edges or surfaces, where they will be visible in the final installation, whether resulting from shipment, delivery or other factors or causes, is not acceptable, and the units must be removed and replaced with new units.
- F. The occurrence of crazing or efflorescence may constitute a cause for rejection, at the sole discretion of the COR.
- G. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.4 REINFORCING

- A. Reinforce the units as required by the shop drawings, and prepared under direction of professional engineer, for safe handling and structural stress.
 - 1. Reinforcing to be minimum 0.25 percent of the cross section area.
- B. Provide non-corrosive reinforcement where faces exposed to weather are covered with less than 1.5 inches of concrete material. Provide reinforcement with minimum concrete coverage of twice the diameter of the bars.

2.5 EMBEDDED ANCHORS AND OTHER INSERTS

- A. Fabricate from stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666, Type 304.

2.6 CURING

- A. Cure units in a warm curing chamber 1000° F at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 700° F for 16 hours after casting. Provide additional yard curing at 95 percent relative humidity and 350-degree-days (i.e. 7 days at 500° F or 5 days at 700° F) prior to shipping. Protect form-cured units from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check cast stone materials for damage, coloration, finish, crazing, efflorescence, fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with the more stringent tolerances of the Cast Stone InstituteSM Technical Manual or this Section.
- B. Set stones 1/8 inch or less, within the plane of adjacent units.
- C. Joints, plus – 1/6 inch, minus –1/8 inch.

3.3 JOINTING

- A. Joint Size:

1. At stone/stone joints in vertical position 1/4 inch.
2. Stone/stone joint exposed on top 3/8 inch.

B. Joint Materials:

1. Leave all joints with exposed tops or under relieving angles open.

C. Location of Joints:

1. As shown on shop drawings.

3.4 REPAIR AND CLEANING

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

3.5 INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute except distance for measuring acceptability to be reduced to 3 feet.

END OF SECTION 047200

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 014529, TESTING LABORATORY SERVICES.
- B. Sustainability Requirements: Section 018111, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Painting: Section 099100, PAINTING.

1.3 QUALITY ASSURANCE

- A. Fabricator and erector must maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Fabricate work in an AISC certified Category Conventional Steel Structures.
- B. The controlling contractor must ensure that the steel erector is provided written notification required by 29 CFR 1926.752, before authorizing the commencement of steel erection; provide copy of this notification to the COR.
- C. Pre-Installation Conference: Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COR and all parties whose work is effected or related to the work of this section.

1.4 1.4 TOLERANCES

- A. Hold fabrication tolerances for structural steel within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145), except as follows:

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

1.5 REGULATORY REQUIREMENTS

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

1.6 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
- C. Certificates:
 1. Structural steel.
 2. Steel for all connections.
 3. Welding materials.
 4. Shop coat primer paint.
- D. Test Reports:
 1. Welders' qualifying tests.
- F. Record Surveys.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Institute of Steel Construction (AISC):
 1. AISC 303-10 Steel Buildings and Bridges
 2. AISC 360-10 Structural Steel Buildings
- C. American National Standards Institute (ANSI):
 1. B18.22.1-03 Plain Washers

2. B18.22M-05 Metric Plain Washers

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

- | | | |
|-----|---------------------|---|
| 1. | A6/A6M-13 | General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling |
| 2. | A36/A36M-12 | Carbon Structural Steel |
| 3. | A53/A53M-12 | Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| 4. | A123/A123M-12 | Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| 5. | A242/A242M-04(2009) | High-Strength Low-Alloy Structural Steel |
| 6. | A283/A283M-12a | Low and Intermediate Tensile Strength Carbon Steel Plates |
| 7. | A307-12 | Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength |
| 8. | A325-10 | Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| 9. | A490/A490M-12 | Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength |
| 10. | A500/A500M-10a | Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| 11. | A501-07 | Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| 12. | A572/A572M-12a | High-Strength Low-Alloy Columbium-Vanadium Structural Steel |
| 13. | A992/A992M-11 | Structural Steel Shapes |

E. American Welding Society (AWS):

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

F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:

1. Specification for Structural Joints Using ASTM A325 or A490 Bolts (2000)

G. Occupational Safety and Health Administration (OSHA):

1. 29 CFR Part 1926 Safety Standards for Construction

PART 1 - PRODUCTS

1.1 MATERIALS

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

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

PART 2 - EXECUTION

2.1 CONNECTIONS (SHOP AND FIELD)

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

2.2 FABRICATION

- A. Execute fabrication in accordance with Chapter M, Specification for Steel Buildings - Allowable Stress Design and Plastic Design.

2.3 SHOP PAINTING

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 099100, PAINTING.
- C. Do not apply paint to following:
 - 1. Surfaces within 2 inches of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.

- D. Zinc Coated Finish (Hot Dip Galvanized): Provide per ASTM A123 (after fabrication).
- E. Touch-up (after erection): Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

2.4 ERECTION

- A. General: Erect structural steel framing in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Provide temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

2.5 FIELD PAINTING

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 099100, PAINTING.

2.6 SURVEY

- A. Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COR for approval. Prepare reports by Registered Land Surveyor or Registered Civil Engineer as specified in Section 010002, GENERAL REQUIREMENTS; specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

END OF SECTION 051200

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified:
 - 1. Handrails.

1.2 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials and recycled content requirements.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS AND PRODUCT DATA.
- B. Shop Drawings:
 - 1. Indicate 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. Submit Design Calculations for specified live loads including dead loads prepared by professional engineer licensed in the State of their practice.

- E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

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

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society of Mechanical Engineers (ASME):
 - 1. B18.6.1-81(R2008) Wood Screws
 - 2. B18.2.2-10 Nuts for General Applications
- C. American Society for Testing and Materials (ASTM):
 - 1. A123/A123M-12 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. A500/A500M-10a Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 3. A653/A653M-11 Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - 4. C1107/C1107M-13 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 5. E488-10 Strength of Anchors in Concrete Elements
 - 6. F436-11 Hardened Steel Washers
- D. American Welding Society (AWS):
 - 1. D1.1/D1.1M:2010 Structural Welding Code Steel
 - 2. D1.3/D1.3M:2008 Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-06-2006

Metal Finishes Manual

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Structural Tubing: ASTM A500.
- D. Modular Channel Units:
 - 1. Factory fabricated, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
- E. Grout: ASTM C1107, pourable type.

2.2 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 is used.
- B. Anchor Bolts: ASTM A307; same material, color, and finish as the metal to which applied when exposed.
- C. Expansion Anchors: Design values listed must be as tested according to ASTM E488.
- D. Lag Screws and Bolts: ASME B18.2.1, type and grade best suited for the purpose.
- E. Toggle Bolts: ASME B18.2.1.
- F. Bolts, Nuts, Studs and Rivets: ASME B18.2.2 or ASTM A307.
- G. Washers: ASTM F436, type to suit material and anchorage.

2.3 FABRICATION

- A. General:
 - 1. Galvanize embedded items exposed to the elements according to ASTM A123.
- B. 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.

C. Size:

1. Size and thickness of members as shown.

D. 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 punch or drill; 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 stainless steel connectors for removable member's machine screws or bolts.

E. 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.

F. 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 standards as listed in article Applicable Publications.
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. Provide as indicated.
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. Fabricate fit of components and the alignment of holes to 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.

G. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
- 2. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.

- 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.

- H. 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.

2.4 SUPPORTS

A. General:

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

2.5 HANDRAILS

- A. Design Criteria: 200 pounds in any direction at any point.
- B. Provide continuous welded joints, dressed smooth and flush.
- C. Standard flush fittings, designed to be welded, may be used.
- D. Exposed threads will not be approved.
- E. Form handrail brackets to size and design shown.
- F. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
- G. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 1. Provide temporary bracing for such items until concrete or masonry is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.
- C. Field weld in accordance with AWS.
 1. Design and finish as specified for shop welding.

2. Use continuous weld unless specified otherwise.

- D. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- 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.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to Structure:

- 1. Secure supports to concrete inserts by bolting or continuous welding.

3.3 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 aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

END OF SECTION 055000

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies wood blocking, sheathing, furring, nailers, and rough hardware.

1.2 PERFORMANCE REQUIREMENTS

- A. Engineered Wood Products:
 - 1. Provide products with no added urea formaldehyde; determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or E1333.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide documentation of conformance with performance requirements of this section.
- C. Prepare shop drawings showing framing connection details, fasteners, connections and dimensions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Forest and Paper Association (AF&PA):
1. Wood Structural Design Data
- C. American Lumber Standard Committee, Incorporated (ALSC):
1. ALSC Board of Review
- D. American National Standards Institute (ANSI):
1. ANSI A190.1-2012 Structural Glued Laminated Timber
- E. American Plywood Association (APA):
1. E30-2011 Engineered Wood Construction Guide
- F. American Society of Mechanical Engineers (ASME):
1. B18.2.1-2012 Square, Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws
 2. B18.2.2-2010 Hex Nuts for General Applications
 3. B18.6.1-81 (R2008) Wood Screws
 4. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws
- G. American Society for Testing and Materials (ASTM):
1. A307-10 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 2. C954-11 Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness
 3. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 4. D6007-02 Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
 5. E1333-10 Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber
 6. F844-07a Washers, Steel, Plan (Flat) Unhardened for General Use

- 7. F1667-11ae1 Nails, Spikes, and Staples
- H. American Wood Protection Association (AWPA)
- I. FM Global Group (FM):
 - 1. FM 4435 Approval Standard for Edge Systems Used with Low Slope Roofing Systems
- J. Green Seal (GS):
 - 1. GS-36 (2013) Commercial Adhesives
- K. South Coast Air Quality Management District (SCAQMD):
 - 1. SCAQMD Rule 1168 (1989; R2005) Adhesive and Sealant Applications
- L. U.S. Department of Commerce/National Institute of Science and Technology:
 - 1. PS 1-09 Structural Plywood
 - 2. PS 20-10 American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER

- A. Unless otherwise specified, each piece of lumber to bear a grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
 - 1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 - 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AF&PA, National Design Specification for Wood Construction having design stresses as shown.
- C. Lumber Other Than Structural:
 - 1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
 - 2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
 - 3. Furring, blocking, nailers and similar items 4 inches and narrower Standard Grade; and, members 6 inches and wider, Number 2 Grade.

D. Sizes:

1. Conforming to Prod. Std. PS20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. At time of delivery and maintained at the site.
2. Boards and lumber 2 inches and less in thickness: 19 percent or less.
3. Lumber over 2 inches thick: 25 percent or less.

F. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Products containing chromium or arsenic will not be permitted.
3. Provide products with waterborne or boron-based preservatives.

G. Waterborne Wood Preservatives:

1. Treat wood products with waterborne wood preservatives listed in Section 4 of AWPA Standards U1, excluding those which contain arsenic and/or chromium.
2. Pressure treatment of wood products must conform to the requirements of AWPA Standards U1 and T1.
3. Retention of preservatives as prescribed in AWPA Standard U1 for the following Use Categories (material conforming to a higher AWPA Use Category may be specified):
 - a. UC1: Interior construction - above ground, dry conditions.
 - b. UC2: Interior construction - above ground, damp conditions.
 - c. UC3A: Exterior construction - above ground, coated and with rapid water runoff.
 - d. UC3B: Exterior construction - above ground, uncoated or poor water runoff.
 - e. UC4A: General purpose soil or fresh water contact - heavy duty above ground.
 - f. UC4B: Heavy duty soil or fresh water contact - critical or difficult to replace components.
 - g. UC4C: Extreme duty soil or fresh water contact - critical structural components.

H. Boron-based Preservatives: Impregnate lumber with preservative treatment conforming to AWPA Standard U1.

2.2 ROUGH HARDWARE

A. Anchor Bolts: ASTM A307, size as indicated, complete with nuts and washers.

B. Washers:

1. ASTM F844.

2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

C. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

D. Nails:

1. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.

2.3 BLOCKING

- A. General: Provide miscellaneous lumber as indicated and lumber support or attachment for other construction, including the following:
 1. Blocking.
 2. Nailers.
- B. Provide Standard or No. 2 Grade lumber.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

- A. Anchors in Masonry: Except where indicated otherwise, embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.
- B. Wood Blocking: Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.
- C. Wood Grounds: Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 8 foot straightedge.

3.2 PROTECTION

- A. Protect rough carpentry from weather.

- B. If rough carpentry becomes wet, apply EPA-registered borate treatment complying with EPA registered label.

END OF SECTION 061000

SECTION 072113
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies insulation for concrete slab.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used.
 - 2. Adhesive, each type used.
 - 3. Tape.

1.3 STORAGE AND HANDLING

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. C270 Mortar for Unit Masonry
 - 2. C553-11 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

3. C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 4. C578-12b Rigid, Cellular Polystyrene Thermal Insulation
 5. C591-12b Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 6. C665-12 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 7. D312-00(R2006) Asphalt Used in Roofing
 8. E84 Standard Test Method for Surface Burning Characteristics of Building Materials
 9. F1667-11ae1 Driven Fasteners: Nails, Spikes and Staples
- C. Scientific Certification Systems (SCS Global): SCS Indoor Advantage certification.
- D. UL Environment, GREENGUARD (ULE GREENGUARD): The GREENGUARD Product Guide (online).
- E. International Code Council Evaluation Service (ICC-ES), Evaluation Report.

PART 2 - PRODUCTS

2.1 INSULATION – GENERAL

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.

2.2 POLYSTYRENE BOARD

- A. Extruded Polystyrene Board Insulation: Comply with ASTM C 576, Type IV, 25 psi minimum compressive strength, 1.55 lbs./cu. ft.
1. Thermal Resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C518 at mean temperature of 75 degree F); R-5.0 per inch thickness, with 90% lifetime limited warranty on thermal resistance.
 2. Blowing Agent Formulation: Zero ozone depleting.
 3. Edge Condition: Square.
 4. Surface Burning Characteristics (ASTM E84): Flame spread less than 25, smoke developed less than 450, certified by independent third party such as Underwriters Laboratories (UL).
 5. Indoor Air Quality: Compliance certified by independent third party such as GREENGUARD Indoor Air Certified® and/or GREENGUARD Children and Schools Certified.
 6. Recycled Content: Minimum 20%, certified by independent third party such as Scientific Certification Systems.
 7. Warranty: Limited lifetime warranty covering all ASTM C578 physical properties.

8. Panel Size: Provide 1 inch thick by 4 feet wide by 8 feet long.

2.3 ADHESIVE

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

2.4 TAPE

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- B. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.
- C. Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.2 POLYSTYRENE BOARD

- A. Vertical Insulation:
 1. Fill joints of insulation with same material used for bonding.
 2. Bond polystyrene board to surfaces with adhesive and applied in accordance with recommendations of insulation manufacturer.

END OF SECTION 072113

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK

- A. Gypsum partitions: Section 092900, GYPSUM BOARD.
- B. Mechanical Work: Section 220511, COMMON WORK RESULTS FOR PLUMBING
Section 230511, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
- E. Meet VOC requirements of pertinent CARB and/or SCAQMD Rule for sealants VOC (4 percent by weight VOC or less in less than 16 ounce package or less than 250 g/L in larger package). All non-porous sealant primers must be below 250g/L and primers for porous substrates less than 775 g/L.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials requirements.

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 - 1. Caulking compound.
 - 2. Primers.
 - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a meeting on site, after submittals are received and approved but before any work, to review drawings and specifications, submittals, schedule, manufacturer instructions, site logistics and pertinent matters of coordination, temporary protection, governing regulations, tests and inspections; participants to include COR and all parties whose work is effected or related to the work of this section.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 440 °F.
 - b. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures less than 40° F or exceeding 90° F.

1.9 DEFINITIONS

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.10 WARRANTY

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period to be extended to five (5) years.
- B. General Warranty: Special warranty specified in this Article will not deprive Government of other rights Government may have under other provisions of Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.11 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. C612-10 Mineral Fiber Block and Board Thermal Insulation
 - 2. C717-12b Standard Terminology of Building Seals and Sealants
 - 3. C734-06(2012) Low Temperature Flexibility of Latex Sealants after Artificial Weathering
 - 4. C834-10 Latex Sealants
 - 5. C919-12 Use of Sealants in Acoustical Applications
 - 6. C920-11 Elastomeric Joint Sealants

- 7. C1021-08 Laboratories Engaged in Testing of Building Sealants
 - 8. C1193-13 Use of Joint Sealants
 - 9. C1248-08(2012) Staining of Porous Substrate by Joint Sealants
 - 10. C1330-02(2013) Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
 - 11. D217-10 Cone Penetration of Lubricating Grease
 - 12. D1056-07 Flexible Cellular Materials—Sponge or Expanded Rubber
 - 13. E84-12c Surface Burning Characteristics of Building Materials
- C. California Air Resources Board (CARB)
 - D. South Coast Air Quality Management District (SCAQMD)
 - E. Sealant, Waterproofing and Restoration Institute (SWRI):
 - 1. The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service application, as demonstrated by joint sealant manufacturer, based on testing and field experience.
- B. S-1:
 - 1. ASTM C920, polyurethane.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade NS.
 - 5. Shore A hardness of 20-40.
- C. S-3:
 - 1. ASTM C920, polyurethane.
 - 2. Type S.
 - 3. Class 25, joint movement range of plus or minus 50 percent.
 - 4. Grade NS.
 - 5. Shore A hardness of 15-25.
 - 6. Minimum elongation of 700 percent.

D. S-4:

1. ASTM C920 polyurethane.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.

F. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

G. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

2.2 CAULKING COMPOUND

A. C-1: ASTM C834, acrylic latex.

- B. C-2: Polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

2.3 COLOR

- A. To match adjacent area color.

- B. Match color of adjacent concrete at unpainted concrete.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26° F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER

- A. Mineral fiber board: ASTM C612, Type IVA.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POURIOUS SURFACES

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

- A. Prepare joints in accordance with manufacturer's instructions and as specified only when installers are ready to initiate sealant application as soon as practicable after preparation and before subsequent surface deterioration.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Masonry.
 - b. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 1/8 inch for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

- A. At widths up to 1/4 inch, sealant depth equal to width.
- B. At widths over 1/4 inch, sealant depth 1/2 of width up to 1/2 inch maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

- A. General:
 1. Comply with manufacturer's written installation instructions for products and applications indicated.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

3.6 CLEANING

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.8 LOCATIONS

- A. Exterior Building Joints, Horizontal and Vertical:
 - 1. Metal to Metal: Type S-6, S-7.
 - 2. Metal to Masonry or Cast Stone: Type S-1.
 - 3. Masonry to Masonry: Type S-1.
 - 4. Threshold Setting Bed: Type S-1, S-3, S-4.
 - 5. Masonry to Wood: Type S-6.
- B. Metal Flashings:
 - 1. Flashings to Wall: Type S-6.
 - 2. Metal to Metal: Type S-6.
- C. Sanitary Joints:
 - 1. Walls to Plumbing Fixtures: Type S-9.
 - 2. Counter Tops to Walls: Type S-9.
 - 3. Pipe Penetrations: Type S-9.
- E. Interior Caulking:
 - 1. Typical Narrow Joint 1/4 inch or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
 - 2. Perimeter Windows, which Adjoin Masonry Surfaces: Types C-1, C-2 and C-3.
 - 3. Joints at Masonry Walls Exterior Walls: Types C-1, C-2 and C-3.
 - 4. Concealed Acoustic Sealant Type: S-4, C-1, C-2 and C-3.

END OF SECTION 079200

SECTION 081113
HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel frames and related components.
- B. Terms relating to frames as defined in ANSI/SDI A250.7 and as specified.

1.2 RELATED WORK

- A. Section 081400, INTERIOR WOOD DOORS
- B. Door Hardware: Section 087100, DOOR HARDWARE.

1.3 TESTING

- A. Perform testing with an independent testing laboratory.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Schedule: Provide a schedule prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on drawings; coordinate with final door hardware schedule.

1.5 SHIPMENT

- A. Prior to shipment label each frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

- A. Store frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. A653/A653M-11 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. A1008/A1008M-12a Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardened
- C. Builders Hardware Manufacturers Association (BHMA):
 - 1. ANSI/BHMA A156.115-06 American National Standard for Hardware Preparation in Steel Doors and Steel Frames
- D. FM Global:
 - 1. Approval Guide
- E. Intertek Testing Services (ITS):
 - 1. Certifications Listings Latest Edition
- G. Steel Door Institute (SDI):
 - 1. ANSI/SDI A250.6-03(R09) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames

- | | | |
|----|-------------------------|--|
| 2. | ANSI/SDI A250.7-1997 | Nomenclature for Standard Steel Doors and Steel Frames |
| 3. | ANSI/SDI A250.8-03(R08) | Recommended Specifications for Standard Steel Doors and Frames |
| 4. | ANSI/SDI A250.11-2012 | Recommended Erection Instructions for Steel Frames |

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Prime Paint: Paint that meets or exceeds the requirements of A250.8.
- E. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.2 FABRICATION GENERAL

- A. General:
 - 1. Doors to receive hardware specified in Section 087100, DOOR HARDWARE. Tolerances must comply to SDI A250.8. Thickness, 1-3/4 inches, unless otherwise shown.
 - 2. Close top edge of exterior doors flush and seal to prevent water intrusion.

2.3 METAL FRAMES

- A. General: SDI Level 1, formed frames to sizes and shapes indicated.
 - 1. Type: Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets; grind welds smooth.
- B. Reinforcement and Covers:
 - 1. ANSI/SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
 - 2. Provide mortar guards securely fastened to back of hardware reinforcements.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

- E. Anchors: Provide anchors to secure the frame to adjoining construction; steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.
 - 1. Wall Anchors: Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.
 - a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire; adjustable or T-shaped.
 - 2. Floor Anchors: Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member.

2.4 HARDWARE PREPARATION

- A. Provide minimum hardware reinforcing gages as specified in SDI A250.6.
- B. Drill and tap frames to receive finish hardware.
- C. Prepare frames for hardware in accordance with the applicable requirements of SDI A250.8 and SDI A250.6; for additional requirements refer to ANSI/BHMA A156.115.
- D. Drill and tap for surface-applied hardware at the project site.
- E. Punch door frames, with the exception of frames that will have weatherstripping or gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors; set lock strikes out to provide clearance for silencers.

2.5 SHOP PAINTING

- A. ANSI/SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set, in accordance with SDI A250.11.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 - 3. Protect frame from accidental abuse.
 - 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.

5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 1/4 inch diameter expansion bolts.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Anchors in Masonry Walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 1/4 inch expansion bolts through spacers. Where sub-frames or rough bucks are used, 1/4 inch expansion bolts on 24 inch centers or power activated drive pins 24 inches on centers. Secure two piece frames to sub-frame or rough buck with machine screws on both faces.

3.2 INSTALLATION OF HARDWARE

- A. Install hardware as specified in this Section and Section 087100, DOOR HARDWARE.
- B. After erection, clean and adjust hardware.

END OF SECTION 081113

SECTION 081400
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior flush doors with prefinish, prefit option.

1.2 RELATED WORK

- A. Metal door frames: Section 081113, HOLLOW METAL FRAMES.
- B. Door hardware including hardware location (height): Section 087100, DOOR HARDWARE.
- C. Finish: Section 090600, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Veneer sample 8 inch by 8 inch showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.
- C. Shop Drawings:
 - 1. Show every door in project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of louvers and pertinent details.
 - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.
- E. Laboratory Test Reports:
 - 1. Screw holding capacity test report in accordance with WDMA T.M.10.
 - 2. Split resistance test report in accordance with WDMA T.M.5.
 - 3. Cycle/Slam test report in accordance with WDMA T.M.7.
 - 4. Hinge-Loading test report in accordance with WDMA T.M.8.

1.4 WARRANTY

- A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty to be as follows:

1. For interior doors, manufacturer's warranty for lifetime of original installation.

1.5 DELIVERY AND STORAGE

- A. Factory seal doors and accessories in cardboard packages; keep packaging intact during delivery and storage.
- B. Label package for door opening where used.
- C. Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- D. Store doors flat on level raised platforms in clean, dry, well-ventilated area protected from sunlight and weather; cover but allow for air circulation.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Window and Door Manufacturers Association (WDMA):
- | | | |
|----|----------------|--|
| 1. | I.S.1A-11 | Architectural Wood Flush Doors |
| 2. | I.S.4-09 | Water-Repellent Preservative Non-Pressure Treatment for Millwork |
| 3. | I.S.6A-11 | Architectural Wood Stile and Rail Doors |
| 4. | T.M.5-90(2009) | Split Resistance Test Method |
| 5. | T.M.7-08 | Cycle-Slam Test Method |
| 6. | T.M.8-08 | Hinge Loading Test Method |
| 7. | T.M.10-08 | Screwholding Test Method |

PART 2 - PRODUCTS

2.1 FLUSH DOORS

- A. General:
1. Meet requirements of WDMA I.S.1-A, solid core.

2. Adhesive: Type II.
3. Thickness: 1-3/4 inches unless otherwise shown or specified.

B. Face Veneer:

1. In accordance with WDMA I.S.1-A.
2. One species throughout the project to match existing interior doors.

2.2 PREFITTING

- A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.

2.3 FACTORY FINISHING

- A. Grade: Premium.
- B. Finish: Veneer finish to match existing doors.

2.4 IDENTIFICATION MARK

- A. Provide on top edge of door.
- B. Provide as a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Include one of the following additional requirements:
 1. An identification mark or a separate certification including name of inspection organization.
 2. Identification of standards for door, including glue type.
 3. Identification of veneer and quality certification.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

- A. Clearances between Doors and Frames and Floors:
 1. Maximum 1/8 inch clearance at the jambs, heads, and meeting stiles, and a 3/4 inch clearance at bottom, except as otherwise specified.

- B. Rout doors for hardware using templates and location heights specified in Section, 087100 DOOR HARDWARE.
- C. Fit doors to frame, bevel lock edge of doors 1/8 inch for each two inches of door thickness.
- D. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- E. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

3.2 INSTALLATION

- A. Hardware: See Section 087100, DOOR HARDWARE.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 DOOR PROTECTION

- A. As door installation is completed, place cardboard shipping container over door and tape in place.
- B. Provide protective covering over handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by COR.

END OF SECTION 081400

SECTION 085200

WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wood windows.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: LC.
 - 2. Minimum Performance Grade: 25.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

2.2 WOOD WINDOWS

- A. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
 - 1. Exterior Finish: Manufacturer's standard factory-prime coat wood.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 2. Interior Finish: Manufacturer's standard stain-and-varnish finish.
 - a. Color: As selected by Architect from manufacturer's full range.
- B. Insulating-Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - 2. Lites: As indicated on drawings.
 - 3. Filling: Fill space between glass lites with air.
 - 4. Low-E Coating: Sputtered on second or third surface.
 - 5. Visible Light Transmittance: 70%.
 - 6. Visible Light Reflectance: 11%.
 - 7. U-Value: 0.27.

- 8. Solar Heat Gain Coefficient: 0.39.
- C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- D. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 FABRICATION

- A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze wood windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
- E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085200

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

- A. Caulking: Section 079200, JOINT SEALANTS.
- B. Application of Hardware: Section 081400, INTERIOR WOOD DOORS and Section 081113, HOLLOW METAL FRAMES.
- C. Finishes: Section 090600, SCHEDULE FOR FINISHES.

1.3 GENERAL

- A. All hardware must comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Make hardware for application on wood doors and frames to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- C. The following items to be of the same manufacturer, if possible, except as otherwise specified:
1. Mortise locksets.
 2. Hinges for hollow metal and wood doors.
 3. Surface applied overhead door closers.
 4. Exit devices.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication	Finish	Mfr. Name and	Key Control	UL Mark (if fire	ANSI/BHMA Finish
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			Type No.		Catalog No.	Symbols	rated and listed)	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 must 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 must be accompanied by copies of reports as referenced. The testing must have been conducted 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.

1.5 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 COR for reference purposes. Tag must identify items by Project Specification number and manufacturer's catalog number. These items will 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.

1.6 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 "HW" followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Keying: Key cylinders into existing Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of lever or lockset. Provide 6 pin type cylinders. Keying information will be furnished at a later date by the COR.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
 - 1. A156.1-13 Butts and Hinges
 - 2. A156.2-11 Bored and Pre-assembled Locks and Latches
 - 3. A156.3-01 Exit Devices
 - 4. A156.4-08 Door Controls (Closers)
 - 5. A156.5-10 Auxiliary Locks and Associated Products
 - 6. A156.6-10 Architectural Door Trim
 - 7. A156.8-10 Door Controls-Overhead Stops and Holders
 - 8. A156.13-12 Mortise Locks and Latches
 - 9. A156.16-02 American National Standard for Auxiliary Hardware
 - 10. A156.18-12 Materials and Finishes
 - 11. A156.21-09 Thresholds
 - 12. A156.22-12 Door Gasketing and Edge Seal Systems
- C. American Society for Testing and Materials (ASTM):
 - 1. F883-09 Padlocks
- D. Builders Hardware Manufacturers Association (BHMA):
 - 1. Certified Products Directory 2014
- E. Underwriters Laboratories, Inc. (UL):
 - 1. Building Materials Directory

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. ANSI A156.1. Provide the following types of butt hinges for the types of doors listed, except where otherwise specified:
 - 1. Interior Doors: Type 8112 for doors 3 feet wide or less and Type A8111 for doors over 3 feet wide.
- B. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 DOOR CLOSING DEVICES

- A. Provide closing devices of one manufacturer.

2.3 OVERHEAD CLOSERS

- A. Conform to ANSI A156.4, Grade 1 and the following:
 - 1. 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
 - 2. Hold-open feature, where specified.
 - 3. Size Requirements: Size closers in accordance with manufacturer's recommendations or provide multi-size closers, sizes 1 through 6.
 - 4. Material of closer must be cast aluminum.
 - 5. Steel or malleable iron arm and brackets.
 - 6. Provide with full size cover.
 - 7. Adjustable hydraulic back-check and separate valves for closing and latching speed.

2.4 DOOR STOPS

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Substitute floor stops Type L02141 or L02161 as appropriate, when wall bumpers would not provide an effective door stop.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161.

2.5 LOCKS AND LATCHES

- A. Conform to ANSI A156.2. Locks and latches for doors 1-3/4 inch thick or over must have beveled fronts. Lock cylinders must have not less than six pins. Cylinders for all locksets to be removable core type. Cylinder to 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. Lever or lockset must not require disassembly to remove core from lockset.
- B. In addition, locks and latches must comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13; Series 1000, minimum Grade 2. Locks and latchsets to be furnished with curved lip strike and wrought box. Lock function F02 to be furnished with emergency tools/keys for emergency entrance. Furnish armored fronts for all mortise locks.
2. Cylindrical Lock and Latch Sets: Levers must meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets to be series 4000 Grade I. Knobs for series 4000 lock and latch sets to have 2-1/4 inch diameters. Where two turn pieces are specified for lock F76, turn piece on inside knob must lock and unlock inside knob, and turn piece on outside knob must unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks specified under hardware sets must conform to ANSI A156.5.

2.6 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
Control key	1 key

2.7 KICK-MOP PLATES

- B. Conform to ANSI Standard A156.6.
- A. Provide protective plates and door edging as specified below:
1. Kick-mop plates and armor plates to be metal, Type J100 series, color as required.
 2. Provide kick-mop plates for both sides of each new restroom door, except where noted as not required. Kick-mop plates to be 8 inches high. On push side of doors where jamb stop extends to floor, make combination kick-mop plates 1-1/2 inches less than width of door, except pairs of metal doors to have plates 1 inch less than width of each door. Extend all other combination kick-mop plates to within 1/4 inch of each edge of doors. For jamb stop requirements, see specification sections pertaining to door frames.
 3. Kick-mop plates are not required on following door sides:
 - a. Push side of restroom doors.

2.8 DOOR PULLS WITH PLATES

- A. Conform to ANSI A156.6. Pull plate 3-1/2 inches by 14 inches, unless otherwise specified. Cut plates of door pulls for cylinders, or turn pieces where required.

2.9 PUSH PLATES

- A. Conform to ANSI A156.6. Metal, Type J302, 8 inches wide by 14 inches high. Provide plastic Type J302 plates, 4 inches wide by 14 inches high, where push plates are specified for doors with stiles less than 8 inches wide. Cut plates for cylinders, and turn pieces where required.

2.10 THRESHOLDS

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, install thresholds in a bed of sealant with machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

2.11 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish.

2.12 FINISHES

- A. Exposed surfaces of hardware to have ANSI A156.18 finishes as specified below. Provide finishes on all hinges, pivots, closers, thresholds, etc. as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 099100, PAINTING.
- B. 626 or 630: Surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Hardware Finishes for Existing Buildings: Match finishes of hardware in existing spaces.

2.13 BASE METALS

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

Finish	Base Metal
652	Steel
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. Locate hardware on doors at heights specified below unless otherwise noted:

B. Hardware Heights from Finished Floor:

1. Locksets and latch sets centerline of strike: 40-5/16 inches.
2. Deadlocks centerline of strike: 48 inches.
3. Centerline of door pulls: 40 inches.
4. Push plates and push-pull: 50 inches to top of plate.
5. Push-pull latch: 40-5/16 inches to centerline of strike.
6. Centerline of deadlock strike: 33 inches when used with push-pull latch.
7. Locate other hardware at standard commercial heights.
8. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Equip and mount closer devices, including those with hold-open features, to provide maximum door opening permitted by building construction or equipment. Closers to be mounted regular arm. Where closers are mounted on doors, mount with sex nuts and bolts; foot fastened to frame with machine screws.

B. Substitute parallel arm or top jamb mounting for regular arm mounting where the following conditions occur:

1. Where door swing, in full open position, would be limited to less than 90 degrees due to partition construction and closer location.

C. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
1-3/4 inch	3 feet and less	4-1/2 inches

D. Provide hinge leaves sufficiently wide to allow doors to swing clear of door frame trim.

E. Where new hinges are specified for new doors in existing frames or existing doors in new frames, provide sizes of new hinges matching sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges cannot be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

F. Hinges Required Per Door:

Doors over 5 ft high and not over 7 ft 6 in high	3 butts
--	---------

- G. Fastenings: Suitable size and type to suit with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather must be of nonferrous metal.
- H. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (Send keys, Master Key level and above by Registered Mail to the Cemetery Director along with the bitting list. Also send a copy of the invoice to the COR for the records.) Installation of locks which do not meet specified keying requirements will be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

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

3.4 HARDWARE SETS

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

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. SA - Sargent
3. RO - Rockwood
4. NO - Norton

Hardware Schedule

Set: 01

Doors: 100, 106

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Dormitory Lock	21 50 8225 LNL	US26D	SA
1 Door Closer	R 7500	689	NO
1 Kickplate	K1050 8" 4BE CSK	US32D	RO
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
1 Louver	LV-IY 24" x 26"	B	PE

Set: 02

Doors: 102

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	21 8205 LNL	US26D	SA
1 Kickplate	K1050 8" 4BE CSK	US32D	RO
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
1 Louver	LV-IY 24" x 26"	B	PE
1 Lite Kit	LT-B1 5" x 20"	B	PE

Set: 03

Doors: 108

1 Continuous Hinge	CFMXXHD1		PE
1 Storeroom Lock	21 8204 LNL	US26D	SA
1 Door Closer	R 7500	689	NO
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
2 Louver	LV-IY 10" x 18"	B	PE

END OF SECTION 087100

SECTION 090600
SCHEDULE FOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 MANUFACTURERS

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

1.3 SUBMITALS

- A. Submit in accordance with SECTION 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, provide quadruplicate samples for color approval of materials and finishes specified in this section.
- B. Color Schedule: Submit full color schedule including manufacturers intending to be provided for project, with equivalent colors to selections provided by this section; format to match this section.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

PART 2 - PRODUCTS

2.1 COLOR BOARD

- A. Size: As required to display building finishes.

B. Labeled for:

1. Building name and number.
2. All finishes used.

2.2 DIVISION 08 - OPENINGS

A. SECTION 081400, INTERIOR WOOD DOORS

Component	Finish/Color
Doors	Match Existing
Frames	Match Existing

B. SECTION 085200, WOOD WINDOWS

Material	Finish	Manufacturer	Manufacturer Color Name/No.
Wood	Match Existing	---	---

Glazing Type	Manufacturer	Mfg. Color Name/No.
G-1	PPG	Solarban 60 – Clear + Clear

C. SECTION 087100, DOOR HARDWARE

Item	Material	Finish
Hinges	Brass	US26D – Brushed
Door Closers	Aluminum	689 Aluminum
Door Stops	Satin Stainless Steel	US32D – Brushed
Lock/ Latches	Brass	US26D – Brushed
Kick Plates	Metal	US32D – Brushed
Louvers	Galvanized Steel	Powder Coated

2.3 DIVISION 09 - FINISHES

A. SECTION 093013, TILING

QUARRY WALL TILE (QT)		
Finish Code	Manufacturer	Mfg. Color Name/No.
QT – 1	Daltile	Satillo Quarry/Sealed Antique Adobe ST81

QUARRY FLOOR TILE (QT)		
Finish Code	Manufacturer	Mfg. Color Name/No.
QT – 2	Daltile	Satillo Quarry/Sealed Antique Adobe ST81

QUARRY WALL TILE (QT)		
Finish Code	Manufacturer	Mfg. Color Name/No.
QT – 3	Daltile	Satillo Quarry/Sealed Antique Adobe ST81; 6-3/4" X 12"

B. SECTION 096513, RESILIENT BASE AND ACCESSORIES

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
VB – 1	Vinyl Wall Base	4 inch	Johnsonite	TA -1 Tannery
VB – 2	Vinyl Wall Base	4 inch	Johnsonite	63 Burnt Umber

C. SECTION 096516, RESILIENT SHEET FLOORING

SHEET VINYL (SV)			
Finish Code	Pattern Name	Manufacturer	Mfg. Color Name/No.
SV-1	Acczent/Tisse	Johnsonite	83016 Tisse Warm Beige

D. SECTION 096800, CARPETING

CARPET EDGE STRIP			
Finish Code	Material	Manufacturer	Mfg. Color Name/No.
TR-1	Metal	Schluter	BB Brushed Stainless Steel
TR-2	Marble Threshold		

CARPET MODULES (CFT)				
Finish Code	Size	Pattern Direction	Manufacturer	Mfg. Color Name/No.
CFT-1	18 x 36	Monolithic	Bentley	New Bohemian/Vagabond/Firefly

E. SECTION 099100, PAINT AND COATINGS

1. MPI Gloss and Sheen Standards:

	Gloss @60	Sheen @85
Gloss Level 1 a traditional matte finish-flat	max 5 units, and max 10 units	
Gloss Level 2 a high side sheen flat-"a velvet-like"	max 10 units, and finish	
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

2. Paint Code:

Paint Code	Gloss	Manufacturer	Mfg. Color Name/No.
P - 1	Exterior	Benjamin Moore	Brilliant White
P - 2	3	Benjamin Moore	Acadia White/AC-41

F. SECTION 123200, MANUFACTURED WOOD CASEWORK

PLASTIC LAMINATE (PL)		
Finish Code	Manufacturer	Mfg. Color Name/No.
PL - 1	Wilsonart	7921-38/Tuscan Walnut

PART 3 - EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	AT
Anodized Aluminum Colored	AAC
Anodized Aluminum Natural Finish	AA
Baked On Enamel	BE
Brick Face	BR
Carpet	CP
Carpet Module Tile	CPT
Concrete	C
Concrete Masonry Unit	CMU
Existing	E
Exposed Divider Strips	EXP
Exterior	EXT
Exterior Finish System	EFS
Exterior Paint	EXT-P
Exterior Stain	EXT-ST
Fabric Wallcovering	WF
Facing Tile	SCT
Floor Mats & Frames	FM
Floor Tile, Mosaic	FT
Fluorocarbon	FC
Granite	GT
Gypsum Wallboard	GWB
High Glazed Coating	SC
Latex Mastic Flooring	LM

Marble	MB
Material	MAT
Mortar	M
Multi-Color Coating	MC
Natural Finish	NF
Paint	P
Paver Tile	PVT
Plaster	PL
Plaster High Strength	HSPL
Plaster Keene Cement	KC
Plastic Laminate	HPDL
Polypropylene Fabric Wallcovering	PFW
Porcelain Paver Tile	PPT
Rubber Base	RB
Rubber Tile Flooring	RT
Stain	ST
Stone Flooring	SF
Suspension Decorative Grids	SDG
Veneer Plaster	VP
Vinyl Base	VB
Vinyl Coated Fabric Wallcovering	W
Vinyl Composition Tile	VCT
Vinyl Sheet Flooring	VSF
Vinyl Sheet Flooring (Welded Seams)	WSF
Wall Border	WB
Wood	WD

A. FINISH SCHEDULE SYMBOLS

1. Symbol Definition

- a. ** Same finish as adjoining walls
- b. - No color required
- c. E Existing
- d. XX To match existing
- e. EFTR Existing finish to remain
- f. RM Remove

3.2 ROOM FINISH SCHEDULE

A. Match adjoining or existing similar surfaces colors, textures or patterns where disturbed or damaged by alterations or new work when not scheduled.

B. ROOM FINISH SCHEDULE

Room No. and Name		FLOOR		BASE	WALL	WAINSCOT	CEILING	REMARKS
100/ Women's Restroom	E X I S T			MAT	MAT	MAT	MAT FCC	
			N					
			E					
			S					
			W					
			C					
100/ Women's Restroom	N E W	QT-2	N	QT-3	P-2	QT-1	GWB/ P-2	
			E	QT-3	P-2	QT-1		
			S	QT-3	P-2	QT-1		
			W	QT-3	P-2	QT-1		
			C	-	-	-		
101/ Break Room	E X I S T		N					
			E					
			S					
			W					
			C	-				
101/ Break Room	N E W	SV-1	N	VB-1	P-2	-	P-2	
			E	VB-1	P-2	-		
			S	VB-1	P-2	-		
			W	VB-1	P-2	-		
			C	-	-	-		

Room No. and Name		FLOOR		BASE	WALL	WAINSCOT		CEILING		REMARKS
102 / Director's Room	E X I S T			MAT	MAT	MAT		MAT	FCC	
			N							
			E							
			S							
			W							
			C							
102 / Director's Room	N E W	CPT-1	N	VB-2	P-2	-				
			E	VB-2	P-2	-				
			S	VB-2	P-2	-				
			W	VB-2	P-2	-				
			C	-						
103 / Mech/ Elec Room	E X I S T	EFTR	N	EFTR		-		EFTR		
			E	EFTR		-				
			S	EFTR		-				
			W	EFTR		-				
			C							
103 / Mech/ Elec Room	N E W		N	EFTR	P-2	-		EFTR		
			E	EFTR	P-2	-				
			S	EFTR	P-2	-				
			W	EFTR	P-2	-				
			C	-						
104 / Office	E X I S T		N			-		EFTR		
			E			-				
			S			-				
			W			-				
			C							

Room No. and Name		FLOOR		BASE		WALL		WAINSCOT		CEILING		REMARKS
104 / Office Room	N E W	CFT-1		MAT		MAT		MAT		MAT	FCC	
			N	CFT-1		P-2		-				
			E	CFT-1		P-2		-				
			S	CFT-1		P-2		-				
			W	CFT-1		P-2		-				
			C	-								
105 / Lobby	E X I S T	EFTR	N					-				
			E					-				
			S					-				
			W					-				
			C									
105 / Lobby	N E W	QT-2	N	QT-3		P-2		-				
			E	QT-3		P-2		-				
			S	QT-3		P-2		-				
			W	QT-3		P-2		-				
			C	-								
106 / Men's Restroom	E X I S T		N									
			E									
			S									
			W									
			C									
106 Men's Restroom	N E W	QT-2	N	QT-3		P-2		QT-1				
			E	QT-3		P-2		QT-1				
			S	QT-3		P-2		QT-1				
			W	QT-3		P-2		QT-1				
			C	-								

Room No. and Name		FLOOR		BASE		WALL		WAINSCOT		CEILING		REMARKS
107 Janitor Closet	E X I S T	EFTR		MAT		MAT		MAT		MAT	FCC	
			N	EFTR				-		EFTR		
			E	EFTR				-				
			S	EFTR				-				
			W	EFTR				-				
			C									
107 Janitor Closet	N E W	EFTR	N	EFTR		P-2		-		EFTR		
			E	EFTR		P-2		-				
			S	EFTR		P-2		-				
			W	EFTR		P-2		-				
			C	-								

END OF SECTION 090600

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel studs wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 TERMINOLOGY

- A. Description of terms to be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead is defined as the underside of the floor or roof construction supported by beams, trusses, or bar joists.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project recycled content requirements.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (Rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Shop Drawings:

1. Typical metal stud and furring construction system including details around openings and corner details.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

- A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society For Testing And Materials (ASTM):
 1. A123/A123M-12 Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
 2. A653/A653M-11 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 3. C11-13 Terminology Relating to Gypsum and Related Building Materials and Systems
 4. C645-11a Non-Structural Steel Framing Members
 5. C754-11 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 6. C841-03(2008)c1 Installation of Interior Lathing and Furring
 7. C954-11 Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness

PART 2 - PRODUCTS

2.1 STEEL STUDS AND RUNNERS (TRACK)

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 1. Deflection Limit:
 - a. L/240 unless otherwise noted.
 - b. L/360 where Level 5 gypsum board finish is indicated, at tile backing panels, where plaster veneer is indicated, and elsewhere as indicated.
 2. Lateral Pressure: 5.0 psf. unless otherwise noted.

- B. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
- C. Protective Coating: ASTM A653, hot-dip galvanized, unless otherwise indicated.
- D. Provide not less than two cutouts in web of each stud, approximately 12 inches from each end, and intermediate cutouts on approximately 24 inch centers.
- E. Doubled studs for openings and studs for supporting concrete backer-board.
- F. Provide studs 12 feet or less in length in one piece.

2.2 FURRING CHANNELS

- A. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.3 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. Conform to ASTM C754, except as otherwise specified.
- B. Fasteners for steel studs thicker than 0.033-inch thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- C. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used instead of tie wire must have holding power equivalent to that provided by the tie wire for the specific application.
- D. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 0.0396-inch thick galvanized steel with corrugated edges.
- E. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.4 COMPONENT FINISH

- A. Provide framing components with Z180 (G60) minimum per ASTM A123.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this section.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 - 1. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where otherwise indicated. Continue framing over frames of doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- C. Install steel studs and furring in sizes and at spacing indicated.
- D. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- E. Frame door openings to comply with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Install two (2) studs at each jamb, unless otherwise indicated.
- F. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.3 TOLERANCES

- A. Fastening surface for application of subsequent materials: Not varying more than 1/8-inch from the layout line.
- B. Plumb and align vertical members within 1/8-inch.
- C. Level or align ceilings within 1/8-inch.

END OF SECTION 092216

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Installation of steel framing members for walls, partitions, furring, and Section 092216, NON-STRUCTURAL METAL FRAMING.
- B. Sealants: Section 079200, JOINT SEALANTS.

1.3 TERMINOLOGY

- A. Definitions and description of terms to be in accordance with ASTM C11, C840, and as specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Cornerbead and edge trim.
 - 2. Finishing materials.
 - 3. Gypsum board, each type.
- C. Shop Drawings:
 - 1. Typical gypsum board installation of all assemblies, showing corner details, edge trim details and the like.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

- A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

- A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. C11-13 Terminology Relating to Gypsum and Related Building Materials and Systems
 - 2. C475/C475M-12 Joint Compound and Joint Tape for Finishing Gypsum Board
 - 3. C840-11 Application and Finishing of Gypsum Board
 - 4. C954-11 Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness
 - 5. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 6. C1047-10a Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - 7. C1325-08b Fiber Mat Reinforced Cementitious Backer Unit
 - 8. C1396/C1396M-13 Gypsum Board
 - 9. C1658/C1658M Glass Mat Gypsum Panels
 - 10. D3273-12 Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board (Typical) - Mold and Moisture-Resistant: ASTM C1396, (Type X,) 5/8 inch thick unless shown otherwise.
- B. Gypsum Backing Board - Mold and Moisture-Resistant: ASTM C1396, 5/8 inch thick.
- C. Provide gypsum cores with a minimum of 95 percent post industrial recycled gypsum content. Provide paper facings with 100 percent post-consumer recycled paper content.

2.2 ACCESSORIES

- A. ASTM C1047, except form of 0.015 inch thick zinc coated steel sheet or rigid PVC plastic.

2.3 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.33 inch.

2.4 FINISHING MATERIALS AND LAMINATING ADHESIVE

- A. ASTM C475 and ASTM C840.
- B. Provide material free of antifreeze, vinyl adhesives, preservatives and biocides; VOC content within limits of stated performance requirements.
- C. Joint Tape: Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

- A. Extend gypsum board from floor to heights as follows, unless shown otherwise:
 - 1. Not less than 6 inches above suspended acoustical ceilings.
 - 2. At ceiling of suspended gypsum board ceilings.
 - 3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

- A. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- B. Provide and install moisture and mold-resistant glass-mat-faced interior gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in high humidity and wet areas or locations which might be subject to moisture exposure during construction.
 - 1. High humidity and wet areas include, but not limited to, at any wallboard furred to concrete or masonry construction, toilet rooms containing a shower.
- D. Install control joints in accordance with ASTM C840.
- E. Accessories:

1. Install the following accessories in accordance with ASTM C1047.

- a. Corner Beads.
- b. Edge Trim (casing beads).

3.3 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840.
- B. Use Level 5 finish for all finished areas open to public view; level 2 finish in utility, maintenance and service areas and level 1 in plenums, attics and other concealed areas.
- C. Follow manufacturer's fire testing reports where fire resistant construction is shown on drawings.

3.4 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.
- B. Patch holes or openings 1/2 inch or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 1/2 inch diameter, or equivalent size, with 5/8 inch thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non-decorated surface to provide fire protection equivalent to the fire rated construction.

END OF SECTION 092900

SECTION 093013

TILING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies porcelain and tile backer board.

1.2 RELATED WORK

- B. Sealing of joints where specified: Section 079200, JOINT SEALANTS.
- C. Color, texture and pattern of field tile and trim shapes, size of field tile, and color of grout specified: Section 090600, SCHEDULE FOR FINISHES.
- E. Metal and resilient edge strips at joints with new resilient flooring, and carpeting: Section 096516, RESILIENT SHEET FLOORING and Section 096800, CARPETING.

1.3 PERFORMANCE REQUIREMENTS

- A. Grout: Provide materials complying with SCAQMD Rule 1168; petroleum- and plastic-free grout.
- B. Finish Flooring: Provide Floor Score certification.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project recycled content requirements.

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Porcelain tile, each type, color, patterns and size.
 - 2. Wall (or wainscot) tile, each color, size and pattern.

3. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:

1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
2. Cementitious backer unit.
3. Dry-set Portland cement mortar and grout.
4. Divider strip.
5. Reinforcing tape.
6. Leveling compound.
7. Latex-Portland cement mortar and grout.
8. Commercial Portland cement grout.
9. Slip resistant tile.
10. Waterproofing isolation membrane.
11. Fasteners.
12. Marble threshold.

D. Certification:

1. Master grade, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
 - a. Commercial Portland cement grout.
 - b. Cementitious backer unit.
 - c. Dry-set Portland cement mortar and grout.
 - d. Reinforcing tape.
 - e. Latex-Portland cement mortar and grout.
 - f. Leveling compound.

1.6 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American National Standards Institute (ANSI):
 1. A108.1B-13 Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar

2. A108.11-10 Interior Installation of Cementitious Backer Units
 3. A108.5-10 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 4. A118.1-12 Dry-Set Portland Cement Mortar
 5. A118.4-12 Latex-Portland Cement Mortar
 6. A118.6-10 Standard Cement Grouts for Tile Installation
 7. A118.7-10 High Performance Cement Grouts for Tile Installation
 8. A118.10-08 Load-bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation
 9. A137.1-12 Ceramic Tile
- C. American Society for Testing and Materials (ASTM):
1. A185/A185M-07 Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
 2. C241/C241M-13 Abrasion Resistance of Stone Subjected to Foot Traffic
 3. C627-10 Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
 4. C954-11 Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
 5. C979/C979M-10 Pigments for Integrally Colored Concrete
 6. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Panel Products
 7. C1027-09 Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
 8. C1028-07e1 Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
 9. C1178 /C1178M-11 Coated Glass Mat Water-Resistant Gypsum Backing Panel
 10. C1325-08b Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 11. D4397-10 Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- D. Marble Institute of America (MIA): Design Manual 7.2-2011
- E. South Coast Air Quality Management District (SCAQMD):
1. SCAQMD Rule 1168 (1989/R2005) Adhesive and Sealant Applications
- F. Tile Council of North America, Inc. (TCNA):

1. Handbook for Ceramic, Glass, and Stone Tile Installation

PART 2 - PRODUCTS

2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
 1. Inspection procedures listed under the Appendix of ANSI A137.1.
 2. Abrasion Resistance Classification: Tested in accordance with values listed in Table 1, ASTM C1027.
 3. Slip Resistant Tile for Floors - Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance: Not less than 0.7 (wet condition) for bathing areas.
 4. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
 5. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - b. Do not coat unexposed tile surfaces.
- D. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 090600, SCHEDULE FOR FINISHES.
- F. Trim Shapes:
 1. Conform to applicable requirements of adjoining floor and wall tile.
 2. Use trim shapes sizes specified in Section 090600, SCHEDULE FOR FINISHES.

2.2 CEMENTITIOUS BACKER UNITS

- A. Use behind all wall.
- B. Comply to ASTM C1325.
- C. Joint materials for Cementitious Backer Units:
 1. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
 2. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A108.1.
 3. Joint material, including reinforcing tape, and tape embedding material, must be as specifically recommended by the backer unit manufacturer.

2.3 FASTENERS

- A. Screws for Cementitious Backer Units:
 - 1. Standard screws for gypsum board are not acceptable.
 - 2. Minimum 7/16 inch diameter head, corrosion resistant coated, with washers.
 - 3. ASTM C954 for steel 0.033 inch thick.
 - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 1/2 inch minimum diameter.

2.4 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

- A. Confirm to ASTM C1178 for optional system instead of cementitious backer units for areas other than showers.

2.5 SETTING MATERIALS OR BOND COATS

- A. Conform to TCNA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.1B.
- C. Latex-Portland Cement Mortar: ANSI A118.4.
 - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
 - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, re-dispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
- D. Dry-Set Portland Cement Mortar: ANSI A108.5 and ANSI A118.1; floor installation only.
 - 1. Contractor Option: Latex-Portland cement mortar.

2.6 GROUTING MATERIALS

- A. Coloring Pigments:
 - 1. Pure mineral pigments, lime-proof and nonfading, complying with ASTM C979.
 - 2. Addition of coloring pigments to grout must be by the manufacturer; job colored grout is not acceptable.
 - 3. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- B. Dry-Set Grout: ANSI A118.6 color as specified.
- C. Latex-Portland Cement Grout: ANSI A118.7 color as specified.

1. Unsanded grout mixture for joints 1/8 inch and narrower.
2. Sanded grout mixture for joints 1/8 inch and wider.

- D. Grout Sealer: Grout manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.7 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

2.8 METAL DIVIDER STRIPS

- A. Provide terrazzo type divider strips; heavy top type strip with 3/16 inch wide top and 1-1/2 inch long leg.
- C. Embedded leg perforated and deformed for keying to mortar.
- D. Aluminum or brass as specified in Section 090600, SCHEDULE FOR FINISHES.

2.9 WATER

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.10 CLEANING COMPOUNDS

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

2.11 FLOOR MORTAR BED REINFORCING

- A. ASTM A185 welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

2.12 WATERPROOF AND CRACK ISOLATION MEMBRANE

- A. Type: Fabric-reinforced, fluid-applied membrane.
- B. Provide manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated; include reinforcement and accessories recommended by manufacturer.

2.13 POLYETHYLENE SHEET

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: Six mils.
- C. Use sheet width to minimize joints.

2.14 MARBLE THRESHOLD

- A. Thickness: 3/8 inch rise with 1/4 inch bevels.
- B. Width: Full length of door opening.
- C. Color: White grey polished.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain environmental temperature and humidity within all manufacturers' recommendations.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1 in 1/4 inch in 10 feet from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1/8 inch in 10 feet where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 1 in 1/4 inch in eight feet from required plane where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1/8 inch in eight feet where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

- A. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown.
 - b. Float finish except finish smooth for elastomeric waterproofing.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
 3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
 4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- B. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown.
 2. Install mortar bed sloped to drains not less than 1% minimum and 2% maximum.
 3. Screed for slope to drain and float finish.
 4. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.
- C. Additional preparation of concrete floors for tile set with waterproof and crack isolation membrane to be in accordance with the manufacturer's printed instructions.
- D. Walls:
1. In restroom other wet areas cover studs with polyethylene sheet.
 2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
 3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
 4. Apply waterproof membrane in accordance with manufacturer's printed instructions.
- E. Existing Floors and Walls:
1. Remove all foreign material from slab intended for tiling. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.

3.5 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD

- A. Install in accordance with manufacturer's instructions.

3.6 METAL DIVIDER STRIPS

- A. Install metal divider strips in floor joints between quarry tile floors and between tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise.
- B. Set divider strip in mortar bed to line and level centered under doors or in openings.

3.7 CERAMIC TILE - GENERAL

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCNA Installation Guidelines:
- C. Installing Mortar Beds for Floors:
 - 1. Install mortar bed to not damage waterproof or crack isolation membrane; 1-1/2 inch minimum thickness.
 - 2. Install floor mortar bed reinforcing centered in mortar fill.
 - 3. Screed finish to level plane or slope to drains where shown, float finish.
 - 4. For thin set systems cure mortar bed not less than seven days; do not use curing compounds or coatings.
 - 5. For tile set with Portland cement, paste over plastic mortar bed coordinate to set tile before mortar bed sets.
- D. Setting Beds or Bond Coats:
 - 1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile with latex-Portland cement mortar over cured mortar bed except as specified otherwise.
 - 2. Set trim shapes in same material specified for setting adjoining tile.
- E. Workmanship:
 - 1. Comply with all ANSI 108, 118, 136, and 137 requirements.

2. Joints:

- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
- b. Make joints 1/16 inch wide for glazed wall tile and mosaic tile work.
- c. Make joints in quarry tile work not less than 1/4 inch nor more than 3/8 inch wide; finish joints flush with surface of tile.
- d. Make joints in paver tile, porcelain type; maximum 1/8 inch wide.

3. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

- a. Tile wall installations in wet areas.
- b. Tile wall installations composed of tiles 8 by 8 inches or larger.

3.8 GROUTING

A. Grout Type and Location: Refer 09 06 00, SCHEDULE OF FINISHES.

B. Workmanship:

- 1. Install and cure grout in accordance with the applicable standard.
- 2. Portland Cement grout: ANSI A108.1.
- 3. Epoxy Grout: ANSI A108.1.
- 4. Dry-set grout: ANSI A108.1.

3.9 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 079200, JOINT SEALANTS.

B. TCNA details EJ 171.

3.10 CLEANING

- A. Thoroughly sponge and wash tile.
- B. Polish glazed surfaces with clean dry cloths.
- C. Methods and materials used must not damage or impair appearance of tile surfaces.
- D. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- E. Clean tile as recommended by the manufacturer of the grout and bond coat.
- F. Apply grout sealer.

3.11 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 3/8 inch thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.12 TESTING FINISH FLOOR

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

3.13 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Ceramic Tile Installation: TCNA F112 and ANSI A108.1B; cement mortar bed (thickset) bonded to concrete.
 - a. Bond Coat for Cured-Bed Method: Portland cement mortar.
 - b. Grout: Sand-Portland cement grout.
- B. Interior Wall Installations, Masonry or Concrete:
 - 1. Ceramic Tile Installation: TCNA W202; thin-set mortar.
 - a. Bond Coat for Cured-Bed Method: Portland cement mortar.
 - b. Grout: Sand-Portland cement grout.
- C. Interior Wall Installations, Wood or Metal Studs or Furring:
 - 1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thin-set mortar on glass-mat, water-resistant gypsum backer board.
 - a. Thin-Set Mortar: Portland cement mortar.
 - b. Grout: Sand-Portland cement grout.

END OF SECTION 093013

SECTION 096513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the installation of resilient base.

1.2 RELATED WORK

- A. Color and texture: Section 090600, SCHEDULE FOR FINISHES.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials and recycled content requirements.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Base manufacturer's recommendations for adhesives.
 - 2. Application and installation instructions.
- C. Samples:
 - 1. Base: 6 inches long, each type and color.

1.5 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.6 STORAGE

- A. Follow manufacturer's instruction for storage and protection from damage by handling and construction operations before, during, and after installation.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. F1344-12e1 Rubber Floor Tile
 - 2. F1859-12 Rubber Sheet Floor Covering without Backing
 - 3. F1860-12 Rubber Sheet Floor Covering with Backing
 - 4. F1861-08(2012)e1 Resilient Wall Base
 - 5. F2169-12 Resilient Stair Treads Base

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

- A. ASTM F1861, 1/8 inch thick, 4 inches high, Type TP (Thermoplastic Rubber).
- B. Where carpet occurs, use Style A-straight at carpet locations; Style B-cove other locations.

2.3 ADHESIVES

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Provide low VOC products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials above 70°F, for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 70°F and 80°F for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the COR.
- B. Submit proposed installation deviation from this specification to the COR indicating the differences in the method of installation.
- C. The COR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.
 - 1. Do not use solvents to remove adhesives.
 - 2. Prepare substrate as specified.

3.3 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 24 inches length.
 - a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:

1. Score back of outside corner.
2. Score face of inside corner and notch cove.

D. Roll base for complete adhesion.

3.4 CLEANING AND PROTECTION

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
 1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

END OF SECTION 096513

SECTION 096516
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes resilient sheet flooring.
- B. Installation of vinyl sheet flooring including following:
 - 1. Heat welded seams.

1.2 RELATED WORK

- A. Concrete Floors: Section 033000, CAST-IN-PLACE CONCRETE.
- B. Color, Pattern and Texture: Section 090600, SCHEDULE FOR FINISHES.
- C. Resilient Base: Section 096513, RESILIENT BASE AND ACCESSORIES.

1.3 PERFORMANCE REQUIREMENTS

- A. VOC Emissions:
 - 1. Provide low VOC products with Green Seal Certification to GS-36 and description of the basis for certification.
 - 2. Submit manufacturer's certification that products comply with SCAQMD Rule 1168.
- B. Finish Flooring: Provide FloorScore certification.

1.4 QUALITY CONTROL and Qualifications

- A. The Contracting Officer will approve products or service of proposed manufacturer, suppliers, and installers
- B. Submit certification that:
 - 1. Heat welded seaming is manufacturers prescribed method of installation.
 - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.

3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet floor coverings must meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer must certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

1.5 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials and recycled content requirements.

1.6 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide documentation of conformance with performance requirements of this section.
- C. Manufacturer's Literature and Data:
 1. Description of resilient material and accessories to be provided.
 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
 3. Application and installation instructions.
- D. Samples:
 1. Sheet material, 1-1/2 inch by 12 inch, of each color and pattern.
 2. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
 3. Edge strips: 6 inches long each type.

1.7 PROJECT CONDITIONS

- A. Maintain temperature of floor materials and room, where work occurs, above 65° F and below 100° F for 48 hours before, during and for 48 hours after installation. Maintain room temperature above 55° F, after previous period.

- B. Construction in or near areas to receive flooring work must be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building must be permanently enclosed. Schedule construction so that floor receives no construction traffic after completed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Follow manufacturer's instructions for storage and protection from damage by handling and construction operations
- B. Move sheet floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing Materials (ASTM):
 - 1. E648-10e1 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
 - 2. E662-13b Specific Optical Density of Smoke Generated by Solid Materials
 - 3. F710-11 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring
 - 4. F1303-04(2009) Sheet Vinyl Floor Covering with Backing
 - 5. F1859-12 Rubber Sheet Floor Covering without Backing
 - 6. F1869-11 Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
 - 7. F2034-08 Sheet Linoleum Floor Covering
 - 8. F2170-11 Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. South Coast Air Quality Management District (SCAQMD)
- D. Resilient Floor Covering Institute (RFCI):
 - 1. Recommended Work Practices for Removal of Resilient Floor Coverings

1.10 SCHEDULING

- A. Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work must be complete and dry before installation. Complete mechanical, electrical, and other work above ceiling line prior to work of this section. Heating, ventilating, and air conditioning systems must be installed and operating in order to maintain temperature and humidity requirements.

1.11 WARRANTY

- A. Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period to be extended to include two (2) years.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOORING

- A. ASTM F1303, Type II, Grade 1, non-asbestos formulated without backing; foam backed sheet flooring is not acceptable.
- B. Minimum nominal thickness 0.08 inch; 6 feet minimum width.
- C. Color and pattern of sheet flooring of the same production run.

2.2 WELDING ROD

- A. Product of floor covering manufacturer in color matching field color of sheet covering.

2.3 APPLICATION MATERIALS AND ACCESSORIES

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix, with condition to be corrected determining type of underlayment selected for use.

2.4 ADHESIVES

- A. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use.

2.5 BASE CAP STRIP AND COVE STRIP

- A. Extruded vinyl compatible with the sheet flooring.
- B. Cap strip "J" shape with feathered edge flange approximately one inch wide; top designed to receive sheet flooring with 1/2 inch flange lapping top of flooring
- C. Cove strip 2-3/4 inch radius.

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.7 PRIMER (FOR CONCRETE SUBFLOORS)

- A. As recommended by the adhesive or sheet flooring manufacturer.

2.8 EDGE STRIPS

- A. Extruded aluminum, mill finish, mechanically cleaned.
- B. 1-1/8 inch wide, 1/4 inch thick, bevel one edge to 1/8 inch thick.
- C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 9 inches on center in between.

2.9 SEALANT

- A. As specified in Section 079200, JOINT SEALANTS.
- B. Compatible with sheet flooring.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of sheet flooring above 65 °F, for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 65°F, for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 65°F.
- D. Building must be permanently enclosed.

- E. Wet construction in or near areas to receive sheet flooring must be complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
 - 1. Examine surfaces to receive resilient sheet flooring with installer and identify areas which are unacceptable for installation of flooring material. Installer to advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation cannot proceed until unsatisfactory conditions have been corrected.
 - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
 - 1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 3lb of water/1000 sq. ft. in 24 hours.

2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.
- H. Preparation includes the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. Coordinate with Asbestos Abatement Section if asbestos abatement procedures will be involved.
- I. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Do not use solvents.

3.3 INSTALLATION OF FLOORING

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 6 inches away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Finish resilient sheet flooring level with other abutting flooring material floors.
- F. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Inform the COR of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.
 1. Air pockets or loose edges will not be accepted.
 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
 1. Locate edge strips under center lines of doors unless otherwise indicated.

2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.

3.4 WELDING

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding includes routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Provide finished flush surface across joint, free from voids, recessed or raised areas, on completion of welding.
- D. Fusion of Material: Joint fused a minimum of 65 percent through thickness of material and meeting specified characteristics for flooring.

3.5 CLEANING

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and seal materials per flooring manufacturer's written recommendations.
- D. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, COR will inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.6 PROTECTION

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the COR.

- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

END OF SECTION 096516

SECTION 096800

CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies modular carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Color and texture of carpet and edge strip: Section 090600, SCHEDULE FOR FINISHES.
- B. Resilient Wall Base: Section 096513, RESILIENT BASE AND ACCESSORIES.

1.3 PERFORMANCE REQUIREMENTS

- A. Flammability and Critical Radiant Flux Requirements: Provide carpet with a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E648.
- B. Tuft Bind: Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 10 pound average force for loop pile.
- C. Colorfastness to Crocking: Comply dry and wet crocking with AATCC 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.
- D. Colorfastness to Light: Comply colorfastness to light with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.
- E. Colorfastness to Water: Comply colorfastness to water with AATCC 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.
- F. Delamination Strength: Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs./inch.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.5 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials and recycled content requirements.

1.6 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
 - 1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserva/tools/cpg/products/>.
 - 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 - 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.7 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
 - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
 - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
 - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
 - 1. Carpet: "Production Quality" samples 12 x 12 inches of carpets, showing quality, pattern and color specified in Section 090600, SCHEDULE FOR FINISHES.
 - 2. Floor Edge Strip (Molding): 6 inches long of each color and type specified.

3. Base Edge Strip (Molding): 6 inches long of each color specified.

- D. Shop Drawings: Installers layout plan showing seams and cuts for carpet module.
- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.8 DELIVERY AND STORAGE

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well-ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 60 degrees F for 2 days prior to installation.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F for 2 days before installation, during installation and for 2 days after installation. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract. Don not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation; complete other work which would damage the carpet prior to installation of carpet.

1.10 WARRANTY

- A. Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

1.11 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American National Standards Institute (ANSI)/NSF International (NSF):
 - 1. NSF/ANSI/140-07 Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):

1. 16.1-12 Colorfastness to Light
2. 107-13 Colorfastness to Water
3. 134-11 Electric Static Propensity of Carpets
4. 165-08 Colorfastness to Crocking: Textile Floor
Conerings-AATCC Crockmeter Method

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

1. D3278-96(2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
2. D5116-10 Determinations of Organic Emissions from Indoor Materials/Products
3. E648-10e1 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
4. F1869-11 Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
5. F2170-11 Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

E. The Carpet and Rug Institute (CRI):

1. Carpet Installation Standard (2011)

PART 2 - PRODUCTS

2.1 CARPET

A. General:

1. Provide product as indicated on drawings.
2. VOC Limits: Use carpet and carpet adhesive that comply with the following limits for VOC content when tested according to ASTM D 5116:
 - a. Carpet, Total VOCs: 0.5 mg/sq.m x hr.
 - b. Carpet, 4-PC (4-Phenylcyclohexene): 0.05 mg/sq.m x hr.
 - c. Carpet, Formaldehyde: 0.05 mg/sq.m x hr.
 - d. Carpet, Styrene: 0.4 mg/sq.m x hr.
 - e. Adhesive, Total VOCs: 10.00 mg/sq.m x hr.
 - f. Adhesive, Formaldehyde: 0.05 mg/sq.m x hr.
 - g. Adhesive, 2-Ethyl-1-Hexanol: 3.00 mg/sq.m x hr.

B. Certification: Platinum level of NSF/ANSI 140 and CRI's "Green Label Plus" program.

C. Color, Texture, and Pattern: As specified in Section 090600, SCHEDULE FOR FINISHES.

2.2 ADHESIVE AND CONCRETE PRIMER

- A. Water-resistant, mildew resistant, non-staining to suit products and subfloor conditions indicated to comply with flammability requirements for installed carpet as recommended by the carpet manufacturer.
- B. Comply with ASTM D3278.

2.3 SEAMING TAPE

- A. Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- B. VOC content of any seam sealant must be less than 50 grams/liter; do not use sealants that contain 1,1,1-trichloroethane or toluene.

2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Comply with manufacturer's recommendations to prepare substrates indicated to receive carpet.
- B. Remove subfloor coatings, including curing compounds and other substances that are incompatible with adhesives.
- C. Broom and vacuum clean subfloors to be covered with carpet. After cleaning, examine subfloor for moisture, alkaline salts, carbonation, or dust.
- D. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
 - 1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours.

2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.

- E. Concrete Subfloor Preparation: Apply concrete slab primer according to manufacturer's directions where recommended by carpet manufacturer.

3.2 MODULAR TILE INSTALLATION

- A. Install modular tiles with permanent vinyl-compatible adhesive and snugly jointed together. Lay tiles in the same direction with accessibility to the subfloor where required.

3.3 EDGE STRIPS installation

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor per manufacturer's recommendations.

3.4 PROTECTION AND CLEANING

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

END OF SECTION 096800

SECTION 099100

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.

1.2 RELATED WORK

- B. Contractor Option: Prefinished flush doors with transparent finishes: Section 081400, WOOD DOORS.
- C. Type of Finish, Color, and Gloss Level of Finish Coat: Section 090600, SCHEDULE FOR FINISHES.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials requirements.

1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
 - 1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/conserved/tools/cpg/products/>.
 - 2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 - 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. 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. Samples:
 - 1. After painters' materials have been approved and before work is started submit samples showing each type of finish and color specified.
 - 2. Samples to show color: Composition board, 6 inch by 6 inch.
- D. Manufacturers' Certificates indicating compliance with specified requirements:
 - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.6 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 65 and 85 degrees F.

1.7 1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
 - 1. ACGIH TLV-BKLT-2009 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - 2. ACGIH TLV-DOC-2009 Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. Master Painters Institute (MPI):
 - 1. No. 43-13 Interior Satin Latex, MPI Gloss Level 4
 - 2. No. 50-13 Interior Latex Primer Sealer
 - 3. No. 51-13 Interior Alkyd, Eggshell, MPI Gloss Level 3
 - 4. No. 52-13 Interior Latex, MPI Gloss Level 3 (LE)
 - 5. No. 54-13 Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
 - 6. No. 134-13 Primer, Galvanized, Water Based

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Tape:
 - 1. Pigmented vinyl plastic film in colors as specified in Section 090600, SCHEDULE FOR FINISHES or specified.
 - 2. Pressure sensitive adhesive back.
 - 3. Widths as shown.
- B. Interior/Exterior Latex Block Filler: MPI 4.
- C. Interior Satin Latex: MPI 43.
- D. Interior Low Sheen Latex: MPI 44.
- E. Interior Primer Sealer: MPI 45.
- F. Interior Enamel Undercoat: MPI 46.
- G. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- H. Interior Latex Primer Sealer: MPI 50.

- I. Interior Alkyd, Eggshell: MPI 51
- J. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- K. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- L. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

2.2 PAINT PROPERTIES

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

2.3 REGULATORY REQUIREMENTS

- A. Paint materials must conform to the restrictions of the local Environmental and Toxic Control jurisdiction or the requirements of this section, whichever is most stringent.
 - 1. Lead-Based Paint:
 - a. Lead based paint is not permitted to be used.
 - b. For lead-paint removal, see Section 028333.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 2. Asbestos: Materials must not contain asbestos.
 - 3. Chromate, Cadmium, Mercury, and Silica: Materials must not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 - 4. Human Carcinogens: Materials must not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
 - 5. Use high performance acrylic paints in place of alkyd paints, where possible.
 - 6. VOC content for solvent-based paints must not exceed specified performance requirement; aromatic hydro carbons contained in solvent-based paints must not exceed one percent by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.

1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
 - a. Less than 5 degrees F above dew point.
 - b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer.
2. Do not exceed application conditions recommended by the manufacturer.
3. Maintain interior temperatures until paint dries hard.
4. Do no exterior painting when it is windy and dusty.
5. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
6. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:

1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.

4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 040513, MASONRY MORTARING, and Section 040516, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 3 pounds of zinc sulfate crystals to 1 gallon of water, allow to dry three days and brush thoroughly free of crystals.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

G. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 1-inch in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

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

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.

- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
- E. Finish surfaces to show solid even color, free from runs, lumps, brush marks, 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.

3.5 PRIME PAINTING

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel. Apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Concrete Masonry Units except glazed or integrally colored and decorative units:
 - 1. MPI 4 (Block Filler) on interior surfaces.

3.6 EXTERIOR FINISHES

- A. Apply following finish coats where specified in Section 090600, SCHEDULE FOR FINISHES.
- B. Finish: Medium.

3.7 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 090600, SCHEDULE FOR FINISHES.
- B. Gypsum Board:
 - 1. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)).
- C. Masonry and Concrete Walls:
 - 1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
 - 2. Two coats of MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)).

3.8 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non-compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of Polyurethane, Moisture Cured, Clear Flat (PV).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with Knot Sealer before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 090600, 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.

3.10 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.

APPENDIX:

- A. Coordinate the following abbreviations used in Section 099100, PAINTING, with other Sections, especially Section 090600, SCHEDULE FOR FINISHES and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or Coating	Abbreviation
Acrylic Emulsion	AE (MPI 10 – flat/MPI 11 – Semigloss/MPI 119 – Gloss)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP
Cementitious Paint	CEP (TT-P-1411)
Exterior Latex	EL (MPI 10/11/119)
Exterior Oil	EO (MPI 9 – Gloss/MPI 8 – Flat/MPI 94 – Semigloss)
Fire Retardant Coating (Clear)	FC (Intumescent Type)
Heat Resistant Paint	HR
Latex Emulsion	LE (MPI 53, Flat/MPI 52, Eggshell/MPI 54, Semigloss/MPI 114, Gloss Level 6)
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Plastic Floor Coating	PL
Polyurethane Varnish	PV
Rubber Paint	RF (CID-A-A-3120 – Paint for Swimming Pools (RF))
Water Paint, Cement	WPC (CID-A-A-1555 – Water Paint, Powder)
Wood Stain	WS

END OF SECTION 099100

SECTION 101400
EXTERIOR SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the Work required to furnish and install the indicated and specified exterior cemetery site signage systems, including, but not limited to, posts and concrete collars.
- B. Signs shall be products of manufacturers regularly engaged in manufacturing signs of types specified.
- C. Signs included are as follows:
 - 1. Information/Regulation.
 - 2. Post and Panel:
 - a. Two lines of text.

1.2 RELATED WORK

- A. Post Setting Excavation, Material, Backfill, Section 312000, EARTH MOVING.
- B. Concrete Bases for posts: Section 033053, CAST-IN-PLACE CONCRETE
- C. Cast Stone Masonry Posts: Section 047200 CAST STONE MASONRY.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Sign manufacturer shall regularly and presently manufacture signs similar to those specified as one of their principal products. Sign manufacturer shall submit qualifications demonstrating a minimum of three years of experience manufacturing the qualifying signs and shall, if possible, demonstrate the successful manufacturing of exterior site signs installed at one or more State or National Veteran Cemeteries.

1.4 SUSTAINABILITY REQUIREMENTS

- A. Materials in this Section may contribute towards Contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project local/regional materials, recycled content, and certified wood requirements.

- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, please visit <http://www.biopreferred.gov/>.

1.5 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Submit 3 sets. One set to the Contractor, one set to the COR and one set to the A/E Designer. The Contractor shall provide submittal documents that indicate each of the sign types, mounting types and materials to be used for the various combinations to be used for this Project. Submittal materials shall indicate the location(s) for the various sign types including their mounting.
 - 1. Post & panel sign mock-up, not less than 8" by 10", shall be constructed and submitted, showing typical color, texture and fonts shown on Contract Drawings. Mock-up shall show typical fabrication methods, including panel to post(s) connection. Sample shall be capable of demonstrating how the face panels can be removed, for repair or replacement, from the mounted location between the posts, for a two post sign system. Mock-ups of all other sign systems for post mounted signs shall be capable of demonstrating how the sign panels are to be removed and replaced from the posts, or mounting support system attached to the posts, without moving the posts. Top surface of the sign panel shall not contain screws or metal joints that could trap or allow water to enter the sign assembly.
 - 2. Aluminum samples showing full range of finish colors available.
 - 3. Color samples of each color, 6 inches x 6 inches. Show anticipated range of color and texture.
 - 4. Sample of typeface in a typical full size layout.
 - 5. Directory panels and frames, with letters and symbols, each type.
- C. Shop Drawings: All signs showing material, finish, colors, size of members, details of construction, letter spacing, size and type, numbers, symbols or image details, and mounting details. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes. The details of construction shall clearly show how the sign is to be disassembled to replace the entire sign or just one side panel, where applicable.
- D. Full size layout in full color of the Sign Panels.
- E. Manufacturer's Literature and Data (Mark literature to indicate items proposed to be furnished): Signs, each type. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions. Manufacturer's recommendations for mounting the Sign Panels shall be provided.
- F. Manufacturer's Certificates: Provide certification from the coating installer, indicating exactly what they did to prepared the aluminum as and applied the coating(s) to the

specified thickness. The certification shall indicate that the coating has been installed according to specific and identified Contract Specifications and/or approved submittal materials so it is absolutely clear what was done.

- G. Samples shall be submitted of sign(s) of sufficient size to show the full scaled features of each of the sign types, including frame, mounting, panels, panel mounting, sign mounting facilities, lettering, color and texture. All aluminum signs shall have full exterior Powder Coated finish, with color and quality as specified herein.

1.6 DELIVERY AND STORAGE

- A. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- B. Deliver signs only when the site, mounting materials, and equipment are ready for installation Work to proceed.
- C. Store products in dry condition inside enclosed facilities.

1.7 WARRANTY

- A. Sign Manufacturer shall guarantee the text and symbols applied to the powder coated aluminum for an extended warranty period of five years following final acceptance of the Project. A warranty inspection shall be performed no later than one year following Project final acceptance and the Contractor shall be responsible for removing and replacing any text and/or symbols identified, during the inspection, that have started to fade, chip, peel or otherwise fail. The Contractor shall remove and replace any sign panel faces with new, where the applied lettering, or the paint system itself, is causing damage to, or failure of, the paint system. All work to produce replacement sign panels with new lettering and/or paint system shall be provided at no cost to the Government, as part of the Warranty Work for the signage system.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Architectural Barriers Act - 1968.
- C. Federal Highway Administration:
 - 1. Manuals on Uniform Traffic Control Devices for Street and Highways
- D. American Society for Testing and Materials (ASTM):

1. B209-10 Aluminum and Aluminum-Alloy Sheet and Plate
 2. B221-12 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 3. B449-93(2010)e1 Standard Specification for Chromates on Aluminum
- E. American Architectural Manufacturer's Association (AAMA):
1. AAMA 2605-05 Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum extrusions and Panels.
- F. Federal Specifications (Fed. Spec.):
1. MIL-P-8184F Plastic Sheet, Acrylic, Modified.
 2. A-A-59502 Plastic Sheet, Polycarbonate
- G. VA Signage Design Guide: Section 12 National Cemetery Signs - <http://wbdg.org/ccb/VA/VASIGN/signage12.pdf>

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: Fed. Spec. QQA-200-9, alloy 6063-T5, applicable as material.
- B. Aluminum, Sheet and Plate: ASTM B209.
- C. Aluminum, Extrusions and Tubing: ASTM B221.
- D. Zinc Chromate Primer: Fed. Spec. TT-P-645.

2.2 SIGNAGE GENERAL

- A. Signs shall be of type, size and design shown on the Drawings and as specified.
- B. Signs shall be complete with lettering, framing, and related components for a complete sign installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale Drawings for dimensions. Verify all dimensions and conditions shown by the Drawings. COR is to be notified of any discrepancy in Drawing(s), in field directions or conditions, and/or of any changes required for any such related construction details.

- E. The Sign Contractor, by commencing Work of this Section, assumes overall responsibility, as part of his warranty of Work, to assure that assemblies, components and parts shown or required within the Work of the Section, comply with the Contract Documents. Warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.3 SIGN STANDARDS

- A. Typography:
 - 1. Type Style: Optima Bold. Initial caps and lower case as indicated in Drawings, unless otherwise indicated.
 - 2. Letter spacing: See graphic standards on Drawings.
 - 3. All text and symbols to be provided in size, colors, typefaces and letter spacing indicated. Text shall be a true, clean, accurate reproduction of typeface(s) indicated. Text indicated in Drawings is for layout purposes only. Text to be installed on specific signs shall be as submitted, reviewed and finally approved in Shop Drawings processed as submittal materials. Final message to be approved by COR.
- B. Sign Colors and Finishes: As specified in this Specification Section and approved in the Shop Drawing & Submittal process.
 - 1. Aluminum sign system color scheme shall have the background color of sign panels and the aluminum tubing as powder coated matching cast bronze.

2.4 SIGNS TYPES

- A. General: The exterior sign system shall be comprised of sign type families that are derived from the 10 Types developed in Chapter 12 - National Cemetery Signs, of the VA Signage Design Guide (SDG). The sign designations used herein follow those in the SDG. An example sign designation, to identify what each of the elements is designated to represent is "NC-07.01 A - m1". "NC" Designates a National Cemetery sign. "07" the two digit numbers identify a particular sign type. "01" the two digit number following the period identifies a specific sign size within the sign type. "A" the letter designates a specific sign configuration, version and/or layout for graphics. "m1" the letter and number designates the post family and style. "c1" denotes concrete family with square insert style; "c2" denotes concrete family with round insert style; "m1" denotes metal family with square style; and "m2" denotes metal family with rectangular style. All of the above is duplicated herein, originally from the graphical indications in the SDG. The basic sign designations for this Project are indicated as follows:
 - 1. NC-01 - Information/Regulations Signs, 2'-0" by 3'-0" size.
 - 2. NC-04 – Post and Panel Signs, Two Lines of Text, 1'-0" by 3'-0" size.

- B. Location, layout and construction details for the all of the Project exterior signs shall be found in the Construction Drawings. Refer to the signage details for the specific sign panel sizes, text and graphic sizes as well as the layout and content for the text and images for the respective individual signs.

2.5 TEXT AND GRAPHICS

- A. There are multiple Message Layout types for some of the different size signs within the same type of sign. See the Construction Drawings for the specifics of the locations for the signs, as well as the size, types, materials and messages for the individual signs for the Project.
 - 1. Surface applied letters, numbers and graphics shall be of a published quality and life expectancy equal to or exceeding that for reflective white opaque Engineering Grade 3M™ Scotchlite™ vinyl, unless otherwise noted. Color shall be selected from the manufacturer's standard color selection, during the submittal process. Font Type Style shall be as indicated in Paragraph "SIGN STANDARDS" as approved during the submittal process.
- B. All text and graphics for the exterior signage shall be provided in detailed submittal information. Each sign face shall be represented in scaled drawings, with exact fonts, letter style, letter spacing, and graphics being shown. Only signs and/or sign faces approved in the submittal process shall be manufactured.

2.6 FABRICATION

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 100 °F, without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form Work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members shall be true. Assemble so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces shall be smooth flat and without oil-canning, free of rack and twist. Maximum variation from true plane of surface shall be plus or minus 1/64 inch. Restore texture to filed or cut areas.
- F. Level or straighten wrought Work. Members shall have sharp lines and angles and smooth surfaces.

- G. Extruded members to be free from extrusion marks. Members shall have square turns and corners sharp, and curves shall be true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, peeling, foreign matter and other imperfections.
- J. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. All contact surfaces fit tight and even without forcing or warping components.
- K. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- L. Completed sign installations shall not have any exposed openings so insect nesting inside of signs will be prevented.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the COR and forwarded to Contractor.
- N. Final sign fabrication shall not proceed until samples and shop drawings detailing the sign system as it will be installed, have been submitted and approved during the submittal process.

2.7 PROTECTION OF ALUMINUM

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze or other metals compatible with aluminum by one of the following:
 - 1. Painting the dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
 - 2. Placing an approved caulking compound, or a non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, or other masonry materials with bituminous paint or zinc chromate primer.

2.8 DOUBLE-POST-PANEL SIGNS

- A. Post and Panel Signs: Furnish the standard post style for each of the Post and Panel Signs, as designated in the Drawings.
 - 1. Concrete post signs:

- a. The posts shall be precast concrete with the face for mounting the metal frame and panel(s) being smooth and flat. The precast concrete posts shall be of the required height (to be imbedded in the ground and extending above finished grade as indicated on the Drawings), and shall be 5 ½ inches x 5 ½ inches with the concrete detailing as indicated on the Drawings. Concrete posts are to be manufactured according to the concrete Specifications for Cast Stone Masonry, detailed as indicated. The precast concrete posts shall be installed and the sign panels mounted as indicated in the Drawings, or as approved in the submittal materials, see paragraph below. The Concrete post signs shall be installed at the locations indicated on the Drawings.
- b. The minimum size for the tubular aluminum frame system, if not indicated in the Drawings, shall be 1-inch x 1-inch x 1/8-inch with the 1/8-inch aluminum panels anchored to the tubing, with all corners mitered and welded and ground smooth. When the sign panel system is mounted to the posts, there shall be no openings for insects to enter. Mounting holes for attaching the sign panel and frame to the posts shall be pre-drilled before the coating system is applied. The entire sign panel and frame system shall be coated with the submitted and approved powder coating system, as indicated herein or on the Drawings. The sign panels shall be secured to the frame system with tamperproof screws and each panel face shall be removable, without removing the sign system from the posts.
- c. Insulating sleeves, gaskets, bolts and concrete anchors shall be provided and signs anchored to sign posts generally as indicated on the Drawings and specifically as submitted and approved on the shop drawings as meeting or exceeding the Drawing requirements.

2.9 CONCRETE COLLARS

- A. Provide concrete collars. The requirements for the collars are as follows:
Reinforced and free floating, concrete not in contact with the element.
 1. As detailed on the Drawings.
 2. Submitted and approved during the submittal process
 3. Separated from the element with expansion joint material the full depth of the concrete.
 4. Closed steel rebar, with overlap at joint, 2 inches minimum distance from surrounding earth.
 5. Minimum No. 3 diameter rebar as enclosing the element or elements approximately 2 inches inside the perimeter of the concrete.
 6. Cast-in-place concrete shall be same as for other flatwork elements.
 7. Construct the collars to be 1 inch above finished grade at the junction with the lawn, and with a slope up toward the element(s) and or middle, for drainage, of 1/2 inch to 3/4 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set Work accurately, in alignment and where shown. Signs shall be plumb, level, free of rack and twist and set parallel or perpendicular as required to line and plane the surface.
- B. Signs shall be installed with direct burial of post into concrete or as shown on Contract Drawings. Depth of posts shall be such that the bottom of the concrete surrounding the posts is at least below the frost, or as indicated in the Drawings, whichever is the greater depth.
- C. Protect aluminum in contact with dissimilar metals or mortar as specified in Article PROTECTION OF ALUMINUM.
- D. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors or sleeves to be built into construction. Provide temporary bracing for such items until permanent anchors are set.
- E. Provide anchoring devices and fasteners as shown and as necessary for securing signs to construction as specified.
- F. Verify that behind or beneath each sign location there are no utility lines, or other buried infrastructure elements, that will be affected by installation of signs. Any damage during installation of signs to utilities, or other buried infrastructure will be the sole responsibility of the Contractor to correct and repair.
- G. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.
- H. Furnish and install concrete collars, with reinforcing to prevent cracking as well as expansion joints around the posts, or other elements of this Section installed in the lawn areas, to allow for movement. The collars shall be set so they are parallel to the finished grade around the sign posts, so mowers can drive around them without hitting the concrete, or going into a depression.
- I. Sign message panels shall be mounted using tamper-proof mechanical fasteners that are coated and colored to match the message panels.
- J. Mounting details and materials shall be provided as samples during the submittal process, and complete demonstration of all of the installation features, materials and methods shall be provided during the submittal process.

3.2 CLEANING

- A. After installation, all items shall be cleaned as recommended by the manufacturer and protected from damage until completion of the Project.

3.3 PROTECTION

- A. Protect finished surfaces from damage during fabrication, erection and after completion of the Work.

END OF SECTION 101400

SECTION 101405
INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior signage for rooms, directional signs, and code required signs.

1.2 MANUFACTURER'S QUALIFICATIONS

- A. Provide evidence that the sign manufacturer regularly and presently manufacture signs similar to those specified in this section as one of their principal products.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013300, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit two sets; one set of samples will be retained by COR, other returned to Contractor.
 - 1. Sign Panel, actual size with letters.
 - 2. Color samples of each color, 6 inches x 6 inches. Show anticipated range of color and texture.
 - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
 - 1. Show the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
 - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Provide sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scale for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon.
- B. Protect materials from damage.
- C. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- D. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- E. Store products in dry condition inside enclosed facilities.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Military Specifications (Mil. Spec.):
 - 1. MIL-PRF-8184F Plastic Sheet, Acrylic, Modified
 - 2. MIL-P-46144C Plastic Sheet, Polycarbonate

1.6 MINIMUM SIGN REQUIREMENTS

- A. Permanent Rooms and Spaces:
 - 1. Tactile and Braille Characters, raised minimum 1/32 inch; characters must be accompanied by Grade 2 Braille.
 - 2. Topography:
 - a. Type Style: Helvetica Bold. Initial caps or all caps as indicated on drawings.
 - b. Provide text, arrows, and symbols in size, colors, typefaces and letter spacing shown; provide a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings is for layout purposes only; final text for signs is listed in Sign Message Schedule.
 - 3. Character Height: Minimum 5/8 in high, Maximum 2 in.
 - 4. Symbols (Pictograms): Place equivalent written description directly below symbol, outside of symbol's background field. Border dimensions of symbol background must be minimum 6 in high.
 - 5. Finish and Contrast: Characters and background to be eggshell, matte or other non-glare finish with adequate contrast with background.

6. Mounting Location and Height: As shown or mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

1.7 COLORS AND FINISHES

- A. Section 090600, SCHEDULE FOR FINISHES.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions; verify and be responsible for all dimensions and conditions indicated. COR to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. By commencing work of this section, Contractor assumes overall responsibility, as part of its warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. Contractor further warrants that all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 PRODUCTS

- A. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic is not acceptable.
- B. Vinyl: 0.1 mm thick machine cut, having pressure sensitive adhesive and integral colors.

2.3 INTERIOR SIGNAGE TYPES FOR ROOMS

- A. General:
 1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.

B. Sign Type:

1. Text and graphics are to be first surface applied vinyl letters.

2.4 FABRICATION

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 100 °F without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members must be true and assembled so joints are tight and practically unnoticeable, without use of filling compound.
- E. Provide signs with fine, even texture, flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces to be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface is plus or minus 0.015 inches. Restore texture to filed or cut areas.
- F. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- I. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- J. No signs are to be manufactured until final sign message schedule and location review has been completed by the COR and forwarded to Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Install signs where best suited to provide a consistent appearance throughout the project, where otherwise

not dimensioned. Contact COR for clarification, when exact position, angle, height or location is in doubt.

- C. Contractor is responsible for all signs that are damaged, lost or stolen while materials are on the job site, until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work COR determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs at each interior door or opening to room.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

END OF SECTION 101405

SECTION 102800
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items usually used in toilets, baths, locker rooms, and at sinks in related spaces.
- B. Items Specified:
 - 1. Grab Bars.
 - 2. Recessed toilet-seat cover and toilet tissue dispenser.
 - 3. Recessed toilet-seat cover/dispenser, sanitary napkin, disposal, and toilet tissue dispenser.
 - 4. Surface mounted paper towel dispenser and waste receptacle.
 - 5. Metal framed mirror.
- C. This section also specifies custom fabricated items used in toilets and related spaces.

1.2 RELATED WORK

- A. Color of finishes: Section 090600, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Provide for each product specified.
 - 2. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.
- C. Manufacturer's Literature and Data:
 - 1. Provide for all accessories specified.
 - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
 - 3. Show working operations of spindle for toilet tissue dispensers.

1.4 QUALITY ASSURANCE

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

1.5 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society for Testing and Materials (ASTM):
 - 1. A167-99(2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - 2. A176-99(2009) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
 - 3. A269-10 Seamless and Welded Austenitic Stainless Steel Tubing for General Service

- | | | |
|----|---------------|---|
| 4. | A653/A653M-11 | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 5. | F446-85(2009) | Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area |

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel:
 - 1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
 - 2. Tube: ASTM A269, Type 304 or 304L.
- B. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Toggle Bolts: For use in hollow masonry or frame construction.
- C. Hex Bolts: For through bolting on thin panels.
- D. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- E. Screws:
 - 1. ASME B18.6.4.
- F. Adhesive: As recommended by manufacturer for products to be joined.

2.3 FINISH

- A. Exposed surfaces shall have a satin finish.

2.4 FABRICATION - GENERAL

- A. Perform welding in accordance AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.

- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- G. Key items alike.
- H. Provide templates and rough-in measurements as required.
- I. Round and smooth edges of sheets to remove sharp edges.

2.5 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS

- A. Surfaced mounted type for public use spaces.
- B. Dispensing capacity for 400 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.
- D. Form face frames, from one piece.
- E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.
- F. Provide removable waste receptacle approximately 10.5 gallon capacity, fabricated of 0.018 inch thick stainless steel.

2.6 TOILET TISSUE DISPENSERS (AS PART OF A COMBINATION UNIT)

- A. Double roll surface mounted type.
- B. Removable spindle ABS plastic or chrome plated plastic.
- C. Wood rollers are not acceptable.

2.7 GRAB BARS

- A. Grab bars complying to ASTM F446.
- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:

1. Stainless Steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor, swing up and on metal toilet partitions.
- D. Bars:
 1. Fabricate from 1-1/4 inch minimum and 1-1/2 maximum outside diameter tubing.
 2. Stainless steel, minimum 0.0478 inch thick.
 3. Fabricate in one continuous piece with ends turned toward walls.
 4. Continuous weld intermediate support to the grab bar.
- E. Flange for Concealed Mounting:
 1. Minimum of 0.1046 inch thick, approximately 3 inch diameter by 1/2 inch deep, with provisions for not less than three set screws for securing flange to back plate.
 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.
- G. Back Plates:
 1. Minimum 0.1046 inch thick metal.
 2. Fabricate in one piece, approximately 1/4 inch deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.

2.8 METAL FRAMED MIRRORS

- A. Mirror Glass:
 1. Minimum 1/4 inch thick.
 2. Set mirror in a protective vinyl glazing tape.
- B. Frames:
 1. Channel or angle shaped section with face of frame not less than 3/8 inch wide. Fabricate with square corners.
 2. Use 0.0359 inch thick stainless steel.
 3. Filler:
 - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.

C. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.036 inch thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

D. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.9 SANITARY NAPKIN DISPOSAL (AS PART OF A COMBINATION UNIT)

- A. Fabricate a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners.
- B. Provide 50 disposable liners of the type standard with the manufacturer.
- C. Retain receptacle in cabinet by tumbler lock.
- D. Provide disposal with a door for inserting disposed napkins.

2.10 TOILET SEAT COVER DISPENSER (AS PART OF A COMBINATION UNIT)

- A. Provide Type 304 stainless steel with recessed mounted partition mounted toilet seat cover dispensers. Provide dispenser with a minimum capacity of 500 seat covers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before starting work notify COR in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COR the exact location of accessories.

3.2 INSTALLATION

- 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. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry.
Expansion bolt to concrete or solid masonry.

- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 CLEANING

- A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

END OF SECTION 102800

SECTION 104413
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers recessed fire extinguisher cabinets.

1.2 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher and fire extinguisher cabinet including installation instruction and rough opening required.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Society of Testing and Materials (ASTM):
 - 1. D4802-10 Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

- A. Partially Recessed type with flat trim of size and design shown.

2.2 FIRE EXTINGUISHER

- A. Type: 2A10BC.
- B. Nominal Capacity: 5 pounds.

2.3 FABRICATION

- A. Form body of cabinet from 0.0359 inch thick sheet steel.
- B. Fabricate door and trim from 0.0478 inch thick sheet steel with all face joints fully welded and ground smooth.
 - 1. Glaze doors with 1/4 inch thick ASTM D4802 clear acrylic sheet, Category B-1, Finish 1.
 - 2. Design doors to open 180 degrees.
 - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.4 FINISH

- A. Finish interior of cabinet body with baked-on semi-gloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 39 inches above finished floor.

END OF SECTION 104413

SECTION 123200

MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies wood veneer casework, plastic laminate casework as detailed on the drawings, including related components and accessories required to form integral units. Provide wood casework items shown on the drawings, but not specified below, as part of the work under this section; applicable portions of the specification apply to these items. Provide like items of casework of the same design and by one manufacturer.

1.2 RELATED WORK

- A. Custom Casework: Section 061000, ROUGH CARPENTRY.
- B. Color and Finish of Plastic Laminate: Section 090600, SCHEDULE FOR FINISHES.
- C. Lavatories and Plumbing in Casework: Section 224000, PLUMBING FIXTURES.

1.3 PERFORMANCE REQUIREMENTS

- A. Sustainably Harvested Wood: Comply with requirements of Section 018111, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Engineered Wood Products:
 - 1. Provide products with no added urea formaldehyde; determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or E1333.
 - 2. Bio-based Content:
 - a. Interior Panels: Engineered products designed specifically for interior applications and providing a surface that is impact-, scratch-, and wear-resistant and that does not absorb or retain moisture; provide minimum 55 percent bio-based content.
 - b. Structural Interior Panels: Engineered products designed for use in structural construction applications; provide minimum 89 percent bio-based content.
 - c. Structural Wall Panels: Engineered products designed for use in structural walls, curtain walls, floors and roofs; provide minimum 94 percent bio-based content.

3. VOC Emissions:

- a. Provide low VOC products with Green Seal Certification to GS-36 and description of the basis for certification.

1.4 MANUFACTURER'S QUALIFICATIONS

- A. Provide casework by a manufacturer who produces casework similar to the casework specified and shown.

1.5 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 018111, SUSTAINABLE DESIGN REQUIREMENTS, for project low-emitting materials, certified wood, and recycled content requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit <http://www.biopreferred.gov>.

1.6 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide documentation of conformance with performance requirements of this section.
- C. Manufacturer's Literature and Data:
 - 1. Sinks, trim and fittings.
- D. Samples:
 - 1. Counter top, plastic laminate, six inch square.
 - 2. Plastic laminate.
- E. Shop Drawings (1/2 size):
 - 1. All casework, showing details of construction, including materials, hardware and accessories.
 - 2. Cabinets and counters showing faucets in connection with sink bowls, and electrical fixtures and receptacles which are mounted on cabinets and counters.
 - 3. Fastenings and method of installation.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Composite Panel Association (CPA):
 - 1. ANSI A208.1-09 Particleboard
- C. U.S. Department of Commerce Product Standards (Prod. Std):
 - 1. PS1-09 Construction and Industrial Plywood
- D. Hardwood, Plywood and Veneer Association (HPVA):
 - 1. HP1-11 Hardwood and Decorative Plywood
- E. Architectural Woodwork Institute (AWI):
 - 1. Architectural Woodwork Quality Standards, Guide Specifications Quality Certification Program
- F. American Society of Mechanical Engineers (ASME):
 - 1. A112.18.1-12 Plumbing Fixture Fittings
- G. National Electrical Manufacturers Association (NEMA):
 - 1. LD3-05 High Pressure Decorative Laminates
 - 2. LD3.1-95 Performance, Application Fabrication and Installations of High-Pressure Decorative Laminates
- H. Builders Hardware Manufacturers Association (BHMA)
 - 1. BHMA 156 Complete set of BHMA Standards
- I. American Society for Testing and Materials (ASTM):
 - 1. D6007-02(2008) Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber
 - 2. E1333-10 Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish.
- C. Cabinet Interiors Including Shelving: Both of following options to comply with NEMA, LD3.1 as a minimum.
 - 1. Plastic laminate clad plywood or particle board.

2.2 PLYWOOD, SOFTWOOD

- A. Prod. Std. PS1, five ply construction from 1/2 inch to 1-1/8 inch thickness, and seven ply for 1 1/4 inch thickness.

2.3 PARTICLEBOARD

- A. CPA A208.1, Type 1, Grade 1-M-3.

2.4 HARDWARE

- A. Provide hardware and accessory materials associated with interior architectural woodwork.
- B. Comply with BHMA 156.9
 - 1. Extension drawer slides: ANSI/BHMA A156.9, Type B85071.
 - 2. Semi-concealed hinges: ANSI/BHMA A156.9, Type B81201, 1-1/2 inches.
 - 3. Full surface hinges: ANSI/BHMA A156.9, Type B81131, 1-1/2 inches.
 - 4. Knob pulls: ANSI/BHMA A156.9, 1-inch diameter, Type B12132.
 - 5. Bar type pulls: ANSI/BHMA A156.9, 4-inch overall length, Type B12012.
 - 6. Semi-concealed hinges: ANSI/BHMA A156.9, Type B81201, 40 millimeter.
 - 7. Full surface hinges: ANSI/BHMA A156.9, Type B81131, 40 millimeter.
 - 8. Knob pulls: ANSI/BHMA A156.9, 25 millimeter diameter, Type B12132.
 - 9. Bar type pulls: ANSI/BHMA A156.9, 100 millimeter overall length, Type B12012.
 - 10. Catches: Magnetic, 22 newton 5-pound pull.
 - 11. Sliding door set: Impregnated fiberboard track; Nylon glides.
- C. Finishes: Comply with BHMA 156.18
- D. Shelf Standards (Except For Fixed Shelves):

1. Bright zinc-plated steel for recessed mounting with screws, 5/8 inch wide by 3/16 inch high providing 1/2 inch adjustment, complete with shelf supports.

2.5 ADHESIVES

- A. Product compliant with Performance Requirements.

2.6 FABRICATION

- A. Casework to be of the flush overlay, except as otherwise specified, be of premium grade construction and of component thickness in conformance with AWI Quality Standards.
- B. Provide both wall and base cabinet assemblies to consisting of individual units joined into continuous sections as indicated.
- C. Provide fastenings to permit removal and replacement of individual units without affecting the remainder of the installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install woodwork to comply with AWI Section 1700.
- B. Field measure installation locations prior to fabrication.
- C. Set casework in place; level, plumb and accurately scribe and secure to walls, and/or floors.
- D. Provide complete installation including all trim and hardware; leave the casework clean and free from defects.
- E. Install without distortion so doors and drawers fit openings and operate unencumbered.

3.2 FASTENINGS

- A. Provide fastenings for securing casework to adjoining construction as detailed on the shop drawings.
- B. See Section 055000, METAL FABRICATIONS, for reinforcement of walls and partitions for casework anchorage.

3.3 TOLERANCES

- A. Install woodwork plumb, level, true, and straight with no distortions.
- B. Install to a tolerance of 1/8 inch in 96 inches for plumb and level including countertops.
- C. Install cabinets and countertops no more than 1/8 inch in 96 inches sag, bow, or other variation from a straight line.

3.4 REPAIR, ADJUSTING, AND CLEANING

- A. It is at the COR's discretion to reject any visually damaged or defective woodwork, or insufficient repairs, and in the event of woodwork unaccepted due to quality, will be replaced.
- B. Repair damaged and defective woodwork where possible. Where not possible to repair, replace woodwork.
- C. Clean, lubricate, and adjust all hardware to operate as intended.
- D. Clean all woodwork on all exposed and all interior surfaces.

END OF SECTION 123200

SECTION 123661

SOLID SURFACE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.

1.2 RELATED WORK

- A. Type of finish and color; Section 090600 SCHEDULE AND FINISHES and Section 123200 MANUFACTURED WOOD CASEWORK.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
1. Front: Drip edge at counter perimeter.
 2. Backsplash: Radius edge with 3/8-inch radius.
 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
- C. Backsplashes: 1/2-inch- thick, solid surface material.

2.2 COUNTERTOP MATERIALS

- A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- B. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Type: Provide Standard Type.
 - 2. Colors and Patterns: As identified in Section 090600 SCHEDULE OF FINISHES.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION 123661

SECTION 220511

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 010002, GENERAL REQUIREMENTS.
- B. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Concrete and Grout: Section 033053, CAST-IN-PLACE CONCRETE.
- D. Section 079200, JOINT SEALANTS.
- E. Section 099100, PAINTING.
- F. Section 230711, HVAC AND PLUMBING INSULATION.
- G. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years.
 - 2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the project.
 - 3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

4. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Contracting Officer's Representative (COR).
 5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 7. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- D. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the COR for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the COR at least two weeks prior to commencing installation of any item.
 2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract drawings to the COR for resolution.
- E. Plumbing Systems: International Plumbing Code.
- 1.4 SUBMITTALS
- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 220511, COMMON WORK RESULTS FOR PLUMBING", with applicable "Group" number.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Equipment and materials identification.
 - 2. Fire-stopping materials.
 - 3. Hangers, inserts, supports and bracing.
 - 4. Wall, floor, and ceiling plates.
- F. Maintenance Data and Operating Instructions:
 - 1. Maintenance and operating manuals in accordance with Section 010002, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protection of Equipment:
 - 1. Equipment and material placed on the job site shall remain in the custody of the Contractor until final acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
 - 2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost to the Government.
 - 3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
 - 4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
- B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Code (BPVC):
 1. SEC IX-2007 Welding and Brazing Qualifications
- C. American Society for Testing and Materials (ASTM):
 1. A36/A36M-08 Carbon Structural Steel
 2. A575-96(2007) Steel Bars, Carbon, Merchant Quality, M-Grades
 3. E84-09 Standard Test Method for Burning Characteristics of Building Materials
 4. E119-08a Standard Test Method for Fire Tests of Building Construction and Materials
- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
 1. SP-58-2002 Pipe Hangers and Supports-Materials, Design and Manufacture
 2. SP 69-2003 Pipe Hangers and Supports-Selection and Application
- E. National Electrical Manufacturers Association (NEMA):
 1. MG1-2007 Motors and Generators
- F. International Plumbing Code (IPC):
 1. IPC-2009 International Plumbing Code

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
 - 1. All components of an assembled unit need not be products of same manufacturer.
 - 2. Constituent parts that are alike shall be products of a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for intended service.
 - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational building that conforms to contract requirements.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.
- B. Valve Tags and Lists:
 - 1. Plumbing: Provide for all valves (Fixture stops not included).
 - 2. Valve tags: Engraved black filled numbers and letters not less than 1/2-inch high for number designation, and not less than 1/4-inch for service designation on 19 gage 1-1/2 inches round brass disc, attached with brass "S" hook or brass chain.
 - 3. Valve lists: Typed or printed plastic coated card(s), sized 8-1/2 inches by 11 inches showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.

4. Provide detailed plan of the building indicating the location and valve number for each valve.

2.4 PIPE PENETRATIONS

- A. Install sleeves during construction.
- B. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COR.
- C. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- D. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- E. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms.
- F. Sleeve Clearance: Sleeve shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- G. Sealant and Adhesives: Shall be as specified in Section 079200, JOINT SEALANTS.

2.5 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 3/32-inch for floor plates. For wall and ceiling plates, not less than 0.025-inch for up to 3-inch pipe, 0.035-inch for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.6 ASBESTOS

- A. Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities.
- B. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- C. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.
 - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
 - 3. Do not penetrate membrane waterproofing.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly

cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

- I. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum, specified in Section 033053, CAST-IN-PLACE CONCRETE.
- J. Install thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- K. Work in Existing Building:
 - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 010002, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 - 2. As specified in Section 010002, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 - 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the COR. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the COR for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After COR's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- L. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- M. Inaccessible Equipment:
 - 1. Where the COR determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.3 MECHANICAL DEMOLITION

- A. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- B. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.4 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the facilities for beneficial use by the Government, the facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to P-2 painting in Section 099100, PAINTING.
- B. In addition, the following special conditions apply:
 - 1. Cleaning shall be thorough. Use cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats. Refer to P-2 painting in Section 099100, PAINTING.
 - 2. Material And Equipment Not To Be Painted Includes:

- a. Control and interlock devices.
 - b. Regulators.
 - c. Control valves and thermostatic elements.
 - d. Lubrication devices and grease fittings.
 - e. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - f. Valve stems and rotating shafts.
 - g. Pressure gauges and thermometers.
 - h. Glass.
 - i. Name plates.
3. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
4. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 IDENTIFICATION SIGNS

- A. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.
- B. Pipe Identification: Pre-printed self-adhesive pipe labels with at least 1-1/2" high lettering showing flow direction and piping system service.

3.6 STARTUP AND TEMPORARY OPERATION

- A. Startup equipment as described in manufacturer's instructions. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 010002, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.7 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 010002, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

END OF SECTION 220511

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

- A. Section 220511, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Valves.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - 1. A112.1.2-04 Air Gaps in Plumbing Systems
 - 2. A112.14.1 Backwater Valves
- C. American Society for Testing and Materials (ASTM):
 - 1. A47-04 Ferritic Malleable Iron Castings
 - 2. A126-04 Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - 3. A536-84-04e1 Ductile Iron Castings
 - 4. B62-02 Composition Bronze or Ounce Metal Castings
- D. International Code Council
 - 1. International Plumbing Code

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

- | | | |
|----|-----------|--|
| 1. | SP-67-02a | Butterfly Valves |
| 2. | SP-70-98 | Cast Iron Gate Valves, Flanged and Threaded Ends. |
| 3. | SP-72-99 | Ball Valves With Flanged or Butt Welding For General Purpose |
| 4. | SP-110-96 | Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends |

PART 2 - PRODUCTS

2.1 VALVES

A. Asbestos packing is prohibited.

B. Shut-off:

1. Domestic Cold and Hot Water:

a. 2 inch and smaller:

- 1) Angle Valve, MSS SP-80, Type 1, Class 125, ASTM B62 bronze body integral seat and screw-in bonnet, bronze disk and stem, CWP Rating 200 PSIG, loose key, threaded or solder-joint ends, chrome plated.
- 2) Ball, MSS SP-72, SP-110, Type II, Class 125, Style 1, rated for 150 psig at 350 Fahrenheit, two piece, full port, chrome plated brass ball, end entry body style, 15% glass reinforced PTFE seats, PTFE packing and blow-out proof stem, vinyl covered steel handle, with solder-joint end connections or threaded ends with adapters are acceptable, SWP Rating 150 PSIG, CWP Rating 600 PSIG.
- 3) 3) Ball, MSS SP-72, SP-110, Type I, Class 150, Style 1, rated for 150 psig at 350 Fahrenheit, three piece, full port, ASTM B 584 Type 316 stainless steel ball and stem, 15% glass reinforced PTFE seats, PTFE packing and blow-out proof stem, vinyl covered steel handle, with solder-joint end connections or threaded ends with adapters are acceptable, SWP Rating 150 PSIG, CWP Rating 600 PSIG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Installation shall comply with the ICC International Plumbing Code and the following:

1. Install valves in accordance with manufacturers installation instructions.

2. Install valves with stem in horizontal position and in a position to allow full stem movement.
3. Install valves for each fixture or plumbing equipment in a manner to allow fixture or equipment removal without distribution system shut-down.
4. All valves shall be easily accessible. Install valve in each water connection to fixture.
5. After piping systems have been tested and placed into service but before final adjusting and balancing, inspect each valve for leaks; replace if necessary.

END OF SECTION 230523

SECTION 221100
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Preparation and finish painting of piping systems: Section 099100, PAINTING.
- B. Section 220511, COMMON WORK RESULTS FOR PLUMBING.
- C. Pipe Insulation: Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Strainers.
 - 3. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - 1. A-A-1427C Sodium Hypochlorite Solution
 - 2. A-A-59617 Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections
- C. American Society of Mechanical Engineers (ASME): (Copyrighted Society)

1. A13.1-07 Standard Markers for Pipe Identification
 2. B16.3-06 Malleable Iron Threaded Fittings ANSI/ASME
 3. B16.4-06 Cast Iron Threaded Fittings Classes 125 and 250 ANSI/ASME
 4. B16.15-06 Cast Bronze Threaded Fittings ANSI/ASME
 5. B16.18-01 (R 2005) Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME
 6. B16.22-01 (R 2005) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME
- D. Element ANSI/ASME. American Society for Testing and Materials (ASTM):
1. A183-03 Carbon Steel Track Bolts and Nuts
 2. B32-08 Standard Specification for Solder Metal
 3. B62-02 Standard Specification for Composition Bronze or Ounce Metal Castings
 4. B75-02 Standard Specification for Seamless Copper Tube
 5. B88-03 Standard Specification for Seamless Copper Water Tube
 6. B584-08a Standard Specification for Copper Alloy Sand Castings for General Applications
 7. B687-99 (R 2005)e1 Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
- E. American Water Works Association (AWWA):
1. C151/ A21.51-09 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids AWWA/ ANSI
 2. C203-02 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied AWWA/ ANSI
 3. C213-07 Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
 4. C651-05 Disinfecting Water Mains
- F. American Welding Society (AWS):
1. A5.8-04 Filler Metals for Brazing
- G. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
1. SP-72-99 Ball Valves With Flanged or Butt Welding For General Service
 2. SP-80-08 Bronze Gate, Globe, Angle and Check Valves
 3. SP-123-98 (R 2006) Non-Ferrous Threaded and Solder-Joint Unions for use with Copper Water Tube
- H. American Society of Sanitary Engineers (ASSE):

1. 1001-08 Performance Requirements for Atmospheric Type Vacuum Breakers
 2. 1018-01 Performance Requirements for trap seal primer valves-potable water supplied
 3. 1020-04 Performance Requirements for Pressure Vacuum Breakers Assembly
- I. Plumbing and Drainage Institute (PDI):
1. PDI WH-201 Water Hammer Arrestor
- J. Federal Specification
1. A-A-1427C Sodium Hypochlorite Solution
 2. A-A-59617 Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections
 3. WW-P-377 Seamless Standard Size Copper Pipe
 4. WW-T-725 Copper and Copper Alloy Tube Fittings
 5. WW-T-799 Seamless Copper Tubing for use with Solder Type or Flared-Tube Fittings

PART 2 - PRODUCTS

2.1 INTERIOR DOMESTIC WATER PIPING

- A. Pipe: Copper tube, ASTM B88, Type K or L, hard drawn.
- B. Fittings for Copper Tube:
1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP72, Solder or braze joints.
 2. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint.
 3. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
- C. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- D. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- E. Brazing alloy: AWS A5.8, Classification BCuP.

2.2 EXPOSED WATER PIPING

- A. Finished Room: Use full size iron chrome plated piping for exposed water piping connecting fixtures, and equipment when not concealed by apron casework or cabinets.
 - 1. Pipe: Fed. Spec. WW-P-377, standard weight.
 - 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
 - 3. Nipples: ASTM B 687, Chromium-plated.
 - 4. Unions: Mss SP-72, Brass or Bronze with chrome finish.
- B. Unfinished Rooms, Mechanical Rooms: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 099100, PAINTING.

2.3 TRAP PRIMER WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.4 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and an underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

2.5 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.6 STERILIZATION CHEMICALS

- A. Liquid Chlorine: ASTM E1120.
- B. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.

2.7 WATER HAMMER ARRESTER:

- A. Closed copper tube chamber with permanently sealed 60 psig air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be

designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the ICC International Plumbing Code and the following:
 - 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
 - 3. All pipe runs shall be laid out to avoid interference with other work.
 - 4. Install union and shut-off valve on pressure piping at connections to equipment.
 - 5. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
 - 6. Penetrations:
 - a. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 079200, JOINT SEALANTS.

3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 100 psi gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
- C. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use either liquid chlorine or hypochlorite for sterilization.

END OF SECTION 221100

SECTION 221300
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Sanitary sewerage systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Preparation and finish painting of piping systems: Section 099100, PAINTING.
- B. Section 220511, COMMON WORK RESULTS FOR PLUMBING.
- C. Pipe Insulation: Section 230711, HVAC AND PLUMBING INSULATION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Floor Drains.
 - 3. Cleanouts.
 - 4. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - 1. A112.6.3-01 Floor and Trench Drains
 - 2. A13.1-07-96 Standard Markers for Pipe Identification
 - 3. B16.3 Malleable Iron Threaded Fittings
 - 4. B16.12-98 Cast Iron Threaded Drainage Fittings
 - 5. B16.15-06 Cast Copper Alloy Threaded Fittings

- 6. B16.23 Cast Copper Alloy Solder Joint Drainage Fittings
- C. American Society for Testing and Materials (ASTM):
 - 1. A53-07 Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless
 - 2. A74-09 Standard Specification for Cast Iron Soil Pipe and Fittings
 - 3. A183-03 Carbon Steel Track Bolts and Nuts
 - 4. A536-84(R 2004) Ductile Iron Castings
 - 5. A888-09 Hubless Cast Iron Soil Pipe and Fittings
 - 6. B32-08 Solder Metal
 - 7. B75-02 Seamless Copper Tube
 - 8. B306-02 Copper Drainage Tube (DWV)
 - 9. C564-08 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- D. Cast Iron Soil Pipe Institute (CISPI):
 - 1. 301-05 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
 - 2. 310-04 Couplings for use in connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- E. International Code Council (ICC), International Plumbing Code
- F. American Society of Sanitary Engineers (ASSE):
 - 1. 1018 Performance for trap seal primer valve-water supply fed
- G. Factory Mutual (FM): Coupling Used in Hubless
 - 1. Cast Iron Systems for Drains, Waste and Vent Systems.
- H. Plumbing and Drainage Institute (PDI):
 - 1. PDI WH-201 Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 SANITARY PIPING

- A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 5 feet outside of building walls and interior waste and vent piping above grade. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method:
1. Material, (Pipe and Fittings): ASTM A74, Hubless ASTM 888, CISPI-301, Service Class. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark CI® of the Cast Iron Soil Pipe Institute.
 2. Joints: Provide any one of the following types to suit pipe furnished.
 - a. ASTM B29 Lead and oakum and caulked by hand.
 - b. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1) Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - 2) Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - c. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers. Provide adapters or similar system to make tight, leakproof joints.

2.2 EXPOSED WASTE PIPING

- A. Finished Room: Use full iron pipe size chrome plated copper or chrome plated brass piping for exposed waste piping connecting fixtures, casework, cabinets and equipment when not concealed by apron including those furnished by the Government or specified in other sections.
1. Pipe: Fed. Spec. WW-P-351, standard weight.
 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
 3. Nipples: ASTM B 687, Chromium-plated.
 4. Unions: Brass or Bronze with chrome finish. Unions 2-1/2 inches and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems per P-2 in Section 099100, PAINTING.

2.3 CLEANOUTS

- A. Same size as the pipe, up to 4 inches; not less than 4 inches for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 24 inches for the rodding.
- B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 2 inches. When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 1/8 inch bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.
- C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 24 inches above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 6 by 6 inches at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the ICC International Plumbing Code.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.4 FLOOR DRAINS

- A. ANSI A112.21.1. Provide a caulking flange for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe, and side outlet when shown. Provide membrane clamp and extensions if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, provide a 16-ounce soft copper membrane, 24 inches square.
- B. Type B: Cast iron body, double drainage pattern, clamping device, light duty square or round nickel bronze adjustable strainer and grate with vandal proof screws. 6 inch minimum square grate.

2.5 TRAPS

- A. Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with

nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.6 TRAP PRIMERS

- A. Trap Primer: 1/2 inch Inlet/1/2 inch Outlet fully automatic, all brass trap primer valve, activated by flushometer usage, no adjustment required. Model for one (1) to four (4) traps with distribution unit, may be located anywhere in an active cold water line, as indicated on the drawings or as required by code. ASSE Standard 1018. Omit distribution unit when serving a single trap.

2.7 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and an underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

2.8 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with the ICC International Plumbing Code and the following:
 - 1. Install branch piping for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
 - 3. All pipe runs shall be laid out to avoid interference with other work.
 - 4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
 - 5. All gravity waste drain lines inside the building with vertical drops over 20 feet shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered, lead and oakum or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the

floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 60 feet or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.

6. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
 - a. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 079200, JOINT SEALANTS.

B. Horizontal Pipe slopes shall conform to the following:

1. Waste and Vent Piping:

Pipe Size	Minimum Pitch
2 1/2 inches and smaller	1:50 (1/4" to the foot).
3 inches and larger	1:100 (1/8" to the foot).

3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Waste Systems: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.
 1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 10 foot head of water. In testing successive sections, test at least upper 10 feet of next preceding section so that each joint or pipe except upper most 10 feet of system has been submitted to a test of at least a 10 foot head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. Air Test: Maintain air pressure of 5 psi gage for at least 15 minutes without leakage. Use force pump and mercury column gage.
 3. Final Tests: Either one of the following tests may be used.
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of one inch of water with a smoke machine. Chemical smoke is prohibited.
 - b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.

END OF SECTION 221300

SECTION 223300

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic electric water heater system complete, ready for operation including: water heater and accessories, connections and equipment.

1.2 RELATED WORK

- A. Section 220511, COMMON WORK RESULTS FOR PLUMBING
- B. Insulation: Section 230711, HVAC AND PLUMBING INSULATION.
- C. Piping, Fittings, Valves and Gages: Section 220523, GENERAL-DUTY VALVES FOR PLUMBING PIPING, and 221100, FACILITY WATER DISTRIBUTION.

1.3 QUALITY ASSURANCE

- A. Comply with American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE) for efficiency performance:
 - 1. ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, Performance Requirements for Water Heating Equipment.

1.4 SUBMITTALS

- A. Submit manufacturer's literature and data pertaining to the water heater in a properly bound package, in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:
 - 1. Water Heater.
 - 2. Thermometer
 - 3. Vacuum Breaker

1.5 APPLICABLE PUBLICATIONS

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

- B. American Society of Mechanical Engineers (ASME):
 - 1. B1.20.1-83-R 2006 Pipe Threads, General Purpose (Inch)
 - 2. B16.5-03 Pipe Flanges and Flanged Fittings
 - 3. B16.24-2006 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500
- C. National Fire Protection Association (NFPA)
 - 1. 70-08 National Electrical Code

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATERS

- A. Tankless Construction: Cast aluminum alloy with 150 psig working pressure rating.
- B. Tapping (Fittings): Factory fabricated of materials in accordance with appropriate ASME standards for piping connection, pressure and thermometer and controls as required:
 - 1. 2 inch and smaller: Threaded ends according to ASME B1.20.1.
- C. Heating Element: Single element, thermostatically adjustable. Set thermostat for maximum water temperature of 120 degrees F. Phase and voltage as shown on the drawings.

2.2 THERMOMETERS

- A. Straight stem, iron case, red reflecting mercury thermometer or red liquid-filled thermometers, approximately 7 inches high, 40 to 240 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Section 220511, COMMON WORK RESULTS FOR PLUMBING
- B. Install water heaters level and plumb.
- C. Install and connect water heaters in accordance with manufacturer's written instructions.
- D. Install thermometers on water heater inlet and outlet piping.

3.2 PERFORMANCE TEST

- A. Ensure that all water outlets have minimum 105 degrees F and maximum of 120 degrees F water at all times. If necessary, make correction to reset the thermostat to make the system comply with design requirements.

END OF SECTION 223300

SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

- A. Sealing between fixtures and other finish surfaces: Section 079200, JOINT SEALANTS.
- B. Section 220511, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.
- C. Submit Operation and Training Manuals including dates of required maintenance in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The American Society of Mechanical Engineers (ASME):
 - 1. A112.6.1M-08 Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
 - 2. A112.18.1-05 Faucets
 - 3. A112.19.1-08 Enameled Cast Iron Plumbing fixtures
 - 4. A112.19.2-08 Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals

- 5. A112.19.5-05 Trim for Water-Closet Bowls, Tanks and Urinals
- 6.
- C. American Society for Testing and Materials (ASTM):
 - 1. A276-2008a Standard Specification for Stainless Steel Bars and Shapes
- D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM AMP 500-06
 - 1. Metal Finishes Manual (2006)
- E. American Society of Sanitary Engineers (ASSE):
 - 1. 1001-08 Integral, Atmospheric Vacuum Breakers
 - 2. 1011-04 Hose-Connection Vacuum Breakers
 - 3. 1037-90 Performance Requirements for Pressurized Flushing Devices (Flushometer) for Plumbing Fixtures
 - F. National Sanitation Foundation (NSF)/American National Standards Institute (ANSI):
 - 4. 61-08 Drinking Water System Components-Health Effects
- F. American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and Surfaces
- G. American Society of Sanitation Engineers (ASSE)
 - 1. 1002-08 Performance Requirements for Anti-Siphon Fill Valves for Water Closet Tanks
- H. Underwriters Laboratory (UL)
 - 1. 1951-03 Sensor Operated Flushometers

PART 2 - PRODUCTS

2.1 STOPS

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework ASME A112.18.1M. Locate stops centrally below fixture in an accessible location.
- B. Furnish keys for lock shield stops to Contracting Officers Representative (COR).
- C. Supply risers from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

2.2 ESCUTCHEONS

- A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.3 LAMINAR FLOW CONTROL DEVICE

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor:
 - 1. Capable of restricting flow to 0.5 gpm for lavatories.
 - 2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 25 and 80 psi.
 - 3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning.

2.4 CARRIERS

- A. Water Closet, ASME A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.
- B. Lavatory, ASME A112.6.1M. All lavatory carriers shall be capable of supporting the lavatory with a 250-lbs vertical load applied at the front of the fixture.
- C. Urinal, ASME A112.6.1M with adjustable gasket faceplate chair carriers for wall hung urinal with auxiliary anchor foot assembly.

2.5 SEATS

- A. Water Closet Seat Type 1: Extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel posts. Seat shall be posture contoured body design. Color shall be white.

2.6 FLUSH VALVES

- A. Flush Tank (Water Closet)
 - 1. Flush tank valve, high efficiency, automatic infra-red sensor, hardwired, 1.28 gpf with maximum 10 percent variance, hidden fixed volume flush tank, motorized control panel with manual courtesy over-ride button, chrome plated back check

angle stop, vandal resistant stop cap, high back pressure vacuum breaker, ASSE 1037, UL 1951, ANSI/ASME 112.19.6.

B. Flush Valve Type 5 (Urinal)

1. Flushometer valve, ultra high efficiency, automatic infra-red sensor, hardwired, 1/8 gpf with maximum 10 percent variance, chloramines resistant exposed flush valve, 3/4 inch top spud, 6VDC battery powered exposed motor actuator, adjustable depth sensor, impact resistant housing, chrome plated metal cover with manual courtesy over-ride button, chrome plated spud coupling, chrome plated cast wall flange with set screw, sweat solder adapter with chrome plated cover tube, chrome plated back check angle stop, vandal resistant stop cap, high back pressure vacuum breaker, ASSE 1037, UL 1951, ANSI/ASME 112.19.6.

2.7 WATER CLOSETS

- A. (P-104) Water Closet (handicap accessible, wall mount, high efficiency flush tank, 1.28 gallons per flush, back outlet, white, elongated high efficient bowl, fully glazed trapway, fully glazed exterior concealed trapway, ASME A112.19.2M). Top of water closet shall be 17 inch to 19 inch above finished floor measured to the top of the toilet seat.

1. Seat: Water Closet Seat Type 1
2. Water Closet Carrier: Adjustable vertical drain.
3. Flush Tank: Sensor, Hard Wired.

2.8 URINALS

- A. (P-202) Urinal, handicap accessible, Ultra high efficient, 1/8 gallon per flush, washout flushing action, 3/4 inch top spud, wall mount, 2 inch IPS back outlet flange, integral trap, white vitreous china, pressure compensating internal flow regulator, 14 inch extended rim, stainless steel vandal resistant outlet strainer, ASME A112.19.2M. Top of urinal flood rim shall be a maximum of 17 inches above finished.

1. Urinal Carrier: Adjustable horizontal and vertical drain.
2. Flush valve: Flush Valve Type 5, Sensor, Hard Wired.

2.9 FAUCETS

A. Faucet Type 1

1. Lavatory Faucet: deck mount, hardwired electronic proximity infrared sensor, dual beam chrome plated solid cast brass construction, vandal resistant, 4 inch centers, 5 inch spout, concealed internal temperature control mixer, 0.5 gpm maximum flow, NSF 61, ANSI A112.18.1M

B. Faucet Type 5

1. Lavatory/Sink Faucet: Deck mount, 2-handle control, 9 inch gooseneck spout, chrome plated solid brass construction, 1/4 turn 4" wristblade type handles, 4-inch centers, 0.5 gpm maximum flow, NSF 61, ANSI A112.18.1M

C. Faucet Type 7

1. Service Sink Faucet, solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have a pail hook, 3/4-inch hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish.

2.10 LAVATORIES

- A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.
- B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.
- C. (P-301) Lavatory handicap accessible, counter mounted, self rimming with faucet ledge, 20 by 17 inch diameter vitreous china, deck mounted faucet, front overflow, ASME A112.19.2.
 1. Faucet: Electronic Infrared Sensor Lavatory Faucet Type 1.
 2. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated. Provide handicap compliant waste pipe cover in accordance with A.D.A 4-19.4.
 3. Stops: Angle type, see paragraph 2.1 Stops. Provide handicap compliant supply riser cover in accordance with A.D.A 4-19.4.
 4. Trap: Cast copper alloy, 1-1/2 by 1-1/4 inch P-trap. Adjustable with connected elbow and 17 gauge tubing extensions to wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall. Provide handicap compliant waste pipe cover in accordance with A.D.A 4-19.4.

2.11 SINKS

- A. Dimensions for sinks are specified, length by width (distance from wall) and depth.
- B. (P-402) Sink handicap accessible, single compartment, counter mount, self rimming, seamless Type 304 stainless steel, 21 inches x 20 inches x 6 inches deep, equal sized basins, vertical and horizontal radius basin corners, basin drains center in the rear for handicap compliance, ASME A112.19.3M.

1. Faucet: Two Handle Lavatory/Sink Faucet Gooseneck Type 5.
 2. Drain: Forged stainless steel basket strainer assembly, and chrome plated copper tailpiece, continuous drain and tee with wall connection and escutcheon. Provide handicap compliant waste pipe cover in accordance with A.D.A 4-19.4.
 3. Stops: Angle type, see paragraph 2.1 Stops. Provide handicap compliant supply riser cover in accordance with A.D.A 4-19.4.
 4. Trap: Cast copper alloy, 1-1/2 by 1-1/4 inch P-trap with cleanout plug. Adjustable with connected elbow and 17 gauge tubing extensions to wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall. Provide handicap compliant waste pipe cover in accordance with A.D.A 4-19.4.
 5. Garbage Disposer: Rugged 1/2 HP, 120V, 60 Hz.
- C. (P-404) Service Sink (Regular, ASME A112.19.1M, Figure 24) service sink, class 1, single bowl, acid resistant enameled cast iron, approximately 22 by 18 inches with raised back. Equip sink with CRS rim guard, and mounted on trap standard. Set sinks rim 28 inches above finished floor.
1. Faucet: Service Sink Faucet Type 7.
 2. Drain: Grid.
 3. Trap: Trap standard, painted outside and enameled inside with acid-resistant enamel, drain through adjoining wall.

2.12 DISPENSER, DRINKING WATER

- A. (P-501) Electric Water Cooler, Two Station, Bi-Level cooler, self contained electric refrigeration with stainless steel basin, non-squirt bubbler, push button activation, single refrigeration system serving both stations including a high efficient compressor, R-134A, fully insulated stainless steel tank. System shall be capable of providing 30L (8 gallons) per hour of chilled water, 115 volt, ANSI 117.1, NFS/ANSI 61, AR Standard 1010.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 079200, JOINT SEALANTS.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Toggle Bolts: For hollow masonry units, finished or unfinished.
- D. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 1/4-inch diameter bolts, and to extend at least 3-inches into masonry and be fitted with loose

tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

- E. Power Set Fasteners: May be used for concrete walls, shall be 1/4-inch threaded studs, and shall extend at least 1-1/4 inches into wall.
- F. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- G. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.
- H. Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures.
- I. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- J. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

3.2 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

END OF SECTION 224000

SECTION 230511

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 23.
- B. Definitions:
 - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.
 - 3. COR: Contracting Officer's Representative.

1.2 RELATED WORK

- A. Section 010002, GENERAL REQUIREMENTS.
- B. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 079200, JOINT SEALANTS.
- D. Section 099100, PAINTING.

1.3 QUALITY ASSURANCE

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality commercial grade products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in commercial HVAC construction.
- B. Flow Rate Tolerance for HVAC Equipment: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as

- controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Contracting Officers Representative (COR).
 4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 7. Asbestos products or equipment or materials containing asbestos shall not be used.
- D. Equipment Service Organizations:
1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located reasonably close to the site.
- E. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME Section IX, "Welding and Brazing Qualifications".
 2. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- F. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the COR for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the COR at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.
 2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of

portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract drawings to the COR for resolution.

3. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.

1.4 SUBMITTALS

- A. Seismic Restraints & Supports: Supports for equipment, ductwork and piping shall be a delegated design. Each seismic-restraint device shall be a delegated design. Seismic-restraint devices shall be stamped and signed by a licensed structural engineer in the State of California.
- B. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Upon request by COR, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.
- G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review will be made only by groups.
- H. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 1. Submit belt drive with the driven equipment.
 2. Submit electric motor data and variable speed drive data with the driven equipment.
 3. Equipment and materials identification.
 4. Fire-stopping materials.

5. Hangers, inserts, supports and bracing.
6. Wall, floor, and ceiling plates.

I. HVAC Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 010002, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.

J. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

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

B. Air Conditioning and Refrigeration Institute (ARI):

1. 430-99 (R2002) Central Station Air-Handling Units

C. Air Movement and Control Association (AMCA):

1. 410-96 Recommended Safety Practices for Air Moving Devices

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

1. A36/A36M-08 Carbon Structural Steel
2. A575-96(2007) Steel Bars, Carbon, Merchant Quality, M-Grades
3. E84-09 Standard Test Method for Burning Characteristics of Building Materials
4. E119-08a Standard Test Method for Fire Tests of Building Construction and Materials

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

1. SP-58-2002 Pipe Hangers and Supports-Materials, Design and Manufacture
2. SP 69-2003 Pipe Hangers and Supports-Selection and Application
3. SP 127-2001 Bracing for Piping Systems, Seismic – Wind – Dynamic, Design, Selection, Application

F. National Electrical Manufacturers Association (NEMA):

1. MG 1-2006 Motors and Generators

G. National Fire Protection Association (NFPA):

- | | | |
|----|--------|--|
| 1. | 70-08 | National Electrical Code |
| 2. | 90A-09 | Installation of Air Conditioning and Ventilating Systems |
| 3. | 101-09 | Life Safety Code |

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost to the Government.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Provide maximum standardization of components.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
 1. All components of an assembled unit need not be products of same manufacturer.
 2. Constituent parts that are alike shall be products of a single manufacturer.

- 3. Components shall be compatible with each other and with the total assembly for intended service.
- 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 LIFTING ATTACHMENTS

- A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.4 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 3/16-inch high of brass with black-filled letters, or rigid black plastic with white letters permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 3/16-inch high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

2.5 GALVANIZED REPAIR COMPOUND

- A. Green Seal Standard GC-03, paint form.

2.6 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Pipe Supports: Comply with MSS SP-58-2002. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69-2003.
- B. Attachment to Concrete Building Construction:
 - 1. Concrete insert: MSS SP-58-2002, Type 18.
 - 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than four inches thick when approved by the Resident Engineer for each job condition.
 - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than four inches thick when approved by the COR for each job condition.
- C. Attachment to Steel Building Construction:
 - 1. Welded attachment: MSS SP-58-2002, Type 22.
 - 2. Beam clamps: MSS SP-58-2002, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 7/8-inch outside diameter.
- D. Attachment to Wood Construction: Wood screws or lag bolts.
- E. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58-2002. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 1-1/2 inches minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- F. Supports for Piping Systems:
 - 1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 230711, HVAC, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.

2.7 PIPE PENETRATIONS

- A. Install sleeves during construction.
- B. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COR.
- C. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

- D. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- E. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for.
- F. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- G. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- H. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- I. Sealant and Adhesives: Shall be as specified in Section 079200, JOINT SEALANTS.

2.8 SPECIAL TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

2.9 ASBESTOS

- A. Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All

gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

- C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- D. Location of pipe sleeves shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.
 - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
 - 3. Do not penetrate membrane waterproofing.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Electrical Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- I. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Contracting Officer's Representative. Damaged or defective items in the opinion of the Contracting Officer's Representative shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- J. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.
- K. Install gages, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read

by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

L. Work in Existing Building:

1. Perform as specified in Article, ALTERATIONS and Article, RESTORATION of the Section 010000, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 010000, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Contracting Officer's Representative. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Contracting Officer's Representative for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Contracting Officer's Representative's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

M. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.
- B. Use wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 1/2-inch clearance between pipe or piping covering and adjacent work.

- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69-2003. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. Overhead Supports:
 - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
 - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
- F. Floor Supports:
 - 1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
 - 2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 2 inch excess on all edges. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
 - 3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.3 MECHANICAL DEMOLITION

- A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Cemetery, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

- C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

3.4 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.
- B. In addition, the following special conditions apply:
 - 1. Cleaning shall be thorough. Use cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
 - 2. Material And Equipment Not To Be Painted Includes:
 - a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - d. Glass.
 - e. Name plates.
 - 3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
 - 4. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 IDENTIFICATION SIGNS

- A. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size and performance.
- B. Pipe Identification: Provide self-adhering stencil.

3.6 LUBRICATION

- A. Lubricate all devices requiring lubrication prior to initial operation, and field-check all devices for proper lubrication.

- B. Equip all devices with required lubrication fittings or devices.
- C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

3.7 STARTUP AND TEMPORARY OPERATION

- A. Startup equipment per manufacturer's instructions. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 010002, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.8 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 010002, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION 230511

SECTION 230541

NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Seismic restraints for equipment for HVAC and plumbing work.

1.2 RELATED WORK

- A. Section 230511, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 233100, HVAC DUCTS AND CASINGS: requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining.

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE in specification Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Noise Criteria:

- 1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

Type Of Room	NC LEVEL
Bathrooms and Toilet Rooms	40
Lobbies, Waiting Areas	40
Offices, large open (3 or more occupants)	40
Offices, small private (2 or fewer occupants)	35

- 2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the fore-going noise criteria, and local ordinance noise levels are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook, Chapter 8, Sound and Vibration.
- 3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may

include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Seismic Restraint Requirements:

1. Equipment:

- a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 20 percent of the weight of the equipment furnished.

2. Piping: Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC.

3. Ductwork: Refer to specification Section 233100, HVAC DUCTS AND CASINGS.

- D. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.4 SUBMITTALS

- A. Submit in accordance with specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Seismic restraint provisions and bolting.

- C. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification. Seismic shall be a delegated design.

1.5 APPLICABLE PUBLICATIONS

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

- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

1. 2009 Fundamentals Handbook, Chapter 8, Sound and Vibration
- C. American Society for Testing and Materials (ASTM):
 1. A123/A123M-08 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 2. A307-07 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 3. D2240-05 Standard Test Method for Rubber Property - Durometer Hardness
- D. Manufacturers Standardization (MSS):
 1. SP-58-02 Pipe Hangers and Supports-Materials, Design and Manufacture
- E. Occupational Safety and Health Administration (OSHA):
 1. 29 CFR 1910.95 Occupational Noise Exposure

PART 2 - PRODUCTS

2.1 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENTS

- A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.
- B. On all sided of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment. The slack cable restraint method, Mason Industries, or equal, is acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

- A. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

END OF SECTION 230541

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
 - 1. Planning systematic TAB procedures.
 - 2. Design Review Report.
 - 3. Systems Inspection report.
 - 4. Systems Readiness Report.
 - 5. Balancing air distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
 - 6. Recording and reporting results.
- B. Definitions:
 - 1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications".
 - 2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
 - 3. AABC: Associated Air Balance Council.
 - 4. NEBB: National Environmental Balancing Bureau.
 - 5. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
 - 6. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

- A. Section 230511, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.
- B. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise and Vibration Requirements.
- C. Section 230711, HVAC AND PLUMBING INSULATION: Piping and Equipment Insulation.
- D. E. Section 238143, AIR-SOURCE UNITARY HEAT PUMPS.

1.3 QUALITY ASSURANCE

- A. Refer to Articles, Quality Assurance and Submittals, in Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Qualifications:
 - 1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
 - 2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
 - 3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
 - 4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the COR. The responsibilities would specifically include:
 - a. Shall directly supervise all TAB work.
 - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
 - c. Would follow all TAB work through its satisfactory completion.
 - d. Shall provide final markings of settings of all HVAC adjustment devices.
 - e. Permanently mark location of duct test ports.
 - 5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and

complexity to this project. Qualifications must be certified by the TAB agency in writing.

- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
 - 1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
 - 2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.
 - a. Air handling unit and all other fans, cubic feet per minute: Minus 10 percent to plus 10 percent.
 - b. Minimum Outside Air: 10 percent to plus 10 percent.
 - c. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 10 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 percent.
 - 3. Systems shall be adjusted for energy efficient operation as described in PART 3.
 - 4. Typical TAB procedures and results shall be demonstrated to the COR for one air distribution system (including all fans, three terminal units and three rooms) as follows:
 - a. When field TAB work begins.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the COR staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:

1. Design Review Report within 90 days for conventional design projects after the system layout on air is completed by the Contractor.
 2. Systems inspection report on equipment and installation for conformance with design.
 3. Systems Readiness Report.
 4. Intermediate and Final TAB reports covering flow balance and adjustments, and performance tests.
 5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final Inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
1. 2007 HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
- C. Associated Air Balance Council (AABC):
1. 2002 AABC National Standards for Total System Balance
- D. National Environmental Balancing Bureau (NEBB):
1. 7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
 2. 2nd Edition 2006 Procedural Standards for the Measurement and Assessment of Sound and Vibration
 3. 2nd Edition 1999 Procedural Standards for Building Systems Commissioning
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. 3rd Edition 2002 HVAC SYSTEMS-Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1 PLUGS

- A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

- A. See Section 230711, HVAC AND PLUMBING INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

- A. The TAB Specialist shall review the Contract Plans and specifications and advise the COR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 SYSTEM READINESS REPORT

- A. Inspect each System to ensure that it is complete including installation and operation of controls.
- B. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the COR.

3.5 TAB REPORTS

- A. The TAB contractor shall provide raw data immediately in writing to the COR if there is a problem in achieving intended results before submitting a formal report.
- B. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.
- C. Do not proceed with the remaining systems until intermediate report is approved by the COR.

3.6 TAB PROCEDURES

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB.
- C. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project.
- D. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- E. Air Balance and Equipment Test: Include air handling units, fans, room diffusers/outlets/inlets.
 - 1. Artificially load air filters by partial blanking to produce air pressure drop of at least 90 percent of the design final pressure drop.
 - 2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 230511, COMMON WORK RESULTS FOR HVAC.
 - 3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
 - 4. Record final measurements for air handling equipment performance data sheets.

3.7 MARKING OF SETTINGS

- A. Following approval of Tab final Report, the setting of all HVAC adjustment devices including splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

3.8 IDENTIFICATION OF TEST PORTS

- A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END OF SECTION 230593

SECTION 230711

HVAC AND PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for

1. HVAC piping, ductwork and equipment.
2. Plumbing piping and equipment.

B. Definitions

1. ASJ: All service jacket, white finish facing or jacket.
2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
3. Cold: Equipment, ductwork or piping handling media at design temperature of 60 degrees F or below.
4. Concealed: Ductwork and piping above ceilings and in chases and pipe spaces.
5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases unfinished attics, crawl spaces and pipe basements are not considered finished areas.
6. FSK: Foil-scrim-kraft facing.
7. Hot: HVAC Ductwork handling air at design temperature above 60 degrees F; HVAC and plumbing equipment or piping handling media above 105 degrees F.
8. Density: Pcf - pounds per cubic foot.
9. Runouts: Branch pipe connections up to one-inch nominal size to fan coil units or reheat coils for terminal units.
10. Thermal conductance: Heat flow rate through materials.
 - a. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
11. Thermal Conductivity (k): Watt per meter, per BTU per inch thickness, per hour, per square foot, per degree F temperature difference.
12. CW: Cold water.
13. HW: Hot water.
14. RS: Refrigerant suction.
15. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

- A. Section 230511, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 232300, REFRIGERANT PIPING: Requirements for refrigerant piping.
- C. Section 233100, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Criteria:
 - 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4:
 - a. 4.3.3.1 - Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.2 or 4.3.3.1.3, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - b. 4.3.3.1.1 - Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)
 - c. 4.3.10.2.6 - Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.
 - d. 4.3.10.2.6.6 - Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.
 - 2. Test methods: ASTM E84, UL 723, or NFPA 255.
 - 3. Specified k factors are at 75 degrees F mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
 - 4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
 - a. Insulation materials: Specify each type used and state surface burning characteristics.
 - b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
 - c. Insulation accessory materials: Each type used.
 - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - e. Make reference to applicable specification paragraph numbers for coordination.

1.5 STORAGE AND HANDLING OF MATERIAL

- A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec):
 - 1. L-P-535E (3)-99 Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. American Society for Testing and Materials (ASTM):
 - 1. A167-04 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

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| 2. | B209-07 | Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| 3. | C411-05 | Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation |
| 4. | C449-07 | Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement |
| 5. | C534-08 | Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form |
| 6. | C552-07 | Standard Specification for Cellular Glass Thermal Insulation |
| 7. | C553-08 | Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications |
| 8. | C585-90 | Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (2004) |
| 9. | D1668-97a (2006) | Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing |
| 10. | E136-09 | Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 1380 F |
- D. National Fire Protection Association (NFPA):
- | | | |
|----|--------|---|
| 1. | 90A-08 | Installation of Air Conditioning and Ventilating Systems |
| 2. | 101-08 | Life Safety Code |
| 3. | 251-06 | Standard methods of Tests of Fire Endurance of Building Construction Materials |
| 4. | 255-06 | Standard Method of tests of Surface Burning Characteristics of Building Materials |
- E. Underwriters Laboratories, Inc (UL):
- | | | |
|----|-----|--|
| 1. | 723 | UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 09/08 |
|----|-----|--|
- F. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):
- | | | |
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| 1. | SP58-2002 | Pipe Hangers and Supports Materials, Design, and Manufacture |
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PART 2 - PRODUCTS

2.1 CELLULAR GLASS CLOSED-CELL

- A. Comply with Standard ASTM C177, C518, density 7.5 pcf nominal, $k = 0.29$ at 75 degrees F.
- B. Pipe insulation for temperatures up to 400 degrees F.

2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

- A. ASTM C177, C518, $k = 0.039$ Watt per meter, per degree C (0.27), at 75 degrees F, flame spread not over 25, smoke developed not over 50, for temperatures from minus 40 degrees F to 200 degrees F. No jacket required, except where exposed to weather, provide stainless steel jacket.

2.3 INSULATION FACINGS AND JACKETS

- A. ASJ jacket shall be white kraft bonded to 1 mil thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 5 units, Suitable for painting without sizing. Jackets shall have minimum 1-1/2 inch lap on longitudinal joints and minimum 4 inch butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- B. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.03 inches. Provide color matching vapor retarder pressure sensitive tape.

2.4 PIPE COVERING PROTECTION SADDLES

- A. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 300 degrees F cellular glass. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 3.0 pcf.

2.5 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

2.6 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching monel or stainless steel.
- C. Wire: 18 gage soft annealed galvanized or 14 gage copper clad steel or nickel copper alloy.
- D. Bands: 3/4 inch nominal width, brass, galvanized steel, aluminum or stainless steel.

2.7 REINFORCEMENT AND FINISHES

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: one inch mesh, 22 gage galvanized steel.
- E. Corner beads: 2 inch by 2 inch, 26 gage galvanized steel; or, 1 inch by 1 inch, 28 gage aluminum angle adhered to 2 inch by 2 inch Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 40 degrees F to 250 degrees F. Below 40 degrees F and above 250 degrees F. Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the COR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 60 degrees F and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 6 inches.
- D. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- E. Protect all insulations outside of buildings with stainless steel jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- F. HVAC work not to be insulated:
 - 1. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
- G. Plumbing work not to be insulated:
 - 1. Piping and valves of fire protection system.
 - 2. Chromium plated brass piping.
 - 3. Water piping in contact with earth.
 - 4. Piping in pipe basement serving wall hydrants.
 - 5. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 3 feet.
- H. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- I. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use

of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

J. Provide metal jackets over insulation as follows:

1. All piping and ducts exposed to outdoor weather.
2. A 2 inch overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 4 inch wide strips of insulation bonding adhesive at 8 inches on center all around duct. Additionally secure insulation to bottom of ducts exceeding 24 inches in width with pins welded or adhered on 18 inch centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
 - a. Above ceilings at a roof level: R-8.0, 3 inch thick insulation faced with FSK.
 - b. Above ceilings for other than roof level: R-8.0, 3 inch thick insulation faced with FSK.
4. Concealed return air duct above ceilings at a roof level, unconditioned areas, and in chases with external wall; R-8.0, 3 inch thick, insulation faced with FSK.
5. Return air duct in interstitial spaces: R-8.0, 3 inch thick insulation faced with FSK.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 4 inches operating at surface temperature of 61 degrees F or more.
 - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 40 degrees

- F, or above 250 degrees F. Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
- c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 60 degrees F or less, vapor seal with a layer of glass fitting tape imbedded between two 1/16 inch coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 2 inches.
3. Nominal thickness in millimeters and inches specified in table below, for piping above ground:

Nominal Thickness of Molded Mineral Fiber Insulation		
Nominal Pipe Size, inches:	1 & below	1-1/4- 3
Domestic hot water supply and return	0.5	0.75

C. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as tabulated below for chilled water and refrigerant piping.

Nominal Thickness of Cellular Glass Insulation		
Millimeters (inches)	Thru 11/2	2-6
40-60 degrees F (CH and CHR pipe chase and underground)	2.0	3.0
40-60 degrees F (CH and CHR)	1.5	2.0

D. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 230511, COMMON WORK RESULTS FOR HVAC.
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the

manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in inches as specified in table below for piping above ground:

Nominal Thickness of Flexible Elastomeric Cellular Insulation		
Nominal Pipe Size (inches)	1 & below	1 1/4-3
1. 40-60 degrees F (CH, CHR, GC, GCR)	1.0	1.5
a. Runouts to fan coil units	0.75	1.5

END OF SECTION 230711

SECTION 232300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field refrigerant piping for direct expansion HVAC systems.
- B. Definitions:
 - 1. Refrigeration system: Combination of interconnected refrigerant-containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
 - a. Low side means the parts of a refrigeration system subjected to evaporator pressure.
 - b. High side means the parts of a refrigeration system subjected to condenser pressure.
 - 2. Brazed joint: A gas-tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

1.2 RELATED WORK

- A. Section 230511, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 230711, HVAC AND PLUMBING INSULATION: Requirements for piping insulation.

1.3 QUALITY ASSURANCE

- A. Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Comply with ASHRAE Standard 15-2007, Safety Standard for Refrigeration Systems (ANSI Approved) and Standard 34-2007, Designation and Classification of Refrigerants. The application of this Code is intended to assure the safe design, construction, installation, operation, and inspection of every refrigeration system employing a fluid which normally is vaporized and liquefied in its refrigeration cycle.
- C. Comply with ASME B31.5-2006: Refrigerant Piping and Heat Transfer Components.

- D. Products shall comply with UL 207 "Refrigerant-Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

1.4 SUBMITTALS

- A. Submit in accordance with specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Sufficient information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with drawings and specifications for components noted below:
 - a. Tubing and fittings
 - b. Moisture-liquid indicators
 - c. Liquid-suction interchanges
 - d. Gages
 - e. Pipe and equipment supports
 - f. Refrigerant and oil
 - g. Pipe/conduit roof penetration cover
 - h. Soldering and brazing materials

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (ARI):
 - 1. 495-2005 Performance Rating of Refrigerant Liquid Receivers
 - 2. 730-2005 Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers
 - 3. 750-2007 Performance Rating of Thermostatic Refrigerant Expansion Valves
 - 4. 760-2007 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
- C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 1. 15-2007 Safety Standard for Refrigeration Systems (ANSI)
 - 2. 17-2008 Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)
 - 3. 63.1-95 (RA 01) Method of Testing Liquid Line Refrigerant Driers (ANSI)

D. American Society of Mechanical Engineers (ASME):

- | | | |
|----|--------------|--|
| 1. | B16.22-2001 | Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI) |
| 2. | B16.24-2006 | Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI) |
| 3. | B31.5-2006 | Refrigeration Piping and Heat Transfer Components (ANSI) |
| 4. | B40.100-2005 | Pressure Gauges and Gauge Attachments |
| 5. | B40.200-2008 | Thermometers, Direct Reading and Remote Reading |

E. American Society for Testing and Materials (ASTM)

- | | | |
|----|---------|--|
| 1. | A126-04 | Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| 2. | B32-08 | Standard Specification for Solder Metal |
| 3. | B88-03 | Standard Specification for Seamless Copper Water Tube |
| 4. | B88M-05 | Standard Specification for Seamless Copper Water Tube (Metric) |
| 5. | B280-08 | Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service |

F. American Welding Society, Inc. (AWS):

- | | | |
|----|-------------------------------|--|
| 1. | AWS BRH-2007 Brazing Handbook | |
| 2. | A5.8/A5.8M-04 | Standard Specification for Filler Metals for Brazing and Braze Welding |

G. Underwriters Laboratories (U.L.):

- | | | |
|----|--------------|---|
| 1. | UL207 | Standard for Refrigerant-Containing Components and Accessories, Nonelectrical |
| 2. | UL 429 REV 6 | Electrically Operated Valves |

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Refrigerant Piping: Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer.
- B. Fittings, Valves and Accessories:

1. Solder joints: Wrought copper fittings, ASME B16.22.
 - a. Solder, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M, 45 percent silver brazing alloy, Class BAg-5.
 - b. Solder, water and drain: 95-5 tin-antimony, ASTM B32 (95TA).
2. Flanges and flanged fittings: ASME B16.24.

2.2 PIPE SUPPORTS

- A. Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC.

2.3 REFRIGERANTS AND OIL

- A. Provide required refrigerant and oil for proper system operation.

2.4 PIPE INSULATION FOR DX HVAC SYSTEMS

- A. Refer to specification Section 230711, HVAC AND PLUMBING INSULATION.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5
 1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
 2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 1 inch minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
 3. Use copper tubing in protective conduit when installed below ground.
 4. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.
- B. Joint Construction:
 1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.
 - a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.

- b. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
 - c. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
 - d. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.
- C. Protect refrigeration system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

3.2 PIPE AND TUBING INSULATION

- A. Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.3 SIGNS AND IDENTIFICATION

- A. Each refrigeration system erected on the premises shall be provided with an easily legible permanent sign securely attached and easily accessible, indicating thereon the name and address of the installer, the kind and total number of pounds of refrigerant required in the system for normal operations, and the field test pressure applied.

3.4 FIELD QUALITY CONTROL

- A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.

3.5 FIELD TESTS

- A. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of COR. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.
 - 1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
 - 2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device

protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding NPS 5/8. This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 68 degrees F minimum.

- B. Test Medium: A suitable dry gas such as nitrogen shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

3.6 SYSTEM TEST AND CHARGING

- A. System Test and Charging: As recommended by the equipment manufacturer or as follows:
 - 1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 10 psi gage. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
 - 2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
 - 3. Evacuate the entire refrigeration system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in microns. Pull the system down to 500 microns 2245.6 inches of mercury at 60 degrees F and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigerant to be charged and charge with the proper volume of refrigerant.

END OF SECTION 232300

SECTION 233100

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Ductwork and accessories for HVAC including the following:
 - 1. Supply air, return air, outside air, and exhaust systems.
- B. Definitions:
 - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
 - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
 - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
 - 4. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK

- A. General Mechanical Requirements: Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Noise Level Requirements: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- C. Duct Insulation: Section 230711, HVAC AND PLUMBING INSULATION
- D. Return Air and Exhaust Air Fans: Section 233400, HVAC FANS.
- E. Testing and Balancing of Air Flows: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Fire Safety Code: Comply with NFPA 90A.

- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Rectangular ducts:
 - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access doors.
 - 2. Round and flat oval duct construction details:
 - a. Manufacturer's details for duct fittings.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access sections.
 - e. Installation instructions.
 - 3. Volume dampers, back draft dampers.
 - 4. Upper hanger attachments.
 - 5. Flexible ducts and clamps, with manufacturer's installation instructions.
 - 6. Flexible connections.
 - 7. Instrument test fittings.
 - 8. Details and design analysis of alternate or optional duct systems.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):

1. A653/A653M-08 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
 2. B209-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 3. C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 4. E84-09 Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):
1. 90A-09 Standard for the Installation of Air Conditioning and Ventilating Systems
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. 3rd Edition – 2005 HVAC Duct Construction Standards, Metal and Flexible
- F. Underwriters Laboratories, Inc. (UL):
1. UL 181 Factory-Made Air Ducts and Connectors

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts and accessories of galvanized sheet steel, ASTM A527, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Joint Sealing:
1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 2. Gaskets in Flanged Joints: Soft neoprene.
- C. Approved factory made joints such as DUCTMATE SYSTEM may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

- A. Follow SMACNA HVAC Duct Construction Standards.
- B. Duct Pressure Class: 2 inch W.G.
- C. Seal Class: In accordance with SMACNA Standards.
- D. Round Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.
 - 1. Elbows: Diameters 6 through 8 inches shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
 - 2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.
- E. Volume Dampers: Single blade, opposed blade, or multi-louver type as detailed in SMACNA Standards.
- F. Duct Hangers and Supports: Refer to SMACNA Standards. Avoid use of trapeze hangers for round duct.

2.3 DUCT LINER (WHERE INDICATED ON DRAWINGS)

- A. Duct sizes shown on drawings for lined duct are clear opening inside lining.
- B. Rectangular Duct Liner: ASTM C1071, Type I (flexible), or Type II (board), 2 inches minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA HVAC Duct Construction Standards.

2.4 FLEXIBLE CONNECTIONS

- A. Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 29 ounce neoprene coated fiberglass fabric approximately 6 inches wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 2 inches on center. Fabric shall not be stressed other than by air pressure. Allow at least one inch slack to insure that no vibration is transmitted.

2.5 SEISMIC RESTRAINT FOR DUCTWORK

- A. Comply with SMACNA and ASCE standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of Section 230511, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
 - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
 - 2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA HVAC Duct Construction Standards. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
 - 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA HVAC Duct Construction Standards.
- C. Install duct hangers and supports in accordance with SMACNA HVAC Duct Construction Standards.
- D. Low Pressure Duct Liner: Install in accordance with SMACNA HVAC Duct Construction Standards.
- E. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by COR. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 TESTING, ADJUSTING AND BALANCING (TAB)

- A. Refer to Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.3 OPERATING AND PERFORMANCE TESTS

- A. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC

END OF SECTION 233100

SECTION 233400

HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Fans for heating, ventilating and air conditioning.
- B. Product Definitions: AMCA Publication 99 Standards Handbook, 99-0066-01 Definitions.

1.2 RELATED WORK

- A. Section 010002, GENERAL REQUIREMENTS.
- B. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 230511, COMMON WORK RESULTS FOR HVAC.
- D. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- E. Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Fans and power ventilators shall bear the AMCA performance seal.
- C. Fans and power ventilators shall comply with the following standards:
 - 1. Testing and Rating: AMCA 210-08.
 - 2. Reverberant Room Method for Sound Testing of Fans: AMCA 300-08.
- D. Performance Criteria:
 - 1. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure.
 - 2. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation a smaller motor may be approved in the interest of energy

conservation. The contractor shall be responsible for making necessary changes to the electrical system.

3. Select fan operating point as follows:

- a. Forward curved and axial fans: Right hand side of peak pressure point.
- b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.

E. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.

F. Corrosion Protection:

- 1. All steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog and ASTM B117 salt spray.
- 2. If flammable gas, vapor or combustible dust is present the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers Literature and Data:

- 1. Fan sections, motors and drives.
- 2. Centrifugal fans, motors, drives, accessories and coatings.

a. In-line centrifugal fans.

3. Ceiling fans.

C. Certified Sound power levels for each fan.

D. Motor ratings types, electrical characteristics and accessories.

E. Maintenance and Operating manuals in accordance with Section 010000, GENERAL REQUIREMENTS.

F. Certified fan performance curves for each fan showing cubic meters per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation and at 110 percent of design static pressure.

1.5 APPLICABLE PUBLICATIONS

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

- B. Air Movement and Control Association International, Inc. (AMCA):
 - 1. 99 Standards Handbook
 - 2. 210-07 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
 - 3. 300-08 Reverberant Room Method for Sound Testing of Fans
- C. American Society for Testing and Materials (ASTM):
 - 1. B117-07a Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 2. D1735-08 Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
- D. Underwriters Laboratories, Inc. (UL):
 - 1. UL 181 Factory-Made Air Ducts and Air Connectors

PART 2 - PRODUCTS

2.1 CEILING FANS (SMALL CABINET FAN)

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.
- B. Steel housing, baked enamel finish, direct connected fan assembly, attached grille and integral backdraft assembly.
- C. Motor: Shaded pole or permanent split capacitor, sleeve bearings, supported by steel brackets in combination with rubber isolators.
- D. Ceiling Grille: White plastic egg crate design, 80 percent free area.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.
- C. Secure equipment per plans.

3.2 PRE-OPERATION MAINTENANCE

- A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.
- C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 START-UP AND INSTRUCTIONS

- A. Verify proper operation of motor, drive system and fan wheel.
- B. Check vibration and correct as necessary for air balance work.

END OF SECTION 233400

SECTION 233700

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Air outlets and inlets, including the following: Grilles, registers and diffusers.

1.2 RELATED WORK

- A. General Mechanical Requirements: Section 230511, COMMON WORK RESULTS FOR HVAC.
- B. Testing and Balancing of Air Flows: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Grilles, registers, diffusers and accessories.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 230511, COMMON WORK RESULTS FOR HVAC.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):

1. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):
 1. A653/A653M-08 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
 2. B209-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 3. E84-09 Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):
 1. 90A-09 Standard for the Installation of Air Conditioning and Ventilating Systems
- E. Underwriters Laboratories, Inc. (UL):
 1. UL 33 Heat Responsive Links for Fire-Protection Service

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

- A. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC.

2.2 AIR OUTLETS AND INLETS

- A. Materials:
 1. Aluminum: Provide manufacturer's standard gasket.
 2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
 3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.
- B. Performance Test Data: In accordance with ANSI/ASHRAE Standard 70-2006.
- C. Air Supply Outlets:
 1. Double Deflection Supply Grilles and Registers: Extruded aluminum, white finish, and individually adjustable blades. Front bars parallel to the short dimension.
 - a. Border: Flat, 1-1/4 inches wide.

- b. Bar spacing: 3/4 inch maximum.
- D. Return and Exhaust Registers and Grilles:
 - 1. Finish: white baked enamel.
 - 2. Standard Type: Fixed horizontal face bars set at 35 degrees, 1-1/4 inch margin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of Section 230511, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
- B. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by COR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING AND BALANCING (TAB)

- A. Refer to Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.3 OPERATING AND PERFORMANCE TESTS

- A. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC.

END OF SECTION 233700

SECTION 238143

AIR-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies electrically operated unitary and applied air-source heat pumps.
- B. Definitions:
 - 1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions.
 - 2. Coefficient of Performance (COP) - Heating: The ratio of the rate of heat delivered to the rate of energy input is consistent units for a complete heat pump system, including the compressor and, if applicable, auxiliary heat under designated operating conditions.
 - 3. Unitary Heat Pump: One or more factory made assemblies that normally include an indoor conditioning coil, compressor(s) and an outdoor refrigerant-to-air heat exchanger. These units provide both heating and cooling functions.

1.2 RELATED WORK

- A. Section 010002, GENERAL REQUIREMENTS: For pre-test requirements.
- B. Section 230511, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 232300, REFRIGERANT PIPING: Requirements for field refrigerant piping.
- D. Section 233100, HVAC DUCTS AND CASINGS: Requirements for sheet metal ductwork.
- E. Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Requirements for testing, adjusting and balancing of HVAC system.

1.3 QUALITY ASSURANCE:

- A. Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC
- B. Comply with ASHRAE Standard 15-2007, Safety Standard for Refrigeration Systems.

1.4 SUBMITTALS

- A. Submit in accordance with specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data.
 - 1. Unitary Heat pumps, Air-to-Air:
 - a. Split system
- C. Certification: Submit, simultaneously with shop drawings, a proof of certification that this product has been certified by AHRI.
- D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required cooling and heating capacities, EER and COP values.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning, Heating and Refrigeration Institute (AHRI) Standards:
 - 1. 210/240-2008 Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment
 - 2. 270-95 Sound Rating of Outdoor Unitary Equipment
 - 3. 310/380-2004 Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)
 - 4. 340/360-2004 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
 - 5. 350-2000 Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
- C. Air Movement and Control Association (AMCA):
 - 1. 210-2007 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI)
- D. American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc (ASHRAE):
 - 1. 15-2007 Safety Standard for Refrigeration Systems (ANSI)
 - 2. 62.1-2007 Ventilation for Acceptable Indoor Air Quality (ANSI)
 - 3. 90.1-2007 Energy Standard for Buildings except Low-Rise Residential Buildings
 - 4. 2004 Handbook HVAC Systems and Equipment

- E. American Society of Testing and Materials (ASTM):
 - 1. B117-07a Standard Practice for Operating Salt Spray (Fog) Apparatus
- F. National Electrical Manufacturer's Association (NEMA):
 - 1. MG 1-2007 Motors and Generators (ANSI)
- G. National Fire Protection Association (NFPA):
 - 1. 90A-2009 Standard for the Installation of Air-Conditioning and Ventilating Systems

PART 2 - PRODUCTS

2.1 UNITARY HEAT PUMPS, AIR TO AIR

- A. Units shall be Type II, (Split System) having remote outdoor section separate from indoor Section.
 - 1. Unitary heat pumps shall comply with ASHRAE 90.1 minimum equipment efficiency requirements.
- B. Casing: Unit shall be constructed of zinc coated, 14-gage minimum galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit surfaces shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet panels shall have lifting handles and shall be water- and air-tight seal. All exposed vertical, top covers and base pan shall be insulated with 2-inch matt-faced, fire-resistant, odorless, glass fiber material. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007. The base of the unit shall have provisions for forklift and crane lifting.
- C. Filters: One inch thick, MERV 8 throwaway filter shall be standard on all units below 7-1/2 Tons. Filter rack can be converted to two inch capability.
- D. Compressors: Compressors shall be direct-drive scroll type. Internal overload shall be provided with the compressors. Crankcase heaters shall be utilized with all compressors.
- E. Refrigerant Circuit: Refrigerant circuit shall have independent fixed orifice or thermostatic expansion devices, service pressure ports, and refrigerant line filter-driers factory installed as standard. An area shall be provided for replacement suction line driers.
- F. Evaporator and Condenser Coils: Internally finned, NPS 3/8 copper tubes mechanically bonded to a configured copper plate fin with coil coating capable of withstanding 5,000 hour salt spray test. The evaporator coil and condenser coil shall

be leak tested at the factory to 200 psig and pressure tested to 400 psig. Sloped condensate drain pans are standard.

- G. Outdoor fans: Direct driven, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motors shall be permanently lubricated and shall have built-in thermal overload protection.
- H. Indoor Fan: Forward-curved centrifugal with adjustable motor sheaves. Motors shall be thermally protected. Oversize motors shall be available for high static application.
- I. Defrost Controls: A time initiated, temperature terminated defrost system shall ship with a setting of 70-minute cycle, with a choice of 50- or 90-minute cycle. Adaptive demand defrost shall be provided on units below 7-1/2 Tons.
- J. Controls: Factory wired with controls and contactor pressure lugs or terminal block for power wiring. Micro-processor controls shall be provided for all 24-volt control functions. The resident control algorithms shall make heating, cooling, and ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. Controls shall include an anti-short-cycle timing and time delay between compressors.
 - 1. Thermostat: Wall-Mounted Automatic Programmable Thermostat with lockable cover.
- K. Accessories:
 - 1. Electric Heater: Constructed of heavy-duty nickel chromium elements. Staging shall be achieved through the unit control processor. Each heater shall have automatically reset high limit control. Heaters shall be individually fused from the factory and shall comply with NEC requirements. Power assemblies shall provide single point connection. Electric heat modules shall be UL listed and labeled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install heat pumps according to manufacturers printed instructions.
- B. Install electrical and control devices furnished by the manufacturer but not specified to be factory mounted. All electrical work shall comply with Division 26 Sections.
- C. Ductwork: Comply with requirements in Section 233100, HVAC DUCTS AND CASINGS.
- D. Piping: Comply with requirements in Section 232300, REFRIGERANT PIPING.

3.2 STARTUP AND TESTING:

- A. Perform startup checks according to manufacturer's written instructions.
- B. Test controls and demonstrate compliance with project requirements. Replace damaged or malfunctioning controls and equipment and retest the equipment to the satisfaction of the COR.

END OF SECTION 238143

SECTION 260511

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, and other items and arrangements for the specified items are shown on drawings.
- C. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval for sizes and settings of these devices.
- D. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards,

such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed; equipment or device of a kind mentioned which:
 - a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
2. Labeled; equipment or device is when:
 - a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
 - b. The laboratory makes periodic inspections of the production of such equipment.
 - c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. Certified; equipment or product is which:
 - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
 2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of 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 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 VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
 - 2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
 - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.6 EQUIPMENT REQUIREMENTS

- A. Where variations from the contract requirements are requested in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, 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.

1.7 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
 - 1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 - 2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
 - 3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
 - 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K 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. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
 - 3. 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. 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.
- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times.
- E. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 010000, GENERAL REQUIREMENTS.

- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
 - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 - 2. "Conveniently accessible" is defined as being capable of being reached 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.

1.10 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 panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 1/4 inch high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.11 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify 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, 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,) associated with equipment or piping so that the proposed installation can be properly reviewed.
 3. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 010000, GENERAL REQUIREMENTS.
1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
 2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract 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 system 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 and maintenance instructions.
 - e. Safety precautions.
 - f. Diagrams and illustrations.
 - g. Testing methods.
 - h. Performance data.
 - i. Lubrication schedule including type, grade, temperature range, and frequency.
 - j. 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 parts, and name of servicing organization.
 - k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
 - G. Approvals will be based on complete submission of manuals together with shop drawings.
 - H. After approval and prior to installation, furnish the COR with one sample of each of the following:
 - 1. A 12 inch length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 - 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, outlet box, manual motor starter, device plate, engraved nameplate, wire and cable splicing and terminating material and single pole molded case circuit breaker.
 - 6. Each type of light fixture specified in Section 265100, INTERIOR LIGHTING or shown on the drawings.
- 1.12 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.
- 1.13 TRAINING
- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 010000, GENERAL REQUIREMENTS.
 - B. Training shall be provided for the particular equipment or system as required in each associated specification.
 - 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.

END OF SECTION 260511

SECTION 260521

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

- A. Excavation and backfill for cables that are installed in conduit: Section 312000, EARTH MOVING.
- B. General electrical requirements that are common to more than one section in Division 26: Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- C. Conduits for cables and wiring: Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Manufacturer's Literature and Data: Showing each cable type and rating.
 - 2. Certificates: Two weeks 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.

1.4 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 the basic designation only.
- B. American Society of Testing Material (ASTM):

1. D2301-04 Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
- C. Federal Specifications (Fed. Spec.):
 1. A-A-59544-00 Cable and Wire, Electrical (Power, Fixed Installation)
- D. National Fire Protection Association (NFPA):
 1. 70-08 National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
 1. 44-02 Thermoset-Insulated Wires and Cables
 2. 83-03 Thermoplastic-Insulated Wires and Cables
 3. 467-01 Electrical Grounding and Bonding Equipment
 4. 486A-01 Wire Connectors and Soldering Lugs for Use with Copper Conductors
 5. 486C-02 Splicing Wire Connectors
 6. 486D-02 Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
 7. 486E-00 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
 8. 493-01 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
 9. 514B-02 Fittings for Cable and Conduit
 10. 1479-03 Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING)

- A. Cable and Wire shall be in accordance with Fed. Spec. A-A-59544, except as hereinafter specified.
- B. Single Conductor:
 1. Shall be annealed copper.
 2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
 3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.
- C. Insulation:
 1. XHHW or dual rated THHN-THWN shall be in accordance with UL 44, and 83.

D. Color Code:

1. Secondary service, feeder and branch circuit conductors shall be color coded as follows:

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

- a. The lighting circuit “switch legs” and 3-way switch “traveling wires” shall have color coding unique and distinct (i.e. pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Field coordinate for a final color coding with the COR.
2. Use solid color compound or solid color coating for No. 12 AWG and No. 10 AWG branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - a. Solid color compound or solid color coating.
 - b. Stripes, bands, or hash marks of color specified above.
 - c. Color as specified using 3/4 inch wide tape. Apply tape in half overlapping turns for a minimum of 3 inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. 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.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E and NEC.
- B. Branch circuits (No. 10 AWG and smaller):
 1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree C with integral insulation, approved for copper and aluminum conductors.
 2. The integral insulator shall have a skirt to completely cover the stripped wires.

3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.

C. Feeder Circuits:

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.
2. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
4. Plastic electrical insulating tape: ASTM D2304 shall apply, flame retardant, cold and weather resistant.

2.3 CONTROL WIRING

- A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.4 WIRE LUBRICATING COMPOUND

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

2.5 WARNING TAPE

- A. The tape shall be standard, 3 inch wide, 4-Mil polyethylene non-detectable type.
- B. The tape shall be red with black letters indicating "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.

- C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
- D. Wires of different systems (i.e. 120V, 277V) shall not be installed in the same conduit or junction box system.
- E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- F. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- G. Wire Pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use ropes made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.
 - 4. Pull in multiple cables together in a single conduit.
- H. No more than (3) single-phase branch circuits shall be installed in any one conduit.
- I. The wires shall be derated in accordance with NEC Article 310. Neutral wires, under conditions defined by the NEC, shall be considered current-carrying conductors.

3.2 SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.3 CONTROL AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

- E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

3.4 CONTROL AND SIGNAL SYSTEM 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.

3.5 FEEDER IDENTIFICATION

- A. In each interior pulbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.
- B. In each handhole, provide tags of the embossed brass type, showing the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.6 EXISTING WIRING

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

3.7 FIELD TESTING

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds.
- C. Test conductor phase-to-phase and phase-to-ground.
- D. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION 260521

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements of electrical equipment operations and to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

- A. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 260521, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

1.3 SUBMITTALS

- A. Submit in accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:

1. Certification that the materials and installation is in accordance with the drawings and specifications.
2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 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. American Society for Testing and Materials (ASTM):
 1. B1-2001 Standard Specification for Hard-Drawn Copper Wire
 2. B8-2004 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 1. 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- D. National Fire Protection Association (NFPA):
 1. 70-2008 National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
 1. 44-2005 Thermoset-Insulated Wires and Cables
 2. 83-2003 Thermoplastic-Insulated Wires and Cables
 3. 467-2004 Grounding and Bonding Equipment
 4. 486A-486B-2003 Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 4 AWG and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

- C. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.2 GROUND RODS

- A. Copper clad steel, 3/4 inch diameter by 10 feet long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.4 GROUND CONNECTIONS

- A. Below Grade: Exothermic-welded type connectors.
- B. Above Grade:
 - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
 - 2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
 - 3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

- A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 3/8 inch x 3/4 inch.

2.6 GROUND TERMINAL BLOCKS

- A. At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.7 SPLICE CASE GROUND ACCESSORIES

- A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

- A. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per NEC between the main equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
 - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- B. Main Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- C. Switchboards: Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- D. Transformers:
 - 1. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode

conductor from the transformer to the nearest component of the grounding electrode system.

E. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. All conduit systems shall contain an equipment grounding conductor.
3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

F. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

G. 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.
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. 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.

L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Communication Room Ground Systems: Ground all metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray pan or the telecommunications ground busbar, whichever is closer, using insulated 6 AWG ground wire bonding jumpers. Use insulated 6 AWG bonding jumpers to ground metallic conduit and wireways at each end and to bond at all intermediate metallic enclosures.

I. Communications Cable Grounding: Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide

100 percent metallic sheath continuity throughout the communications distribution system.

1. At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
2. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.4 CORROSION INHIBITORS

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

3.5 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.6 ELECTRICAL ROOM GROUNDING

- A. Building Earth Ground Busbars: Provide ground busbar hardware at each electrical room and connect to pigtail extensions of the building grounding electrode system.

3.7 WIREWAY GROUNDING

- A. Ground and Bond Metallic Wireway Systems as follows:
 1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
 2. Install insulated 6 AWG bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 50 feet.
 3. Use insulated 6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.

3.8 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.
- B. 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 and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. 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.

3.9 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 10 feet in depth.
- B. Where 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.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

END OF SECTION 260526

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 RELATED WORK

- A. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 079200, JOINT SEALANTS.
- B. General electrical requirements and items that is common to more than one section of Division 26: Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Shop Drawings:
 - 1. Size and location of main feeders;
 - 2. Size and location of panels and pull boxes
 - 3. 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.
- C. 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.

1.4 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):
 - 1. 70-08 National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
 - 1. 1-05 Flexible Metal Conduit
 - 2. 5-04 Surface Metal Raceway and Fittings
 - 3. 6-07 Rigid Metal Conduit
 - 4. 50-07 Enclosures for Electrical Equipment
 - 5. 360-09 Liquid-Tight Flexible Steel Conduit
 - 6. 467-07 Grounding and Bonding Equipment
 - 7. 514A-04 Metallic Outlet Boxes
 - 8. 514B-04 Fittings for Cable and Conduit
 - 9. 514C-96 Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
 - 10. 651-05 Schedule 40 and 80 Rigid PVC Conduit
 - 11. 651A-00 Type EB and A Rigid PVC Conduit and HDPE Conduit
 - 12. 797-07 Electrical Metallic Tubing
 - 13. 1242-06 Intermediate Metal Conduit
- D. National Electrical Manufacturers Association (NEMA):
 - 1. TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing
 - 2. FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 1/2 inch unless otherwise shown. Where permitted by the NEC, 1/2 inch flexible conduit may be used for tap connections to recessed lighting fixtures. Not less than 3/4 inch for telecommunications and IDS conduit.
- B. Conduit:
 - 1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3.
Maximum size not to exceed 4 inch and shall be permitted only with cable rated 600 volts or less.
5. Flexible galvanized steel conduit: Shall Conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
8. Surface metal raceway: Shall Conform to UL 5.

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.
2. Rigid aluminum conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
 - b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
 - c. Set screw fittings: Not permitted for use with aluminum conduit.
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 2 inches and smaller. Use set screw type

- couplings with four set screws each for conduit sizes over 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, 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 1 1/2 by 1 1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8 inch diameter steel hanger rods.
 - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- 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 3 inch wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 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.
 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.
- 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 078400, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 079200, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

- A. In accordance with UL, NEC, as shown, and as hereinafter specified.
- B. 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 1 foot of changes of direction, and within 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.

C. 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.

D. 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.

3.3 CONCEALED WORK INSTALLATION

A. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors 600 volts and below:
 - a. Rigid steel or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.
3. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit extending from a junction box to the fixture.
4. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
 - 1. Rigid steel or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over eight foot intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting: Paint exposed conduits to match adjacent finishes.

3.5 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 within 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 20 mil bonded PVC or field coat with asphalt before installation. After installation, completely coat damaged areas of coating.

3.6 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.

3.7 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 8 foot on center.
- C. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- D. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 1/4 inch bolt size and not less than 1-1/8 inch embedment.
 - b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than 3 inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- E. Hollow Masonry: Toggle bolts are permitted.
- F. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- H. Attachment by wood plugs, rawlplug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

3.8 COMMUNICATION AND IDS SYSTEM CONDUIT

- A. Install the communication and raceway systems as shown on drawings.
- B. Minimum conduit size of 3/4 inch, but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All four inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- E. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

- F. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- G. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- H. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

3.9 BOX INSTALLATION

Sizes of Conduit Trade Size	Radius of Conduit Bends, Inches
3/4	6
1	9
1-1/4	14
1-1/2	17
2	21
2-1/2	25
3	31
3-1/2	36
4	45

- 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 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 4 inches square by 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 260533

SECTION 260571

ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements of the Electrical System Protective Device Study.
- B. A short circuit study shall be prepared for the electrical over current devices to be installed under this project to assure proper equipment and personnel protection.

1.2 RELATED WORK

- A. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 262416, PANELBOARDS: Low voltage panelboards.

1.3 SUBMITTALS

- A. In accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Complete short circuit study as described herein.
- C. Protective equipment shop drawings shall be submitted simultaneously with or after the protective device study. Protective equipment shop drawings will not be accepted prior to protective device study.
- D. Certification: Two weeks prior to final inspection, submit four copies of the following to the COR:
 - 1. Certification by the Contractor that the protective devices have been adjusted and set in accordance with the approved protective device study.

1.4 QUALIFICATIONS

- A. The protective device study shall be prepared by a Professional Engineer, Licensed in the State of California.

1.5 REQUIREMENTS

- A. The complete study shall include a system one line diagram, arc flash analysis, short circuit and ground fault analysis.
- B. One Line Diagram:
 - 1. Show, on the one line diagram, all electrical equipment and wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
 - 2. Also show on the one line diagram the following specific information:
 - a. Short circuit values at each bus.
 - b. Breaker and fuse ratings.
 - c. Generator kW and Transformer kVA and voltage ratings.
 - d. Voltage at each bus.
 - e. Identification of each bus.
 - f. Conduit material and feeder sizes.
- C. Short Circuit Study:
 - 1. Systematically calculate the fault impedance to determine the available short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
 - 2. The study shall be calculated by means of a computer program. Pertinent data shall be incorporated in the drawings.
 - 3. Assume infinite impedance at the primary of the utility source transformer.
 - 4. Present the data determined by the short circuit study on the drawings. Include the following:
 - a. Device identification.
 - b. Operating voltage.
 - c. Protective device.
 - d. Device rating.
 - e. Calculated short circuit current.
- D. Arc-flash hazard analysis
 - a. Comply with NFPA 70E and its Annex D for hazard analysis study.
 - b. Preparatory Studies: Short-Circuit Study and Coordination Study.
 - c. Calculate maximum and minimum contributions of fault-current size.
 - d. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
 - e. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 - f. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

- g. Include low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.
- h. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.
- i. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors shall be decremented as follows:
- j. Fault contribution from induction motors should not be considered beyond three to five cycles.
- k. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
 - 1) When the circuit breaker is in a separate enclosure.
 - 2) When the line terminals of the circuit breaker are separate from the work location.
- l. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.
- m. Create Arc Flash Label and affix to electrical equipment.

1.6 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

- A. Necessary final field adjustments, settings and minor modifications shall be made to conform with the protective device study without additional cost to the Government.
- B. All final circuit breaker and relay settings and fuse sizes shall be made in accordance with the recommendations of the protective device study.

END OF SECTION 260571

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of panelboards.

1.2 RELATED WORK

- A. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.
- B. Section 260571, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for the over current protective devices to be installed to ensure proper equipment and personnel protection.
- C. Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.
- D. Section 260521, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- E. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

- A. Submit in accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams accessories and weights of equipment. Complete nameplate data including manufacturer's name and catalog number.
- C. Certification: Two weeks prior to final inspection, submit four copies of the following to the COR:

1. Certification that the material is in accordance with the drawings and specifications has been properly installed, and that the loads are balanced.

1.4 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 Electrical Manufacturers Association (NEMA):
 1. PB-1-2006 Panelboards
 2. AB-1-2002 Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures
- C. National Fire Protection Association (NFPA):
 1. 70-2005 National Electrical Code (NEC)
 2. 70E-2009 Standard for Electrical Life Safety in the Workplace
- D. Underwriters Laboratories, Inc. (UL):
 1. 50-2007 Enclosures for Electrical Equipment
 2. 67-2009 Panel boards
 3. 489-2009 Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be hinged "door in door" type with:
 1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
 2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
 3. Push inner and outer doors shall open left to right.

- D. All panelboards shall be completely factory assembled with molded case circuit breakers. Include one-piece removable, inner dead front cover independent of the panelboard cover.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.
- F. Panelboards shall conform to NEMA PB-1, NEMA AB-1 and UL 67 and have the following features:
 - 1. Nonreduced size copper bus bars, complete with current ratings as shown on the panel schedules connection straps bolted together and rigidly supported on molded insulators.
 - 2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single-phase, three-wire panelboard busing shall be such that when any two adjacent single-pole breakers are connected to opposite phases; two-pole breakers can be installed in any location. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two-or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.
 - 3. Mechanical lugs furnished with panelboards shall be cast, stamped or machined metal alloys of sizes suitable for the conductors indicated to be connected thereto.
 - 4. Neutral bus shall be 100% rated, mounted on insulated supports.
 - 5. Grounding bus bar equipped with screws or lugs for the connection of grounding wires.
 - 6. Buses braced for the available short circuit current.
 - 7. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.
 - 8. Protective devices shall be designed so that they can be easily replaced.
 - 9. Where designated on panel schedule "spaces", include all necessary bussing, device support and connections. Provide blank cover for each space.
 - 10. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panels, and with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
 - 11. Series rated panelboards are not permitted.

2.2 CABINETS AND TRIMS

- A. Cabinets:
 - 1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50 and UL 67.
 - 2. Cabinet enclosure shall not have ventilating openings.
 - 3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Breakers shall be UL 489 listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
 - 1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated on the drawings.
 - 2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100-ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher.
- C. Breaker features shall be as follows:
 - 1. A rugged, integral housing of molded insulating material.
 - 2. Silver alloy contacts.
 - 3. Arc quenchers and phase barriers for each pole.
 - 4. Quick-make, quick-break, operating mechanisms.
 - 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
 - 6. Electrically and mechanically trip free.
 - 7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 - a. Line connections shall be bolted.
 - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings.
 - 8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
 - 9. Shunt trips shall be provided where indicated
 - 10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory in a neat and typewritten manner.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the Manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- C. Install a typewritten schedule of circuits in each panelboard after being submitted to and approved by the COR. Schedules, after approval, shall be typed on the panel directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule. Include the room numbers and items served on the cards.
- D. Mount the panelboard fully aligned and such that the maximum height of the top circuit breaker above finished floor shall not exceed 78 inches. For panelboards that are too high, mount panelboard so that the bottom of the cabinets will not be less than 6 inches above the finished floor.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Directory-card information shall be typewritten to indicate outlets; lights, devices, and equipment controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.
- G. Where new panels are to be installed in existing backboxes, backboxes shall have rust and scale removed from inside. Paint inside of backboxes with rust preventive paint before the new panel interior is installed. Provide new trim and doors for these panels. Covers shall fit tight to the box with no gaps between the cover and the box.
- H. Provide ARC flash identification per NFPA 70E.

END OF SECTION 262416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of wiring devices.

1.2 RELATED WORK

- A. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlets boxes.
- C. Section 260521, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.
- C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the COR: Technical data sheets and information for ordering replacement units.

- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR: Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, and tested.

1.5 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 basic designation only.
- B. National Fire Protection Association (NFPA):
 - 1. 70-08 National Electrical Code (NEC)
- C. National Electrical Manufacturers Association (NEMA):
 - 1. WD 1-99 General Color Requirements for Wiring Devices
 - 2. WD 6-02 Wiring Devices – Dimensional Requirements
- D. Underwriter's Laboratories, Inc. (UL):
 - 1. 5-07 Surface Metal Raceways and Fittings
 - 2. 20-08 General-Use Snap Switches
 - 3. 231-08 Power Outlets
 - 4. 467-07 Grounding and Bonding Equipment
 - 5. 498-08 Attachment Plugs and Receptacles
 - 6. 943-08 Ground-Fault Circuit-Interruption

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., and conform to NEMA WD 6.
 - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
 - 2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captive held binding screws.
- B. Duplex Receptacles: Heavy duty, specification grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
 - 1. Bodies shall be white in color.

2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
3. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, heavy duty, specification grade, suitable for mounting in a standard outlet box.
 - a. Ground fault interrupter shall consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliamp) on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a ground fault interrupter duplex receptacle, mounted in box with a gasketed, weatherproof, cover. The weatherproof integrity shall not be affected when heavy duty specification or cemetery grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 TOGGLE SWITCHES

- A. Toggle Switches: Shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be white in color unless otherwise specified. The rocker type switch is not acceptable and will not be approved.
 1. Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.
 2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self-grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
 3. Ratings:
 - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
 - b. 277 volt circuits: 20 amperes at 120-277 volts AC.

2.3 WALL PLATES

- A. Wall plates for switches and receptacles shall be smooth nylon . Oversize plates are not acceptable.
- B. Color shall be white unless otherwise specified.

- C. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD 6.
- D. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- E. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- F. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum with lockable cover.
- G. Wet-Location, Weatherproof Receptacle Cover Plate: Gasketed, type 3R weather-resistant, with die-cast aluminum lockable While-In-Use cover.

2.4 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 7. Bypass Switch: Override the "on" function in case of sensor failure.
 - 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- B. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

- B. Wall-Switch Sensor :

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: Single Level Switch Type: single circuit, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.
- C. Outlet boxes for light and dimmer switches shall be mounted on the strike side of doors.

- D. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- E. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades. In addition, check for exact direction of door swings so that local switches are properly located on the strike side.
- F. Install wall switches 48 inches above floor, OFF position down.
- G. Install convenience receptacles 18 inches above floor, and 6 inches above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- H. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.
- I. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
- J. Test GFCI devices for tripping values specified in UL 1436 and UL 943.

3.2 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, ceiling beams in exposed ceiling areas and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

END OF SECTION 262726

SECTION 262911
MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All motor starters including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise), shall meet these specifications.

1.2 RELATED WORK

- A. Other sections which specify motor driven equipment, except elevator motor controllers.
- B. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.
- C. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, weights, mounting details, materials, running over current protection, size of enclosure, over current protection, wiring diagrams, starting characteristics, interlocking and accessories.
- C. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance and operation.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
 - c. Elementary schematic diagrams shall be provided for clarity of operation.
 2. Two weeks prior to the project final inspection, submit four copies of the final updated maintenance and operating manual to the COR.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the COR:
1. Certification that the equipment has been properly installed, adjusted, and tested.

1.5 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 basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
1. ICS 1-08 Industrial Control and Systems General Requirements
 2. ICS 6-06 Industrial Control and Systems Enclosures
- C. National Fire Protection Association (NFPA):
1. 70-08 National Electrical Code (NEC)
- D. Underwriters Laboratories Inc. (UL):
1. 508-05 Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

- A. Shall be in accordance with the requirements of the IEEE, NEC, NEMA (ICS 1, ICS 1.1, ICS 2, ICS 6, ICS 7 and ICS 7.1) and UL.
- B. Shall have the following features:

1. Separately enclosed unless part of another assembly.
2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
3. Enclosures:
 - a. Shall be the NEMA types shown on the drawings for the motor controllers and shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
 - b. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.
 - c. Enclosures shall be primed and finish coated at the factory with the manufacturer's prime coat and standard finish.
- C. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.
- D. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.
- E. Provide a disconnecting means or safety switch near and within sight of each motor. Provide all wiring and conduit required to facilitate a complete installation.

2.2 MANUAL MOTOR STARTERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Manual motor starters.
 1. Starters shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
 2. Units shall include overload and low voltage protection, red pilot light, NO, and NC auxiliary contact and toggle operator.
- C. Fractional horsepower manual motor starters.
 1. Starters shall be general-purpose Class A, manually operated with full voltage controller for fractional horsepower induction motors.
 2. Units shall include thermal overload protection, red pilot light and toggle operator.
- D. Motor starting switches.
 1. Switches shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
 2. Units shall include thermal overload protection, red pilot light low voltage protection, NO, and NC auxiliary contact and toggle operator.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.
- B. In seismic areas, equipment shall be adequately anchored and braced per details on structural contract drawing to withstand the seismic forces at the location where installed.
- C. Furnish and install heater elements in motor starters and to match the installed motor characteristics. Submit a list of all motors listing motor nameplate rating and heater element installed.
- D. Motor Data: Provide neatly-typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating and heater element installed.
- E. Connect hand-off auto selector switches so that automatic control only is by-passed in "manual" position and any safety controls are not by-passed.
- F. Install manual motor starters in flush enclosures in finished areas.
- G. Examine control diagrams indicated before ordering motor controllers. Should conflicting data exist in specifications, drawings and diagrams, request corrected data prior to placing orders.

3.2 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

3.3 Acceptance Checks and Tests

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 - 1. Visual and Mechanical Inspection
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Inspect contactors.
 - d. Clean motor starters and variable speed motor controllers.
 - e. Verify overload element ratings are correct for their applications.
 - f. If motor-running protection is provided by fuses, verify correct fuse rating.

- g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

3.4 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor starters and variable speed motor controllers are in good operating condition and properly performing the intended functions.

3.5 SPARE PARTS

- A. Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project.

END OF SECTION 262911

SECTION 265100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of the interior lighting systems. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.2 RELATED WORK

- A. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 260521, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 262726, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
 - 1. Material and construction details include information on housing, optics system and lens/diffuser.
 - 2. Physical dimensions and description.

3. Wiring schematic and connection diagram.
4. Installation details.
5. Energy efficiency data.
6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.
7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).
8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).

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.

1.5 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. Institute of Electrical and Electronic Engineers (IEEE):
1. C62.41-02 Guide on the Surge Environment in Low Voltage (1000V and less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
1. 70-08 National Electrical Code (NEC)
 2. 101-09 Life Safety Code
- D. National Electrical Manufacturer's Association (NEMA):
1. C78.138-98 Electric Lamps - 250-Watt, 70 Watt, M85 Metal-Halide Lamps
 2. C78.43-07 Standard for Electric Lamps - Single-Ended Metal-Halide Lamps

3. C78.81-05 Electric Lamps - Double-capped Fluorescent Lamps Dimensional and Electrical Characteristics
 4. C78.901-05 Electric Lamps - Single Base Fluorescent Lamps Dimensional and Electrical Characteristics
 5. C82.1-04 Ballasts for Fluorescent Lamps - Specifications
 6. C82.2-02 Method of Measurement of Fluorescent Lamp Ballasts
 7. C82.4-02 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps
 8. C82.11-02 High Frequency Fluorescent Lamp Ballasts
- E. Underwriters Laboratories, Inc. (UL):
1. 496-08 Safety Lampholders
 2. 542-05 Lampholders, Starters, and Starter Holders for Fluorescent Lamps
 3. 844-06 Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
 4. 924-06 Emergency Lighting and Power Equipment
 5. 935-01 Fluorescent-Lamp Ballasts
 6. 1029-94 High-Intensity-Discharge Lamp Ballasts
 7. 1029A-06 Ignitors and Related Auxiliaries for HID Lamp Ballasts
 8. 1598-08 Luminaires
 9. 1574-04 Standard for Track Lighting Systems
 10. 2108-04 Standard for Low-Voltage Lighting Systems
 11. 8750-08 Light Emitting Diode (LED) Light Sources for Use in Lighting Products
- F. Federal Communications Commission (FCC):
1. Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.
- B. Sheet Metal:
1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
 2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
 3. Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic.
 2. Flat lens panels shall have not less than 1/8 inch of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.

3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in NFPA 70, and shall comply with UL 844.
- K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp). Fixtures shall be designed for lamps as specified.

2.2 BALLASTS

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V) electronic rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
 1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.87 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFT 18, Ch.1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
- B. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
 1. Lamp end-of-life detection and shutdown circuit.

2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: 10 percent or less.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

2.3 FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 EMERGENCY LIGHTING UNIT

- A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch. Comply with UL 924.
1. Enclosure: Shall be impact-resistant thermoplastic, which will protect components from dust, moisture, and oxidizing fumes from the battery. Enclosure shall be suitable for the environmental conditions in which installed.
 2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
 3. Lamps: Shall be sealed-beam MR-16 halogen, rated not less than 12 watts at the specified DC voltage.

4. Battery: Shall be maintenance-free nickel-cadmium. Minimum normal life shall be 10 years.
5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.5 LAMPS

A. Linear T8 Fluorescent Lamps:

1. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
3. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, a Color Rendering Index (CRI) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless otherwise indicated.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.

2.6 EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.

B. Housing and Canopy:

1. Shall be made of die-cast aluminum.
2. Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.
3. Steel housing shall have baked enamel over corrosion resistant, matte black or ivory white primer.

C. Door frame shall be cast or extruded aluminum, and hinged with latch.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:

1. Maximum fixture wattage shall be 1 watt or less.

2. Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch thick, stenciled with 6 inch high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life.
3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
4. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltages: Refer to Lighting Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Lighting Fixture Supports:
 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning and relamping.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 4. Hardware for recessed fluorescent fixtures:
 - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
 - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
 5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
 - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid

members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

- b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

6. Hardware for recessed lighting fixtures:

- a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
- b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
- c. In addition to the above, the following is required for fixtures exceeding 20 pounds in weight.
 - 1) Where fixtures mounted in ASTM Standard C635-69 "Intermediate" and "Heavy Duty" ceilings and weigh between 20 pounds and 56 pounds provide two 12-gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
 - 2) Where fixtures weigh over 56 pounds they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
- d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

7. Surface mounted lighting fixtures:

- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 1/4-20 bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices

- designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12-gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 56 pounds shall be supported directly from the building structure.
- b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
 - c. Fixtures less than 15 pounds in weight and occupying less than two square feet of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
 - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
 - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
 - 3) The outlet box is supported vertically from the building structure.
 - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
8. Single or double pendant-mounted lighting fixtures:
- a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- D. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- E. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- F. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- G. Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range.
- H. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and

compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.

- I. At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

END OF SECTION 265100

SECTION 270511

REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Requirements for Communications Installations, applies to all sections of Division 27.
- B. Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

- A. References to industry and trade association standards and codes are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

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

1.4 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of 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 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 VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
 - 2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.
 - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

- A. Where variations from the contract requirements are requested in accordance with Section 007200, GENERAL CONDITIONS and Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, 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.

1.6 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 010000, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 010000, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and pathways with other trades to minimize interferences. See Section 007200, GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Inaccessible Equipment:
 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 2. "Conveniently accessible" is defined as being capable of being reached 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.

1.9 EQUIPMENT IDENTIFICATION

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 1/4 inch high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify 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, 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,) associated with equipment or piping so that the proposed installation can be properly reviewed.
 - 3. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 010000, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
 2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract 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 system 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 and maintenance instructions.
 - e. Safety precautions.
 - f. Diagrams and illustrations.
 - g. Testing methods.
 - 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 parts, and name of servicing organization.
 - j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A 12 inch length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 2. Each type of conduit and pathway coupling, bushing and termination fitting.
 3. Raceway and pathway hangers, clamps and supports.
 4. Duct sealing compound.

1.11 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.

1.12 TRAINING

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 010000, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- 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 270511

PART 1 - GENERAL

A. This section specifies the furnishing, installation, and connection of the network cabling system to provide a comprehensive telecommunications infrastructure.

- A. General electrical requirements that are common to more than one section in Division 27: Section 270511, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Conduits for cables and wiring: Section 260533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
- C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

1. Manufacturer's Literature and Data: Showing each cable type and rating.
2. Certificates: Two weeks 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.

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 the basic designation only.

- B. American Society of Testing Material (ASTM):
1. D2301-04 Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

C. Federal Specifications (Fed. Spec.):

- | | | |
|----|--------------|--|
| 1. | A-A-59544-00 | Cable and Wire, Electrical (Power, Fixed Installation) |
|----|--------------|--|

D. National Fire Protection Association (NFPA):

- | | | |
|----|-------|--------------------------------|
| 1. | 70-08 | National Electrical Code (NEC) |
|----|-------|--------------------------------|

E. Underwriters Laboratories, Inc. (UL):

- | | | |
|----|---------|---|
| 1. | 44-02 | Thermoset-Insulated Wires and Cables |
| 2. | 83-03 | Thermoplastic-Insulated Wires and Cables |
| 3. | 486C-02 | Splicing Wire Connectors |
| 4. | 486E-00 | Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors |
| 5. | 514B-02 | Fittings for Cable and Conduit |
| 6. | 1479-03 | Fire Tests of Through-Penetration Fire Stops |

PART 2 - PRODUCTS

2.1 COMMUNICATION AND SIGNAL WIRING

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.
- C. Multi-conductor cables shall have the conductors color coded.

2.2 WIRE LUBRICATING COMPOUND

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

PART 3 - EXECUTION

3.1 CODES OF PRACTICE

- A. Adherence to the VA/NCA Network Cable Specifications by cabling installation contractors is a condition of contract. In the event the cabling installation is sub-contracted by the prime contractor, the prime contractor will supply a copy of these

specifications to the sub-contractor. This requirement shall cover all levels of sub-contracting.

- B. Any variations to the issued job specification shall be referred for approval to the Contracting Officer Representative (COR). VA Quantico Regional Processing Center also must approve these variations.
- C. Contractors shall install all cable and cabling products with a proven track record for data network cabling installations. Such installations shall also meet all requirements as set out in this specification.
- D. Un-terminated "future capacity" cables are not permitted. All installed cables shall be terminated at each end and documentation, labeling and (where applicable) test results provided. This applies to all permanently installed cable types.

3.2 DOCUMENTATION

- A. At least two copies of documents describing the data cable installation shall be provided. A copy shall be supplied to:
 - 1. Director, VA National Cemetery for which the work is being performed.

3.3 NETWORK EQUIPMENT

- A. VA Quantico Regional Processing Center must approve the installation or removal of network hardware equipment. Non-VA/NCA staff shall carry out such work only with prior approval from the VA Quantico Regional Processing Center.

3.4 NETWORK EQUIPMENT ENVIRONMENT

- A. Punch down area(s) (location of the data communication rack(s)) will be determined by the building Architect/Engineer and the VA Quantico Regional Processing Center.
- B. Contractor shall relocate existing 100BaseT, Category 5e or Category 6 certified rack-mounted modular RJ45 punch down block/panel (24/48 ports) for jacks meeting the ANSI/EIA/TIA 568-B category 5e/6 standards.
- C. Contractor shall relocate the existing steel data communication rack with associated network equipment.
- D. Each jack on the punch down block/panel shall correspond with the jack at the wall device faceplate.
- E. Where network equipment is to be located in a secure room or large closet, the room or closet shall have a dry powder extinguisher, suitable for electrical fires, provided and installed within the room. Adequate through flow ventilation shall be provided in a manner that does not compromise the security of the closet

3.5 UNSHEILDDED TWISTED PAIR (UTP) CATEGORY 5E/6

- A. IEEE 802.3 100BaseT UTP Level 5e/6, 24 AWG plenum rated cable grade.

3.6 NETWORK CONFIGURATION RESTRAINTS

- A. Each segment comprises a four pair Category 5e/6 cable.
- B. Pin all 8 conductors.
- C. Maximum link length - 90 meters
- D. Maximum channel length - 100 meters
- E. Maximum number of stations per segment - 1.

3.7 INSTALLATION STANDARDS

- A. Cable and connecting hardware meeting or exceeding the Category 5e/6 specifications shall be used throughout, with pairs terminated according to the T568B wiring scheme.

3.8 GENERAL REQUIREMENTS

- A. The cabling system shall include all patch panels, horizontal cables, transition blocks, vertical cabling, modular jacks, system cables, patch cables, cable management, and a comprehensive labeling system.

3.9 DATA OUTLETS

- A. The following information represents a minimum requirement for the number of UTP outlets that shall be installed in each type of workspace.
- B. If the construction at the location of the data outlet is drywall, provide flush-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates (cable to be installed behind drywall).
- C. If the construction at the location of the data outlet is a solid wall, provide surface-mounted single-gang outlet boxes with two-port base plates and applicable wall device faceplates (cable to be installed in plastic wall mold equipped with protective insulator or sleeve).
- D. Where modular furniture is used, the location of the data outlet will be in the baseboard of the furniture, where the networked equipment (computers, printers, etc.) will be located. Provide flush-mounted single gang outlet boxes with two-port base plates and applicable wall device faceplates. If flush-mounted single-gang outlet boxes cannot be used, then modular surface mount boxes will be used with two-port

inserts. All cable runs in modular furniture will be through furniture wire baseboard ducts/conduit.

3.10 HORIZONTAL CABLING

- A. The horizontal wiring shall be a star topology connecting each network outlet jack to a jack on a patch panel rack in a communications enclosure/room.
- B. The cable used shall be 4-pair 100-ohm high performance, 24 AWG solid conductor, unshielded twisted pair cable, meeting or exceeding the Category 5e/6 specification.

3.11 NETWORK OUTLET AND LABELING

- A. Each network outlet faceplate shall incorporate one or more modular, universal RJ45 IDC jack sockets meeting or exceeding the Category 5e/6 specification. Label each jack at this wall device faceplate to correspond with the label on the patch panel jack (N1, N2, etc.). All numbering should be readily visible.

3.12 CABLE INSTALLATION

- A. The cable interconnecting a network outlet to the patch panel shall be one continuous length with no intermediate joins, splices or taps.
- B. Cable termination onto a horizontal distribution panel or patch panel shall be undertaken in a manner that permits additional cables to be terminated without unduly disturbing previously installed cables.
- C. Each data outlet/device location will have two (2) cable runs that will terminate in the punch down block/panel at the punch down area. No more than 24 cables shall be cable tied in a bunch.
- D. A 2-meter loop of cable shall be left within or on the approach to each communications room/enclosure to facilitate re-termination of the cable in the future, should this be required. Such cable slack shall be coiled and supported in a neat and practical manner.
- E. A 0.5-meter loop of cable shall be left in the trunking on the approach to each network outlet to facilitate re-termination of the cable in the future, should this be required. The amount of untwisting in a pair as a result of termination to connecting hardware shall be no greater than 13 mm, and less than this if possible.
- F. Cable bend radii shall be no less than eight times the cable diameter or as specified by the cable manufacturer; whichever is greater. Precautions shall be observed to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles.

- G. Cable bundles shall not rub on, or be unduly compressed against any building infrastructure, building equipment, cable tray, equipment racking, or other cable support.
- H. Cable bundles shall not obstruct the installation and removal of equipment in equipment racks.
- I. Where UTP cables are run parallel with electrical cables the following minimum separation rules shall be observed:

Circuit rating Unshielded power/data		Shielded power/data
< 1 KVA	300mm	25mm
> 1 < 2 KVA	450mm	50mm
> 2 < 5 KVA	600mm	150mm
5 KVA	1500mm	300mm

- J. Where UTP cables are run in the proximity of electrical motors or transformers the minimum separation shall be 1 meter.
- K. In situations where the above minimum distances cannot be applied due to a lack of available space, data cables shall be enclosed in rigid and/or flexible steel conduit. Conduit shall be bonded to a protective ground at one point in the installation. No steel cabling enclosure medium shall be installed without having continuity to a protective ground.

3.13 PATCH CABLES

- A. The cable to be used for copper patch shall be 4 pair 100-ohm high performance, stranded conductor, unshielded twisted pair cable, meeting or exceeding the Category 5e/6 specifications.
- B. Each patch lead shall be terminated in RJ45 connectors (male) meeting or exceeding the Category 5e/6 specification.
- C. Contractor will supply one (1) 6' category 5e/6 patch cable with RJ45 connectors (male) for every cable run installed into the patch panel. This will allow connectivity between the patch panel and VA supplied switch.
- D. Contractor will supply one (1) 25' category 5e/6 patch cable with RJ45 connectors (male) for every cable run terminated at the user/device work location. This will allow connectivity from the networked device (computer, printer, etc.) to the wall jack.

3.14 WIRING MAINTENANCE OR OTHER LOCAL BUILDINGS:

- A. Local network connectivity for Maintenance building is required, follow all specifications as stated in this document.

3.15 RADIO FREQUENCY TRANSMISSION BRIDGES

- A. A radio frequency transmission bridge exists to connect the Administration (PIC) building to the existing Maintenance building. The system utilizes the Cisco Aironet Wireless Bridge and the Air Fortress Security Gateway for this transmission design. The system shall be re-connected and tested after relocation of the existing Network Equipment Rack. All wireless installations shall be documented and supplied to the Quantico Regional Processing Center; this includes but is not limited to configurations, passwords, and diagrams.

3.16 TESTING

- A. Testing shall be carried out with building electrical services operating (lighting, power, air conditioning plant and lift services where applicable).
- B. Wiring shall be tested to verify the continuity, integrity and polarity of the cable according to the specified pin and pair grouping assignments.

3.17 Documentation

- A. The contractor shall provide installation documentation at the completion of the cabling system installation.
- B. The contractor shall certify that the cabling system meets the UTP cabling system requirements for Category 5e/6 performance levels.

3.18 EXISTING WIRING

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

END OF SECTION 271000

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "the System"), and associated equipment and hardware to be installed in the NCA Facility, here-in-after referred to as "the Facility". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and analog radio frequency (RF) systems coaxial distribution cables, connectors, "patch" cables, and/or "break out" devices. The existing Network Equipment shall be relocated, installed within a new rack, reconnected, tested and commissioned to provide a fully functioning system. The existing system shall be surveyed and existing conditions documented prior to providing design documents
- B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The Voice and Digital and Analog Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System. Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Support Codes, which ever are the more stringent for this Facility. At a minimum, the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Chapter 3-4; NFPA, Section 101, Life Safety Code, The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.
- E. The VA Project Manager (PM) and/or if delegated, COR are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract

specifications and drawings, from the PM and/or the COR before proceeding with the change.

F. System Performance:

1. At a minimum the System shall support the following operating parameters:

a. Telecommunications Outlet (TCO):

1) Voice:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, balanced (BAL).
- c) Signal Level: 0 deciBel per mili-Volt (dBmV) \pm 0.1 dBmV.
- d) System speed: 100 mBps, minimum.
- e) System data error: 10 to the -6 Bps, minimum.

2) Data:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, BAL.
- c) Signal Level: 0 dBmV \pm 0.1 dBmV.
- d) System speed: 120 mBps, minimum.
- e) System data error: 10 to the -8 Bps, minimum.

1.2 RELATED WORK

- A. Specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Specification Section 270511, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Specification Section 260533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
- D. Specification Section 262726, WIRING DEVICES.
- E. Specification Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- F. 088-C3, VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.

B. National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	Installation Requirements for Lightning Protection Systems
467	Grounding and Bonding Equipment
497/497A/497B	Protectors for Paired Conductors/ Communications Circuits/Data Communications and Fire Alarm Circuits
884	Underfloor Raceways and Fittings

D. ANSI/EIA/TIA Publications:

568B	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for Telecommunications Pathways and Spaces
606A	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

E. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

F. International Telecommunication Union – Telecommunication Standardization Sector (ITU-T).

G. Federal Information Processing Standards (FIPS) Publications.

- H. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.
- I. United States Air Force: Technical Order 33K-I-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

1.4 QUALITY ASSURANCE

- A. The authorized representative of the OEM shall be responsible for the design, satisfactory total operation of the System, and its certification.
- B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.
- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.
- D. All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
- E. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the COR before being allowed to commence work on the System.

1.5 SUBMITTALS

- A. Provide submittals in accordance with Specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The COR shall retain one copy for review and approval.
 - 1. If the submittal is approved the COR shall retain one copy for Official Records and return three (3) copies to the Contractor.
 - 2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal

deviated from the System specifications. The COR shall retain one copy for Official Records.

- B. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
1. Title page to include:
 - a. NCA Location.
 - b. Contractor's name, address, and telephone (including FAX) numbers.
 - c. Date of Submittal.
 - d. VA Project No.
 2. List containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
 - a. Installation Location and Name.
 - b. Owner's or User's name, address, and telephone (including FAX) numbers.
 - c. Date of Project Start and Date of Final Acceptance by Owner.
 - d. System Project Number.
 - e. Brief (three paragraphs minimum) description of each system's function, operation, and installation.
 3. Narrative Description of the system.
 4. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. The following is the minimum equipment required by the system:

QUANTITY	UNIT
As required	Cabinet Assembly(s)
As required	Cross Connection (CCS) Systems
As required	Wire Management System/Equipment
As required	Telecommunications Outlets (TCO)
As Required	Distribution Cables
As required	TCO Connection Cables
As required	System Connectors
As required	Terminators
1 ea.	Installation Kit
As-required	Separate List Containing Each Equipment Spare(s)

5. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
6. List of test equipment as per paragraph 1.5.D. below.

7. Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.
8. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

C. Test Equipment List:

1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.
2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
 - a. Spectrum Analyzer.
 - b. Signal Level Meter.
 - c. Volt-Ohm Meter.
 - d. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
 - e. Bit Error Test Set (BERT).
 - f. Camera with a minimum of 60 pictures to that will develop immediately to include appropriate test equipment adapters. A video camera in VHS format is an acceptable alternate.
 - g. Video Waveform Monitor.
 - h. Video Vector Scope.
 - i. Color Video Monitor with audio capability.
 - j. 100 mHz Oscilloscope with video adapters.

D. Samples: A sample of each of the following items shall be furnished to the COR for approval prior to installation.

1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
 - a. One each telephone (or voice) rj45 jack installed.
 - b. Two each multi pin data rj45 jacks installed.
 - c. Cover Plate installed.
2. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
3. 2 ft. section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.

E. Certifications:

1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are

- authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
 3. Pre-acceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.
- F. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the COR. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.
- G. Record Wiring Diagrams:
1. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the COR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.
 2. The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.
- H. Surveys Required As A Part of the Technical Submittal: The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:
1. The required EPBX connections (each CSU shall be compatible with) shall be compatible with the following:

- a. Initially connect:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Main Station Lines		
Single Line		
Multi Line (Equipped for direct input dial [DID])		
Central Office (CO) Trunks		

Two Way		
DID		
Two-way DRTL		
Foreign Exchange (FX)		
Conference		
Radio Paging Access		
Audio Paging Access		
Off-Premise Extensions		
CORunk By-pass		
CRT w/keyboard		
Printers		
Attendant Consoles		
T-1 Access/Equipment		
Maintenance console		

- b. Projected Maximum Growth: The Contractor shall clearly and fully indicate this category for each item identified in Paragraph 1.4.H.1.a. as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Servers		
PC's		
Projected Maximum Growth		

- c. The Contractor shall clearly and fully indicate this category for each item identified in Paragraph 1.4.H.2.a. as a part of the technical submittal.
2. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems entire cable requirements and engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:

- a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
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FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run

3. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
 - a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic

Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.

- b. Be a voice and data cable distribution system that is based on a physical "Star" Topology.

B. System Performance:

- 1. At a minimum the System shall support the following operating parameters:

- a. Telecommunications Outlet (TCO):

- 1) 1) Voice:

- a) Isolation (outlet-outlet): 24 dB.
 - b) Impedance: 600 Ohms, balanced (BAL).
 - c) Signal Level: 0 deciBel per mili-Volt (dBmV) \pm 0.1 dBmV.
 - d) System speed: 100 mBps, minimum.
 - e) System data error: 10 to the -6 Bps, minimum.

- 2) Data:

- a) Isolation (outlet-outlet): 24 dB.
 - b) Impedance: 600 Ohms, BAL.
 - c) Signal Level: 0 dBmV \pm 0.1 dBmV.
 - d) System speed: 120 mBps, minimum.
 - e) System data error: 10 to the -8 Bps, minimum.

C. General:

- 1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
 - a. Maintains a stock of replacement parts for the item submitted.
 - b. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
 - c. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
- 2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.
- 3. The Contractor shall provide written verification, in writing to the COR at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper

- size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. The Telephone Contractor is responsible for providing interfacing cable connections for the telephone systems with the System.
 5. The telephone equipment and interface cabling from the telephone switch via the system telephone interface unit.
 6. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.
 7. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
 8. All interconnecting twisted pair, cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire cable unterminated, unconnected, loose or unsecured.
 9. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 271000, STRUCTURED CABLING.
 10. Plug-in connectors shall be provided to connect all equipment Base-band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
 11. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.
 12. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

D. Equipment Standards and Testing:

1. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 270511, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.
2. The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the COR approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

3. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

2.2 EQUIPMENT ITEMS

A. Cabinet with Internal Equipment Mounting Rack:

1. The provided equipment cabinet shall be lockable, fabricated of heavy 16 gauge steel, and have fully adjustable internal equipment mounting racks or rails that allows front panel equipment mounting and access. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using Facility Service Chief. It shall be floor or wall mounted with knock-out holes for cable entrance and conduit connection, contain ventilation ports and a quiet fan with non-disposable air filter for equipment cooling. Two keys shall be provided to the COR for each lock when the VA accepts the System.
2. A minimum of one cabinet shall be provided with blank rack space, for additional equipment. Blank panels shall be installed to cover any open or unused rack space. In addition, provide two 120 VAC power strips connected to surge protectors, a ventilation fan with non-disposable air filter, and a conduit or cable duct interfaced to adjacent cabinet(s), as part of this cabinet.
3. Blank panels shall be color matched to the cabinet, 1/8 in. aluminum with vertical dimensions in increments of one rack unit 1.75 in. with mounting holes spaced to correspond to EIA 19 in. rack dimensions. Single standard size blank panels shall be used to fill unused panel or rack spaces in lieu of numerous 1.75 in. types. One blank 1.75 in. high blank panel shall be installed between each item of equipment.
4. Technical Characteristics:

Overall Height	85 7/8 in., maximum
Overall Depth	25 1/2 in., maximum
Overall Width	21 1/16 in., maximum
Front Panel Opening Width	19 in., EIA horizontal
Hole Spacing	per EIA and Industry Standards

5. Internal Cabinet Components (minimum required):
 - a. AC power outlet strip(s):
 - 1) Power outlet strip(s) shall be provided as directed by the COR or the IRM. The additional equipment cabinet with no installed items in the cabinet shall contain strip(s) with a minimum of 12 ea. AC power outlets. Each strip shall be mounted inside and at the rear of the cabinet. It shall contain "U" grounded AC outlets for distributing AC power to the installed electronic equipment. The strip shall be self-

contained in a metal enclosure and may be provided with a 2 M (6 ft.) long (maximum) connecting cord with three prong plug.

2) Technical Characteristics:

- a) Power capacity 20 Ampere (AMP), 120 VAC continuous duty.
- b) Wire gauge: Three conductor, #12 AWG copper.

b. Cabinet AC Power Line Surge Protector and Filter:

- 1) Each cabinet shall be equipped with a AC Surge Protector and Filter. The Protector and Filter shall be housed in one single enclosure. The Protector and Filter shall perform instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. The unit shall be equipped with AC voltage and current surge protectors to prevent damage to the electronic equipment from power line induced voltage spikes, surges, lightning, etc. It shall be cabinet mounted and the cabinet AC power strip (maximum of two strips) may be connected to it as long as the system design is met.

2) Technical Characteristics:

Input Voltage range	120 VAC + 15%
Power capacity	20 AMP, 120 VAC
Voltage output regulation	+3.0%
Circuit breaker	15 AMP, may be self contain
Noise filtering	Greater than -45 dB
AC outlets	Four duplex grounded types, minimum
Response time	5.0 ns
Surge suppression	10,000 AMPS
Noise suppression	
Common	-40 dB
Differential	-45 dB

3) Specific requirements for current and surge protection shall include:

- a) Voltage protection threshold, line to neutral, starts at no more than 220 Volts peak. The transient voltage shall not exceed 300 volts peak. The Contractor shall furnish documentation on peak clamping voltage as a function of transient AMP.
- b) Peak power dissipation minimum 35 Joules per phase, as measured for 1.0 mS at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. The Contractor shall furnish an explanation of how the ratings were measured or empirically derived.

- c) Surge protector must not short circuit the AC power line at any time.
 - 1) The primary surge protection components must be silicon semiconductors. Secondary stages, if used, may include other types of devices.
 - 2) Surge protectors shall incorporate a visual device which indicates whether the surge suppression component(s) is (are) functioning.
 - 3) Surge protection devices shall be UL listed.
 - 4) Voltage and current surge protectors shall be provided on all ancillary equipment provided by the Contractor.
- d) Power dissipation 12,000 Watts (W) for 1.0 mS (or 12 Joules).
- e) Voltage protection threshold starts at not more than 100 VAC.

2.3 INSTALLATION KIT

- A. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the COR all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:
- B. System Grounding:
 - 1. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
 - 2. This includes, but is not limited to:
 - a. Coaxial Cable Shields.
 - b. Control Cable Shields.
 - c. Data Cable Shields.
 - d. Equipment Racks.
 - e. Equipment Cabinets.
 - f. Conduits.
 - g. Duct.
 - h. Cable Trays.
 - i. Power Panels.
 - j. Connector Panels.
 - k. Grounding Blocks.
- C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie

wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

- D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
- E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Product Delivery, Storage and Handling:
 - 1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The COR may inventory the cable, patch panels, and related equipment.
 - 2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the COR.
- B. System Installation:
 - 1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the COR and PM.
 - 2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.

3. The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
5. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
7. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Conduit and Signal Ducts:

1. Conduit:
 - a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 3/4 in.
 - b. All cables shall be installed in separate conduit COR. Conduits shall be provided in accordance with Section 260533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS, and NEC Article 800 for Communications systems, at a minimum.
 - c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 260533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS, and the NEC.
 - d. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

D. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

1. Wires:

- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
 - b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.
- 2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.
- E. AC Power: AC power wiring shall be run separately from signal cable.
- F. Grounding:
 - 1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.
 - a. The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.
 - b. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
 - c. The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.
 - 2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.
 - 3. Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.
 - 4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable

shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

G. Equipment Assembly:

1. Cabinets:

- a. Each enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s), and connector or patch panel(s).
- b. Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made. Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support. Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure. A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation. The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and nondisposable air filter.
- c. Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.
- d. Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".
 - 1) Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
 - 2) Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.
 - 3) All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.

- H. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for voice and data circuits shall be stenciled using laser printers. Handwritten labels are not acceptable.
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".
 2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
 3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 10 ft. identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
 4. Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams".

3.2 TESTS

A. Interim Inspection:

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6, marking of outlets, faceplates, outlet/connectors and patch cords.
2. The Contractor shall notify the COR, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.
3. Results of the interim inspection shall be provided to the COR and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.
4. The COR and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

B. Pretesting:

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

2. Pretesting Procedure:

- a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
- b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:
 - 1) Local Telephone Company Interfaces or Inputs.
 - 2) EPBX interfaces or inputs and outputs.
 - 3) MDF interfaces or inputs and outputs.
 - 4) EPBX output S/NR for each telephone and data channel.
 - 5) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.

3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the COR.

C. Acceptance Test:

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the COR, then the Contractor shall schedule an acceptance test date and give the COR 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

D. Verification Tests:

1. Test the UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.

E. Performance Testing:

1. Perform Category 6 and 5e tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.

- F. Total System Acceptance Test: The Contractor shall perform verification tests for UTP copper cabling system after the complete telecommunication distribution system and workstation outlet are installed.
 - 1. Voice Testing: Connect to the network interface device at the demarcation point. Go off-hook and receive dial tone from the LEC. If a test number is available, place and receive a local, long distance, and FTS telephone call.
 - 2. Data Testing: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network is achieved.

3.3 TRAINING

- A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.
- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

3.4 GUARANTEE PERIOD OF SERVICE

- A. Contractor's Responsibilities:
 - 1. The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the COR (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.
 - 2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.
 - 3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
 - 4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period:
 - a. Response Time:
 - 1) The COR (or facility Contracting Officer if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.

- 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
- 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
 - a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
 - b) An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
- 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
 - a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
 - b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the COR or Facility Director. The COR or Facility Contracting Officer shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year guarantee period
 - 1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.
 - a) The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.
 - b) The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.
 - c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COR or Facility Contracting Officer.

- 2) The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COR with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:
 - a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COR or Facilities Contracting Officer by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance
 - b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
 - 3) The COR or Facility Contracting Officer shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
 - a) The COR or Facility Contracting Officer shall ensure copies of these reports are entered into the System's official acquisition documents.
 - b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.
- B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The COR or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

END OF SECTION 271100

SECTION 280511

REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Requirements for Electronic Safety and Security Installations, applies to all sections of Division 28.
- B. Furnish and install electronic safety and security cabling, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of, cable and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

- A. References to industry and trade association standards and codes are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

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

1.4 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of 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 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 VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
 - 2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.
 - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

- A. Where variations from the contract requirements are requested in accordance with Section 007200, GENERAL CONDITIONS and Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, 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.

1.6 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
 - 1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter;

and be vacuum cleaned both inside and outside before testing and operating and repainting if required.

2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 010000, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 010000, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 007200, GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Inaccessible Equipment:
 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 2. "Conveniently accessible" is defined as being capable of being reached 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.

1.9 EQUIPMENT IDENTIFICATION

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 1/4 inch high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify 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, pictures, nameplate data and test reports as required.
 - 2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - 3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 010000, GENERAL REQUIREMENTS.
 - 1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract 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 system 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 and maintenance instructions.
 - e. Safety precautions.
 - f. Diagrams and illustrations.
 - g. Testing methods.
 - 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 parts, and name of servicing organization.
 - j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

G. Reviews will be based on complete submission of manuals together with shop drawings.

H. After reviews and prior to installation, furnish the COR with one sample of each of the following:

1. A 12 inch length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. Each type of conduit and pathway coupling, bushing and termination fitting.
3. Conduit hangers, clamps and supports.
4. Duct sealing compound.

1.11 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.

1.12 TRAINING

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 010000, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- 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 280511

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

1. A-A-59544-08 Cable and Wire, Electrical (Power, Fixed Installation)
- D. National Fire Protection Association (NFPA):
 1. 70-08 National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
 1. 44-05 Thermoset-Insulated Wires and Cables
 2. 83-08 Thermoplastic-Insulated Wires and Cables
 3. 467-07 Electrical Grounding and Bonding Equipment
 4. 486A-03 Wire Connectors and Soldering Lugs for Use with Copper Conductors
 5. 486C-04 Splicing Wire Connectors
 6. 486D-05 Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
 7. 486E-00 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
 8. 493-07 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
 9. 514B-04 Fittings for Cable and Conduit
 10. 1479-03 Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CONTROL WIRING

- A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.2 COMMUNICATION AND SIGNAL WIRING

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.
- C. Multi-conductor cables shall have the conductors color coded.

2.3 WIRE LUBRICATING COMPOUND

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

2.4 FIREPROOFING TAPE

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and 3/4 inch wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Splice cables and wires only in outlet boxes, junction boxes, or pull boxes.
- B. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- C. Wire Pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use ropes made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COR.
 - 4. Pull in multiple cables together in a single conduit.

3.2 SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.

- B. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.3 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

3.4 CONTROL, COMMUNICATION AND SIGNAL SYSTEM 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.

3.5 EXISTING WIRING

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

END OF SECTION 280513

SECTION 281611
INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install a complete Intrusion Detection System, hereinafter referred to as IDS, as specified in this section.

1.2 RELATED WORK

- A. For window installation, Section 085200, WOOD WINDOWS.
- B. For electrical installation, Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- C. For power cables, Section 260521, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- D. For grounding of equipment, Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- E. For infrastructure, Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- F. For Warranty Construction, Section 007200, GENERAL CONDITIONS.
- G. For General Requirements, Section 010002, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the IDS as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

1.4 SUBMITTALS

- A. Submit below items in conjunction with Master Specification Sections 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 024110, DEMOLITION AND SITE CLEARING.
- B. Provide certificates of compliance with Section 1.3, Quality Assurance.
- C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches; drawing submittals shall be per the established project schedule.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
 - 1. Index Sheet that shall:
 - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
 - b. Provide a list of all security abbreviations and symbols.
 - c. Reference all general notes that are utilized within the design package.
 - d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
 - 2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
 - a. Include a title block as defined above.
 - b. Define the drawings scale in both standard and metric measurements.
 - c. Provide device identification and location.
 - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
 - e. Identify all pull box and conduit locations, sizes, and fill capacities.
 - f. Address all general and drawing specific notes for a particular drawing sheet.
 - 3. A riser drawing for each applicable security subsystem shall:
 - a. Indicate the sequence of operation.
 - b. Relationship of integrated components on one diagram.
 - c. Include the number, size, identification, and maximum lengths of interconnecting wires.
 - d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted,

Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.

4. A system drawing for each applicable security system shall:
 - a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
 - b. Provide full detail of all system components wiring from point-to-point.
 - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
 - d. Show device locations that correspond to the floor plans.
 - e. All general and drawing specific notes shall be included with the system drawings.
 5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
 - a. Device ID.
 - b. Device Location (e.g. site, building, floor, room number, location, and description).
 - c. Mounting type (e.g. flush, wall, surface, etc.).
 - d. Power supply or circuit breaker and power panel number.
 - e. In addition, for the IDS, provide the sensor ID, sensor type and housing model number.
 6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
1. 35 percent
 2. 65 percent
 3. 90 percent
 4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 010002, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Security Industry Association (SIA):
 - 1. PIR-01-00 Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity
 - 2. CP-01-07 Control Panel Standard-Features for False Alarm Reduction
- C. Department of Justice American Disability Act (ADA)
 - 1. 28 CFR Part 36-90 ADA Standards for Accessible Design
- D. National Electrical Manufacturers Association (NEMA):
 - 1. 250-08 Enclosures for Electrical Equipment (1000 Volts Maximum)
- E. National Fire Protection Association (NFPA):
 - 1. 70-08 National Electrical Code
 - 2. 731-08 Standards for the Installation of Electric Premises Security Systems
- F. Underwriters Laboratories, Inc. (UL):
 - 1. 464-03 Audible Signal Appliances
 - 2. 609-96 Local Burglar Alarm Units and Systems
 - 3. 634-07 Standards for Connectors with Burglar-Alarm Systems
 - 4. 639-07 Standards for Intrusion Detection Units
 - 5. 1037-04 Standard for Anti-theft Alarms and Devices
 - 6. 1635-96 Digital Alarm Communicator System Units
- G. Uniform Federal Accessibility Standards (UFAS), 1984

1.6 WARRANTY OF CONSTRUCTION.

- A. Warrant IDS work subject to the Article "Warranty of Construction" of FAR 52.246-21.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. General

1. All equipment associated within the IDS shall be rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
2. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 96 hours of run time in the event of a loss of primary power to the facility.
3. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.
4. All equipment and materials for the system will be compatible to ensure functional operation in accordance with requirements.

2.2 EQUIPMENT ITEMS

A. General:

1. All requirements listed below are the minimum specifications that need to be met in order to comply with the IDS.
2. All IDS sensors shall conform to UL 639, Intrusion Detection Standard.
3. The IDS provided shall not limit the expansion and growth capability to a single manufacturer and shall allow modular expansion with minimal equipment modifications.

B. IDS Components: The IDS shall consist of, but not be limited to, the following components:

1. Control Panel
2. Interior Detection Devices (Sensors)
3. Power Supply
4. Enclosures

C. Control Panel:

1. The Control panel shall be the main point of programming, monitoring, accessing, securing, and troubleshooting the IDS. Refer to American National Standards Institute (ANSI) CP-01 Control Panel Standard-Features for False Alarm Reduction.

2. The Control Panel shall provide a means of reporting alarms to an Access Control System and Database Management via a computer interface or direct connection to an alarm control monitoring panel.
3. The Control panel shall utilize a Multifunctional Keypad, Input and Output Modules for expansion of alarm zones, interfacing with additional security subsystems, programming, monitoring and controlling the IDS.
4. The Control panel shall meet or exceed the following minimum functional requirements for programming outputs, system response, and user interface:
 - a. Programming Outputs:
 - 1) 2 Amps (A) alarm power at 12 VDC
 - 2) 1.4 A auxiliary power at 12 VDC
 - 3) Four alarm output patterns
 - 4) Programmable bell test
 - 5) Programmable bell shut-off timer
 - b. System Response:
 - 1) Selectable point response time
 - 2) Cross point capability
 - 3) Alarm verification
 - 4) Watch mode
 - 5) Scheduled events arm, disarm, bypass and un-bypass points, control relays, and control authority levels
 - c. User Interface:
 - 1) Supervises up to eight command points (e.g. Up to 16 unsupervised keypads can be used)
 - 2) Provides custom keypad text
 - 3) Addresses full function command menu including custom functions
 - 4) Allows user authority by defined area and 16-character name
 - 5) Provides for 14 custom authority control levels allowing user's authority to change, add, delete pass codes, disarm, bypass points, and start system tests.
5. The Control panel shall meet or exceed the following technical characteristics:

Input Voltage via 110 VAC or 220 VAC Step-down Transformer	16 or 18 VAC
Operating Voltage	12 VDC
Output Voltage	12 VDC @ 2 A max
Direct Hardwire Zones	7
Partitions	8
Multifunctional Keypads	16 (2 per partition)
Communications Port	RJ-11

6. A multifunctional keypad shall be utilized as a user interface for arming, disarming, monitoring, troubleshooting, and programming the alarm control panel.
7. Keypads shall have the following features:
 - a. Multiple function keypads suitable for remote mounting, no greater than 4000 ft., shall be provided from the control panel and have a light emitting diode (LED) readout of alarm and trouble conditions by zone.
 - b. An alphanumeric English language display, with keypad programmability, and EE-PROM memory, shall also be provided.
 - c. Trouble alarm indicators shall be distinguishable from intrusion alarms.
 - d. A minimum of four (4) zones selectable as entry and exit with programmable time delay.
 - e. Complete system test activated capability at the keypad.
 - f. Capability for opening and closing reports to a remote monitoring location.
 - g. Adjustable entry and exit delay times.
 - h. Capability for a minimum of two (2) multiple function keypads.
 - i. Capability to shunt or bypass selected interior zones while arming perimeter protection and remaining interior zones.
 - j. Capability for a minimum of seven assignable pass-codes that are keypad programmable from a suppressed master code.
8. Keypads shall meet or exceed the following technical characteristics:

Connections	4-wire flying lead for data and power
Operating Temperature	+32°F to +122°F
Display Window	8-point LED
Indicators: Illuminated keys	Armed Status-LED
	Point Status-LED
	Command Mode-LED
	Power-LED
Voltage	Nominal 12 VDC

9. An input module shall be utilized to connect additional detection devices to the control panel. This module will meet or exceed the following technical characteristics:

Operating Voltage	8.5 to 14.5 VDC Nominal
Zone Inputs	Style A (Class B) Supervised
Operating Temperature	32 to 140 degrees F

10. An output module shall be utilized to interface the control panel with other security subsystems. The output module shall meet or exceed the following technical characteristics:

Operating Voltage	8.5 to 14.5 VDC Nominal
Output Relays	"Form C" Dry Relay Contracts
Relay Contact Rating	4A @ 24 VDC
	4A @ 24 VAC
	1A @ 70 VAC
Operating Temperature	32 to 140 degrees

11. The control panel shall have a communications port that will allow for communications with a computer for programming, monitoring, and troubleshooting purposes. The communications port will be, at a minimum, and RJ-11 or better.
12. The control panel will have a systems success probability of 95% or better, and shall include the following success considerations:
- a. False Alarm: Shall not exceed one (1) false alarm per 30 days per sensor zone.
 - b. Nuisance Alarm: Shall not exceed a rate of one (1) alarm per seven (7) days per zone within the first 60 days after installation and acceptance. Sensor adjustments will be made and then shall not exceed one (1) alarm per 30 days.
13. The Control Panel will be able to detect either a line fault or power loss for all supervised data cables.
- a. Line Fault Detection: Communication links of the IDS shall have an active mode for line fault detection. Fault isolation at the systems level shall have the same geographic resolutions as provided for intrusion detection. The line fault alarm shall be clearly distinguishable from other alarms.
 - b. Power Loss Detection: Provide the capability to detect when critical components experience temporary or permanent loss of power and annunciate to clearly identify the component experiencing power loss.

D. Interior Detection Devices: (Sensors)

1. The IDS shall consist of interior, exterior, and other detection devices that are capable of:
- a. Locating intrusions at individually protected asset areas or at an individual portal;
 - b. Locating intrusions within a specific area of coverage;
 - c. Locating failures or tampering of individual sensors or components.
2. Provide and adjust for devices so that coverage is maximized in the space or area it is installed in. For large rooms where multiple devices are required, ensure device coverage is overlapping.

3. Detection sensitivity shall be set up to ensure maximum coverage of the secure area is obtained while at the same time limiting excessive false alarms due to the environment and impact of small animals. All detection devices shall be anti-masking with exception of video motion detection.
4. Dual sensor technology shall be used when possible. Sensor technology shall not be of the same type that is easily defeated by a single method. This will reduce the amount of false alarms.
5. Interior Environmental Conditions: Systems shall be able to operate in environmentally protected interior areas and shall meet operational performance requirements for the following ambient conditions:
 - a. If components are installed in unheated areas they shall be able to operate in temperatures as low as -17 C (0 F);
 - b. Interior Sensor Environmental Characteristics:

Temperatures	32F to 120 F
Pressure	Sea Level to 15,000 ft. above sea level
Humidity	5% - 95%
Fungus	Components of non-fungus nutrient materials
Acoustical Noise	Suitable for high noise environments above 100db

6. Balanced Magnetic Switches (BMS)
 - a. BMS switches shall be surface or recessed mounted according to manufacture's instructions. Recessed mounted is the preferred method to reduce tampering or defeating of the system. Switches shall activate when a disturbance in the balanced magnetic field occurs.
 - b. Switches shall have a minimum of two (2) encapsulated reed switches.
 - c. Contractor shall provide each BMS with a current protective device, rated to limit current to 80% of the switch capacity.
 - d. Surface Mounted BMS: For exterior application, components shall be housed in weatherproof enclosures.
 - e. BMS field adjustments in the fixed space between magnet and switch housing shall not be possible. Attempts to adjust or disturb the magnetic field shall cause a tamper alarm.
 - f. BMS Technical Characteristics:

Maximum current	.25 amperes
Maximum voltage	30 VDC
Maximum power	3.0 W (without internal terminating resistors). 1.0 W (with internal terminating resistors).
Components	Three (3) pre-adjusted reed switches Three (3) pre-adjusted magnets
Output contacts	Transfer type SPDT
Contact rating	0.5 amperes, 28 VDC
Switch mechanism	Internally adjustable 1/4 – 1/2 in.

Wiring	Two (2) wires #22 American Wire Gauge (AWG), three (3) or 11 foot attached cable
Activation lifetime	1,000,000 activations
Enclosure	Nonferrous materials
Tamper alarm activation	Cover opened 1/8 in. and inaccessible until actuated

7. Window Intrusion Detection: These IDS devices shall detect intrusions thru inertia (shock) or by sound, and shall utilize either a Breakwire Sensor or Acoustic and Seismic Sensor.
 - a. Breakwire Sensors (wire trap):
 - 1) Detect intrusion thru shock or breakage of window glazing. Also used for the protection of utility openings.
 - 2) Sensors shall consist of fine wire embedded in or affixed to interior of glazing. Breakage of protected glazing shall result in wire breakage.
 - 3) Wire shall be hard-drawn copper up to #26 AWG diameter.
 - 4) If sensors are affixed to glazing the sensor shall be protected by a clear coating which shall not affect sensor functioning.
 - 5) Sensor shall be terminated in insulated connectors which are concealed and tamper resistant.
 - 6) Protection of inlet openings:
 - a) Shall consist of up to 26 AWG hard-drawn copper wire with a tensile strength of 17.8 N 4 pounds maximum.
 - b) Wire shall be interlaced throughout the opening such that no opening between wires shall be larger than 4 in. on center.
 - c) Sensors shall be terminated so that attempts to cut the wire or otherwise enlarge openings between wires shall cause an alarm.
 - d) Sensors shall be terminated in insulated connectors which are concealed and tamper resistant.
 - b. Acoustic and Seismic Glass Break Detectors:
 - 1) Detects intrusion thru the use of audible sound and vibration emitted from the breaking of glass using a tuned frequency range and sound pattern recognition. This initiates an alarm when glass they protect is broken or cracked.
 - 2) Detectors shall be installed in strict conformance with manufacture's installation instructions.
 - 3) The detector's power circuit shall be switched via an output relay on the control panel to provide latching alarm LED reset capability.
 - 4) Sensors shall be contained in a fire-resistant ABS plastic housing and must be mounted in contact with a window.
 - 5) Sensing shall be accomplished through the use of a mechanical filtered piezoelectric element.

- 6) Sensors shall have a sensitivity adjustment controlling output voltage from the piezoelectric element which triggers a solid-state latching device.
- 7) Sensors shall selectively filter input to minimize false alarms and not initiate alarm in response to ambient seismic vibrations or other ambient stimuli.
- 8) A manufacture's test unit will be used to validate the sensor by simulating glass breakage.
- 9) The Contractor shall provide sensors for adjusting sensitivity and two-sided polyurethane tape with acrylic adhesive for window attachment.
- 10) Sensor shall include exterior label to protect adhesive tape from direct sunlight.
- 11) Window Intrusion Detection Sensor Technical Specifications:

Power	Auxiliary power supply 12 VDC @ 25 mA (+/-) 10%
Power Input	10 – 15 VDC at 16mA protected against reverse polarity, 20 mA during relay closure
Relay Output Rating	Minimum of 25 VDC mA
Coverage Audio	6,000 Square ft.
Coverage Glass Break	25 ft. wide by 25 ft. wide Minimum: 25 feet from the detector to the furthest point on protected glass.
Audio Output	300 – 12,000 HZ
Alarm Output	Relay NO or NC selectable
Interconnection	12 pin Panduit connector, 22 AWG
Radio Frequency Interface	No alarm or setup on between frequencies 26 – 100 MHz 50 v/m Immunity to mobile RF interference 100 watts @ 9.8 Ft. in 27-100 MHz range
Alarm period	Two (2) to three (3)
Mounting	Ceiling, same wall, adjacent wall, opposite wall
Features	Test and alarm LEDs for acoustic seismic and alarm condition latching, Alarm LED and tamper switch on cover.
Alarm verification	Digital signal processing or dual acoustic processing technologies
Detection ability	Single and multi-pane glass, wired glass, tempered and laminated glass to 1/4 inch or thickness

8. Screening: This material shall be used on windows to protect and detect intrusion as follows.
 - a. Security screens shall be constructed from a maximum of 26 AWG insulated hard-drawn copper.

- b. Screens shall be connected to an alarm circuitry by means of flexible armored cords. Security screen circuitry shall provide end-of-line resistors in series or equivalent methods ensuring alarm activation if short-circuiting of the screen is attempted.
 - c. If unable to install a break wire sensor (wire traps), then tamper switches will be provided.
 - d. Contractor shall provide tamper switches in the frames as required with not less than one (1) switch on each side if dimensions are 2 ft. square or less, and two (2) switches if dimensions exceed 2 ft. square. Tamper switches shall be corrosion-resistant, spring-operated, and shall initiate an alarm with a movement of 2 inches or less before access to the switch is possible.
 - e. Electrical characteristics of the switch shall match the alarm system requirements.
9. Vibration Sensors: These sensors shall initiate alarms upon detecting drilling, cutting, or blasting through walls, or other methods of forced entry through a structure as follows.
- a. Sensors shall detect and selectively amplify signals generated by forced penetration of a protective structure.
 - b. Sensors shall be designed to give peak response to structurally conveyed vibrations associated with forcible attack on the protected surface.
 - c. Sensors will initiate an alarm if attempts are made to remove them from the surface of the wall.
 - d. Sensors shall be enclosed in protective mountings.
 - e. Sensors shall include an adjustable alarm discriminator to prevent incidental vibrations which may occur from triggering the alarm circuit.
 - f. Sensors shall be provided with a tamper switch.
 - g. Sensor sensitivity shall be individually adjustable unless a sensor is designed to accommodate vibration ranges of specific surface type on which it will be mounted. Sensitivity adjustments shall not be accessible without removing the sensor cover. Also, a sensor shall not be responsive to airborne sound.

h. Vibration Sensor Technical Characteristics:

Power requirements	External DC power source Eight (8)- 14.5 VDC, two (2) volt max peak to peak ripple
Alarm output	Form C (NO/C/NC) solid state alarm relay, rated 100 mA, 28 VDC
Tamper Connection	Tamper switch and external magnetic
Current rating and alarm output	No alarm state 20mA SPDT relay contact rating (Form C)
Sensor range	Concrete (poured) 4 m (13.2 ft.) Concrete block 2 m (6.6 ft.) Brick block 1 m (3.3 ft.)
Frequency range	3kHz-20kHz (-15db) 7kHz-10kHz (-10db)
Adjustable	Sensitivity eight (8) steps Alarm response 0-30 sec

10. Passive Infrared Motion Sensors (PIR): These sensors shall detect an intruder presence by monitoring the level of infrared energy emitted by objects within a protected zone and meet ANSI PIR-01 Passive Infrared Motion Detector Standards Features for Enhancing False Alarm Immunity. An alarm shall be initiated when motion and temperature changes within set patterns are detected as follows.
- a. The detector shall provide multiple detection zones distributed at a variety of angles and distance.
 - b. Sensors shall be passive in nature; no transmitted energy shall be required for detection.
 - c. Sensors shall be sensitive to infrared energy emitted at wavelengths corresponding to human body and other objects at ambient temperatures.
 - d. Sensors shall not alarm in response to general area thermal variations and shall be immune to radio frequency interference.
 - e. Sensors shall not be susceptible to changes in temperature due to an air conditioner being turned on or off.
 - f. Sensors shall be housed in a tamper-alarmed enclosure.
 - g. Sensor detectors shall include motion analyzer processing, adjustable lens, and walk test LED's visible from any angle.
 - h. Sensors shall provide some means of indicating an alarm condition during installation and calibration. A means of disabling the indication shall be provided within the sensor enclosure.
 - i. Sensor detectors shall include a motion monitoring verification circuit that will signal trouble or alarm if the detector fails to detect motion for an extended period.

j. PIR Technical Characteristics:

Power	Six (6) – 12 VDC 25 mA continuous current draw 38 mA peaks
Alarm Velocity	5 ft. at a velocity of 0.1 ft. per second, and one (1) step per second, assuming 6 in. per step. Also, faster than 1 foot per second, up to 10 feet per second
Maximum detection range	35 ft.
Frequency range-non activation or setup use	26 to 950 MHz using a 50 watt transmitter located 1 ft. from the unit or attached wiring
Infrared detection	3°F different from the background temperature
Detection Pattern	180 degrees for volumetric units, non PIR 360
PIR 360°Detection Pattern	Programmable 60 detection zones including one directly below
Mounting	Ceiling and walls
Ceiling heights	8 ft. – 18 ft.
Sensitivity adjustments	Three (3) levels

11. Microwave-Passive Infrared Detector: This sensor shall be designed to detect the motion of a human body within a protected area by means of a combination of microwave sensing technology and passive infrared (MPIR) sensing technology as follows.
- a. The sensor shall require both technologies to sense intrusion before an alarm may occur.
 - b. The sensor shall be designed for wall mounting on swivel bracket. A high-security gimbaled bracket shall be provided.
 - c. The PIR fields of view shall be focused on the pyroelectric element by means of an internal multi-faceted mirror.
 - d. The sensor shall incorporate a look-down lens system that detects the passing of an intruder directly beneath the sensor.
 - e. The sensor shall incorporate a microwave supervision system which shall activate the trouble output if the device technology fails.
 - f. The sensor shall incorporate self-diagnostics which shall monitor the sensor systems and report a trouble to the control panel if any system device fails.
 - g. The sensor shall have compensation against loss of sensitivity as the ambient temperature nears human body temperature.

h. MPIR Technical Characteristics:

Technology	Microwave and Passive Infrared
Power	Nine (9) – 15 VDC max current consumption 22 mA at 12 VDC
Operating Temperature	32°F – 120° F
Detection Area	98 ft. long by 9.8 ft. wide or 69 ft. long by 69 ft. wide
Electronics	Microcontroller based
Alarm Contact	Form-C rated 125 mA, 28 VDC
Tamper Contact	125 mA, 28 VDC
Trouble Contact	Form-B rated 25 mA, 30 VDC
Microwave Operating Frequency	10.525 GHz
Microwave Sensitivity	Adjustable on circuit board
Detection pattern adjustment	Changing of internal lens
Sensing element	Pyro-electric
LED Indicators	PIR, microwave, alarm
Bug and Dust protection	zero-clearance, gasket bug guard
Lens	Interchangeable: standard 60x80 ft., corner mounting, ultra-wide, pet alley, long range, room and corridor combo, room and ceiling combo, creep zone

12. Ultrasonic Sensors: These sensors shall transmit ultrasonic energy into a protected zone, receiving the direct and reflected energy, and monitoring frequency shift between transmitted and received signals as follows.
- a. Sensors shall automatically adapt to changing levels of air turbulence and shall consist of a control unit and as many transceivers as required to protect a zone within limitations of the control unit per manufacture's instructions.
 - b. Ultrasonic system sensors shall provide a means of indicating an alarm condition at the protected zone during installation and calibration. This indication shall be provided with a disabling device within the sensor enclosure.
 - c. Transceivers shall consist of an adjustable-gain preamplifier, an ultrasonic-to-electrical transducer, and an electrical-to-ultrasonic transducer in a single enclosure. Transducers shall be adjustable in position to allow adequate adjustment and directivity.
 - d. Each sensor will consist of sensitivity adjustments. Controls shall be inaccessible to operating personnel and sensitivity requirements shall be set approximately at midrange.
 - e. Sensor elements shall be housed in a tamper-alarmed enclosure.
 - f. Ultrasonic Sensor Technical Characteristics:

Power output	Peak not to exceed 105 dB at 3 ft.
Transceiver protection zone	20 ft. by 30 ft. in a zone with an 8 ft. to 12 ft. ceiling
Nuisance alarm reduction	Selective filtering
Detection frequency range	Above 24 kHz and below 30 kHz (nominally 26 kHz)
Detection velocity	5 ft. at a velocity of 0.5 ft. per second to 15 feet per second, also Higher than 0.5 foot per second, up to 8 ft. per second

13. Photoelectric Sensors: The sensor devices shall be able to detect an intruder presence by sending out a series of infrared or ultraviolet beams. Intrusion is based on disruption of the signal beams as follows.
- a. Sensors shall consist of a modulating transmitter, focusing lenses, mirrors, demodulating receiver, power supply, and interconnecting lines.
 - b. Beam transmitters shall be designed to emit light. Beams may be reflected by one (1) or more mirrors before being received and amplified.
 - c. The photoelectric sensor shall initiate an alarm when the beam is interrupted with monitoring controls set at midrange.
 - d. Transmitted beams shall be uniquely modulated to prohibit defeat of the IDS system by shining another light source into the receiver.
 - e. Sensors shall provide a means of local alarm indication on the detector for use at the protected zone during installation and calibration.
 - f. Sensors shall include an indicator-disabling device within the sensor enclosure.
 - g. Sensors shall utilize automatic gain control or be provided with sensitivity adjustments to allow for various beam lengths.
 - h. Sensor controls shall be inaccessible to operating personnel.
 - i. Sensors that use multiple beams shall be tested by attempting to crawl under and jump through and over beams. Each system sensor shall provide cutoffs of at least 90% to handle a high percentage of light cutoffs prior to initiating an alarm.
 - j. Sensor components shall be housed in tamper-alarmed enclosure.

k. Photoelectric Sensor Technical Characteristics:

Power requirements	Nine (9)-16 VDC, protected against reverse polarity
Relay output	Normally closed. 18 ohm resistor in series with contacts. 0.5 amperes resistance/24 VDC
Current	Transmitter 15 mA, Receiver 15 mA
LED	Alignment, walk-test alarm, off
Range	Indoor: 130 ft. Outdoor: 65 ft.
Alarm relay contacts	Two (2) amperes at 120 VAC minimum
Enclosure	High impact acrylic
Type	Dual beam
Mounting	Wall, corner, flush
Beam width	Six (6) degrees
Receiver field of view	Six (6) degrees horizontal and vertical
Adjustments	Vertical +10 – 20 degrees Horizontal 30 degrees
Alarm period	Two (2) – three (3) sec
Infrared source	Long-life Gallium Arsenide LED
Infrared sensor	PIN photodiode
Transmitter Frequency	One (1) kHz 10 microsecond pulse width
IR Wavelength	950 nm

14. Tamper Alarm Switches: The following IDS sensors shall be used to monitor and detect potential tampering of sensors, control panels and enclosures.
- a. Tamper Switches: All enclosures including cabinets, housings, boxes, raceways, and fittings with hinged doors or removable covers containing circuits and power supplies related to the IDS shall include corrosion-resistant tamper switches.
 - b. Tamper alarms shall be annunciated to be clearly distinguishable from IDS alarms.
 - c. Tamper switches will not be in a viewable from a direct line of sight perspective. The minimum amount of time the tamper switch becomes active and sends a signal after an enclosure is opened or panel removable is attempted, shall be one (1) second.
 - d. Tamper switches will initiate when enclosure doors or covers is removed as little as 1/4 inch from the closed position unless otherwise indicated. Tamper switches shall be:
 - 1) Push/pull automatic reset type;
 - 2) Inaccessible until switch is activated;
 - 3) Spring-loaded and held in closed position by door or cover; and
 - 4) Wired to break a circuit when door or cover is removed with each sensor annunciated individually at a central reporting processor.
 - e. Fail-Safe Mode: Shall provide the capability to detect and annunciate diminished functional capabilities and perform self-tests. Fail-safe alarms

shall be annunciated to be clearly distinguishable from other types of alarms.

E. Power Supply

1. A power supply shall only be utilized if the control panel is unable to support the load requirements of the IDS system.
2. All power supplies shall be UL rated and able to adequately power two entry control devices on a continuous base without failure.
3. Power supplies shall meet the following minimum technical characteristics:

INPUT POWER	110 VAC 60 HZ 2 amp
OUTPUT VOLTAGE	12 VDC Nominal (13.8 VDC) 24 VDC Nominal (27.6 VDC) Filtered and Regulated
BATTERY	Dependent on Output Voltage shall provide up to 14 Ah, rechargeable
OUTPUT CURRENT	4 amp max. @ 13.8 VDC 3 amp max. @ 27.6 VDC
BATTERY FUSE SIZE	3.5 A @ 250 VAC
CHARGING CIRCUIT	Built-in standard

F. Enclosures:

1. All control panels, input and output modules, and power supplies shall be housed inside a metal enclosure in accordance with National Electrical Manufacturers Association (NEMA) 250 Enclosures for Electrical Equipment.
2. The enclosure shall be UL rated, lockable and alarmed with a tamper alarm switch that is monitored by the control panel.
3. The enclosures will be NEMA 4 rated if exterior mounted.
4. All connections to the enclosure shall meet or exceed the requirements set forth in the NEC.

2.3 INSTALLATION KIT

A. General

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the

Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:

2. System Grounding
 - a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
 - b. This includes, but is not limited to:
 - 1) Coaxial Cable Shields
 - 2) Control Cable Shields
 - 3) Data Cable Shields
 - 4) Equipment Racks
 - 5) Equipment Cabinets
 - 6) Conduits
 - 7) Cable Duct blocks
 - 8) Cable Trays
 - 9) Power Panels
 - 10) Grounding
 - 11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. IDS installation shall be in accordance with Underwriters Laboratories (UL) 639 Standards for Intrusion Detection Units and UL 634 Standards for Connectors with Burglar Alarm Systems, and appropriate manufacture's installation manuals for each type of IDS.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including VA furnished equipment, and appurtenances in accordance with the manufacturer's instructions and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The IDS will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a standalone or designed as a computer network.
- E. The IDS shall be able to be integrated with other security subsystems. Integration with these security subsystems shall be achieved by computer programming and the direct hardwiring of the systems. Determination for methodology shall be outlined when the system(s) is/are being designed and engineered. For installation purposes, the IDS shall utilize an output module for integration with other security subsystems. The Contractor will ensure all connections are per the OEM and that any and all software upgrades required to integrate the systems are installed prior to system start-up.
- F. For programming purposes, the Contractor shall refer to the manufacturer's requirements and Contracting Officer instructions for correct system operations. This includes ensuring computers being utilized for system integration meet or exceeds the minimum system requirements outlined in the IDS software packages.
- G. Lightning and power surges to the central alarm reporting and display unit shall be protected at both ends against excessive voltages. This requirement shall apply for circuits that are routed both in underground conduits and overhead runs.
- H. At a minimum, the Contractor shall install primary detection devices, such as three electrode gas-type surge arresters, and secondary protectors to reduce dangerous voltages to levels that will cause no damage. Fuses shall not be permitted as protection devices.
- I. The Contractor shall provide fail-safe gas tube type surge arresters on exposed IDS data circuits. In addition, transient protection shall protect against spikes up to 1000 volts peak voltage with a one-microsecond rise time and 100-microsecond decay time, without causing false alarms. The protective device shall be automatic and self-restoring. Also, circuits shall be designed or selected assuming a maximum of 25 ohms to ground.

J. Product Delivery, Storage and Handling:

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name, equipment model and serial identification numbers, and UL logo. The Contracting Officer may inventory the IDS equipment at the time of delivery and reject items that do not conform to this requirement.
2. Storage and Handling: Store and protect equipment in a manner that will preclude damage as directed by the Contracting Officer.

K. Cleaning and Adjustments:

1. Cleaning: Subsequent to installation, clean each system component of dust, dirt, grease, or oil incurred during installation in accordance to manufacture instructions.
2. Prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or synchronization. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.

L. Tamper Switches

1. Install tamper switches to initiate an alarm signal when a panel, box, or component housing door or cover is moved as little as 1/4 inch from the normally closed position unless otherwise specified.
2. Locate tamper switches within enclosures, cabinets, housings, boxes, raceways, and fittings to prevent direct line of sight to any internal components and to prevent tampering with switch or circuitry.
3. Conceal tamper switch mounting hardware so that the location of the switch within the enclosure cannot be determined from the exterior.

M. Unique IDS Installation Components:

1. BMS Surface Mounted:
 - a. Surface mounted BMS housing for the switch element shall have the capability to receive threaded conduit. Housing covers for surface mounted BMS, if made of cast aluminum, shall be secured by stainless steel screws. Magnet housing cover shall not be readily removable and BMS housings shall be protected from unauthorized access by a cover operated, corrosion-resistant tamper device.
 - b. Conductors running from a door to alarm circuits shall be contained within a flexible armored cord constructed from corrosion-resistant metal. Each end of the armored cord shall terminate in a junction box or other enclosure. Armored cord ends shall be mechanically secured to the junction boxes by clamps or bushings. Conductors within the armored cord shall be provided with lug terminals at each end. Conductors and the armored cord shall experience no mechanical strain as the door is removed from fully open to closed position. Switch circuits shall initiate an alarm if a short circuit is applied to the door cord.

- c. For exterior application on double gates, both BMS elements must be mounted on the gate. Flexible armored cord constructed from corrosion-resistant metal shall be used to provide electrical connection.
- 2. BMS Recessed Mounted:
 - a. Ball bearing door trips shall be mounted within vault door headers such that when the locking mechanism is secured, the door bolt engages an actuator, mechanically closing the switch.
 - b. Door bolt locking mechanisms shall be fully engaged before the ball bearing door trip is activated. Also, circuit jumpers from the door shall be provided.
- 3. Vibration Sensors:
 - a. Mount vibration sensors directly contacting the surface to be protected.
 - b. Provide at least one (1) sensor on each monolithic slab or wall section, even though spacing closer than that required for midrange sensitivity may result.
 - c. House sensors in protective mountings and fasten to surface with concealed mounting screws or an epoxy.
 - d. Adjust discriminator on the job to precise needs of application. Connect sensors to an electronic control unit by means of wiring or fiber optics cable run in rigid steel conduit or electrical metallic tubing (EMT).
- 4. Ultrasonic Sensors:
 - a. Installation shall ensure that transceiver zones slightly overlap.
 - b. Care shall be taken to ensure adequate sensitivity in area abundant in acoustic-absorbing materials such as carpets and drapes.
 - c. When the protected zone is broken up by furniture or large objects, it shall not be possible to traverse the zone undetected by moving the blind zones created by the objects.
- 5. Passive Infrared Detectors: (PIR)
 - a. The protective beam shall be focused in a straight line.
 - b. Installed beam distance from transmitter to receiver shall not exceed 80% of the manufacturer's maximum recommended rating.
 - c. Mirrors may be used to extend the beam or to establish a network of beams. Each mirror used shall not lower the rated maximum system range by more than 50%.
 - d. Mirrors and photoelectric sources used in outdoor applications shall have self-heating capability to eliminate condensation and shall be housed in weatherproof enclosures.

3.2 TESTS AND TRAINING

- A. All testing and training shall be compliant with the VA General Requirements, Section 010000, GENERAL REQUIREMENTS.

END OF SECTION 281611

SECTION 282300
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install a complete Video Surveillance System, which is identified as the Closed Circuit Television System hereinafter referred to as the CCTV System as specified in this section.

1.2 RELATED WORK

- A. For connection of high voltage, Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. For power cables, Section 260521, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- C. For grounding of equipment, Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- D. For infrastructure, Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the CCTV System as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

1.4 SUBMITTALS

- A. Submit below items in conjunction with Master Specification Sections 01 33 23, Shop Drawings, Product Data, and Samples.
- B. Provide certificates of compliance with Section 1.3, Quality Assurance.
- C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
 - 1. Index Sheet that shall:
 - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
 - b. Provide a list of all security abbreviations and symbols.
 - c. Reference all general notes that are utilized within the design package.
 - d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
 - 2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
 - a. Include a title block as defined above.
 - b. Define the drawings scale in both standard and metric measurements.
 - c. Provide device identification and location.
 - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
 - e. Identify all pull box and conduit locations, sizes, and fill capacities.
 - f. Address all general and drawing specific notes for a particular drawing sheet.
 - 3. A riser drawing for each applicable security subsystem shall:
 - a. Indicate the sequence of operation.
 - b. Relationship of integrated components on one diagram.
 - c. Include the number, size, identification, and maximum lengths of interconnecting wires.

- d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
 - 4. A system drawing for each applicable security system shall:
 - a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
 - b. Provide full detail of all system components wiring from point-to-point.
 - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
 - d. Show device locations that correspond to the floor plans.
 - e. All general and drawing specific notes shall be included with the system drawings.
 - 5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
 - a. Device ID.
 - b. Device Location (e.g. site, building, floor, room number, location, and description).
 - c. Mounting type (e.g. flush, wall, surface, etc.).
 - d. Power supply or circuit breaker and power panel number.
 - e. In addition, for the CCTV Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.
 - 6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
- 1. 35 percent
 - 2. 65 percent
 - 3. 90 percent
 - 4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 010002, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
 - 1. 330-09 Electrical Performance Standards for CCTV Cameras
 - 2. 375A-76 Electrical Performance Standards for CCTV Monitors
- C. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. C62.41-02 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
 - 2. 802.3af-08 Power over Ethernet Standard
- D. National Electrical Contractors Association (NECA):
 - 1. 303-2005 Installing Closed Circuit Television (CCTV) Systems
- E. National Fire Protection Association (NFPA):
 - 1. 70-08 Article 780-National Electrical Code
- F. Federal Information Processing Standard (FIPS):
 - 1. 140-2-02 Security Requirements for Cryptographic Modules
- G. Underwriters Laboratories, Inc. (UL):
 - 1. 983-06 Standard for Surveillance Camera Units
 - 2. 3044-01 Standard for Surveillance Closed Circuit Television Equipment

1.6 WARRANTY OF CONSTRUCTION.

- A. Warrant CCTV System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. All equipment associated within the CCTV System shall be UL 3004 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
- B. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 96 hours of run time in the event of a loss of primary power to the facility.
- C. The system shall be designed, installed, and programmed in a manner that will allow for easy of operation, programming, servicing, maintenance, testing, and upgrading of the system.
- D. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

- A. CCTV system shall meet following requirements:
- B. All Cameras will be EIA 330 and UL 983 compliant as well as:
 - 1. Will be charge coupled device (CCD) cameras and shall conform to National Television System Committee (NTSC) formatting.
 - 2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below. Pan/Tilt/Zoom (P/T/Z) cameras shall be color and are to be utilized to compliment the fixed cameras.
 - 3. Shall be powered by either 12 volts direct current (VDC) or 24 VAC. Power supplies shall be Class 2 and UL compliant and have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the CCTV System.
 - 4. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.
 - 5. Dummy or fake cameras will not be utilized at any time.
 - 6. Lightning protection shall be IEEE C62.41 compliant and provided for all cameras. Surge protectors shall be utilized. Ensure all lightning protection equipment is compliant with Article 780 of the National Electrical Code (NEC). The use of Fuses and Circuit Breakers as a means of lightning protection shall not be allowed.
 - 7. If using the camera as part of a CCTV network a video encoder shall be used to convert the signal from National Television System(s) Committee (NTSC) to Moving Picture Experts Group (MPEG) format.

8. Fixed Color Cameras Technical Characteristics:

Imaging Device	1/3-inch interline transfer CCD
Picture Elements	NTSC 510 (H) x 492 (V)
Scanning System	NTSC 525 lines, 21 interlace
Synchronization System	AC line lock/internal
Horizontal Resolution	330 TV lines
Iris Control	Selectable on/off
Electronic Shutter Range	NTSC 1/60-1/100,000 second
Auto Iris Lens Type	DC/video drive (auto sensing)
Minimum Illumination	0.6 lux
Signal to Noise Ratio	>50 dB
Automatic Gain Control	On/off switchable
Backlight Compensation	On/off switchable
Auto White Balance	On/off switchable
Video Output	1 Vp-p, 75 ohms
Power Consumption	Less than 5 watts
Video Connector	BNC
Lens Mount	C/CS mount (adjustable)

C. Lenses: Shall be utilized in a manner that provides maximum coverage of the area being monitored by the camera. The lenses shall:

1. Be 1/3" to fit CCD fixed camera.
2. Be all glass with coated optics.
3. Have mounts that are compatible with the camera selected.
4. Be packaged and supplied with the camera.
5. Have a maximum f-stop of f/1.3 for fixed lenses, and a maximum f-stop of f/1.6 for variable focus lenses.
6. Be equipped with an auto-iris mechanism.
7. Have sufficient circle of illumination to cover the image sensor evenly.
8. Not be used on a camera with an image format larger than the lens is designed to cover.
9. Be provided with pre-set capability.

D. One type of lens shall be utilized for interior fixed cameras:

1. Auto Iris Fixed

E. Auto Iris Fixed

1. Shall be utilized in areas where a small specific point of reference is to be monitored. Examples of this are doorways, elevators, etc.
2. To determine the exact size of the fixed lens required, complete a focal length calculation using either a focal length calculator or a focal length chart provided by the product manufacturer.
3. Technical Characteristics:

Image format	1/3 inch	1/3 inch	1/3 inch
Focal length	2.8 mm	4 mm	8 mm
Iris range	F1.2 – 200	F1.2 – 200	F1.2 - 200
Min. Object	0.3 m (1 ft)	0.3 m (1 ft)	0.3 m (1 ft)
Lens mount	CS-mount	CS-mount	CS-mount
Angle of view	94 X 72	64 X 49	33 x 25
Focus control	Manual	Manual	manual

F. Video Display Equipment

1. Will consist of color monitors and shall be EIA 375A compliant.
2. Shall be able to display analog, digital, and other images in either NTSC or MPEG format associated with the operation of the Security Management System (SMS).
3. Shall:
 - a. Have front panel controls that provide for power on/off, horizontal and vertical hold, brightness, and contrast.
 - b. Accept multiple inputs, either directly or indirectly.
 - c. Have the capabilities to observe and program the CCTV System.
 - d. Be installed in a manner that they cannot be witnessed by the general public.
4. Liquid Crystal Display (LCD) Flat Panel Display Monitor
 - a. Technical Characteristics:

Sync Format	PAL/NTSC
LCD Panel	TFT LCD
Resolution	1280 x 1024 pixels; 500 TV
Contrast Ratio (CR)	500:1
Viewing Angle	140° horizontal, 130° vertical
Video Input	(CVBS) 1.0 Vp-p (0.5–1.5 Vp-p), 75 Ohm Y/C (S-video) 0.7 Vp-p, 0.3 Vp-p, 75 Ohm
Video 1	Composite video two (2) BNC (1 in, 1

	out)
Video 2	Composite video two (2) BNC (1 in, 1 out)
Y/C (S-video)	two (2) mini-dins, 4-pin (1 in, 1 out)

G. Camera Housings and Mounts:

1. This section pertains to all interior and exterior housings, domes, and applicable wall, ceiling, corner, pole, and rooftop mounts associated with the housing. Housings and mounts shall be specified in accordance to the type of cameras used.
2. All cameras and lenses shall be enclosed in a tamper resistant housing. Any additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
3. The camera and lens contained inside the housing shall be installed on a camera mount. All additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
4. Shall be manufactured in a manner that are capable of supporting a maximum of three (3) cameras with housings, and meet environmental requirements for the geographical area the camera support equipment is being installed on or within.
5. Environmentally Sealed
 - a. Shall:
 - 1) Be designed in manner that it provides a condensation free environment for correct camera operation.
 - 2) Operate in a 100 percent condensing humidity atmosphere.
 - 3) Be constructed in a manner that:
 - a) Has a fill valve to allow for the introduction of nitrogen into the housing to eliminate existing atmospheric air and pressurize the housing to create moisture free conditions.
 - b) Has an overpressure valve to prevent damage to the housing in the event of over pressurization.
 - c) to ensure correct atmospheric conditions at all times.
 - d) The leak rate of the housing is not to be greater than 13.8kPa or 2 pounds per square inch at sea level within a 90 day period.
 - e) It shall contain camera mounts or supports as needed to allow for correct positioning of the camera and lens.
 - f) The housing and sunshield are to be white in color.
 - b. All electrical and signal cables required for correct operations shall be supplied in a hardened carrier system from the controller to the camera.
 - c. The mounting bracket shall be adjustable to allow for the housing weight of the camera and the housing unit it is placed in.
 - d. Accessibility to the camera and mounts shall be taken into consideration for maintenance and service purposes.

6. Indoor Mounts

a. Ceiling Mounts:

- 1) This enclosure and mount shall be installed in a finished or suspended ceiling.
- 2) The enclosure and mount shall be fastened to the finished ceiling, and shall not depend on the ceiling tile grid for complete support.
- 3) Suspended ceiling mounts shall be low profile, and shall be suitable for replacement of 2 foot by 2 foot ceiling tiles.

b. Wall Mounts:

- 1) The enclosure shall be installed in manner that it matches the existing décor and placed at a height that it will be unobtrusive, unable to cause personal harm, and prevents tampering and vandalism.
- 2) The mount shall contain a manual pan/tilt head that will provide 360 degrees of horizontal and vertical positioning from a horizontal position, and has a locking bar or screw to maintain its fixed position once it has been adjusted.

7. Interior Domes

- a. The interior dome shall be a pendant mount, pole mount, ceiling mount, surface mount, or corner mounted equipment.
- b. The lower portion of the dome that provides camera viewing shall be made of black opaque acrylic and shall have a light attenuation factor of no more than 1 f-stop.
- c. The housing shall be equipped with integral pan/tilt capabilities complete with wiring, wiring harness, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to fully provide a fully functional pan/tilt dome.
- d. The pan/tilt mechanism shall be:
 - 1) Constructed of heavy duty bearings and hardened steel gears.
 - 2) Permanently lubricated to ensure smooth and consistent movement of all parts throughout the life of the product.
 - 3) Equipped with motors that are thermally or impedance protected against overload damage.
- e. Pan movements shall be 360 degrees and tilt movement shall no be less than +/- 90 degrees.
- f. Pan speed shall be a minimum of 10 degrees per second.

H. Controlling Equipment

1. Shall be utilized to call up, operate, and program all cameras associated CCTV System components.

2. Will have the ability to operate the cameras locally and remotely. A matrix switcher or a network server shall be utilized as the CCTV System controller.
3. The controller shall be able to fit into a standard 19 inch equipment rack.
4. Control and programming keyboards shall be provided with its own type of switcher. All keyboards shall:
 - a. Be located at each monitoring station.
 - b. Be addressable for programming purposes.
 - c. Provide interface between the operator and the CCTV System.
 - d. Provide full control and programming of the switcher.
 - e. Have the minimum following controls:
 - 1) programming
 - 2) switching
 - 3) lens function
 - 4) P/T/Z
 - 5) environmental housing
 - 6) annotation

I. Recording Devices

1. All cameras on the CCTV System shall be recorded in real time using a Digital Video Recorder (DVR).
2. All recording devices shall be 19 inch rack-mountable.
3. Digital Video Recorder (DVR):
 - a. Shall record video to a hard drive-based digital storage medium in either NTSC or MPEG format.
 - b. Shall meet the following minimum requirements:
 - 1) Record at minimum rate of 30 images per second (IPS).
 - 2) Have a minimum of eight (8) to 16 looping inputs.
 - 3) Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
 - 4) Shall provide instantaneous playback of all recorded images.
 - 5) Be IP addressable, if part of a CCTV network.
 - 6) Have built-in digital motion detection with masking and sensitivity adjustments.
 - 7) Provide easy playback and forward/reverse search capabilities.
 - 8) Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
 - 9) DVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
 - 10) Accessible locally and remotely via the Internet, Intranet, or a personal digital assistant (PDA).
 - 11) Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.
 - 12) Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.

- 13) Allow for independently adjustable frame rate settings.
- 14) Be compatible with the matrix switcher utilized to operate the cameras. The DVR could be utilized as a matrix switcher only if it meets all of the requirements listed in the matrix switcher section.

c. Technical Characteristics:

Processor	Intel Pentium III 750 MHz
Memory	256 MB RAM
Operating System	Windows 98, NT, ME, 2000, and XP
Video Card	4 MB of RAM capable of 24-bit true color display
Free Hard Disk Space	160 MB for software installation
Network Card	10Base-T network for LAN operation
Archiving	80 GB, 160 GB, 320 GB and 640 GB Hard Drive; CD-RW
Video Input	1.0 Vpp (signal 714mV, sync 286mV) 75 ohms (BNC unbalanced)
Video Output Level	1.0 Vpp +/-10%, 75 ohms (BNC unbalanced)
Impedance	75 ohms/Hi- impedance x 16 switchable
Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

J. Wires and Cables

1. Shall meet or exceed the manufactures recommendation for power and signal.
2. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.

4. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Access Control System and Database Management or at a remote monitoring station, shall not be less than 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.
10. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 3 ft. of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:
 - a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.
 - b. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.
11. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.
12. Coaxial Cables
 - a. All video signal cables for the CCTV System, with exception to the PoE cameras, shall be a coaxial cable and have a characteristic impedance of 75 ohms plus or minus 3 ohms.
 - b. For runs up to 750 feet use of an RG-59/U is required. The RG-59/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 23 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
 - c. For runs between 750 feet and 1250 feet, RG-6/U is required. RG-6/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 18 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
 - d. For runs of 1250 to 2750 feet, RG-11/U is required. RG-11/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 14 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.

- e. All runs greater than 2750 feet will be substituted with a fiber optic cable. If using fiber optics as a signal carrier then the following equipment will be utilized:
- 1) Multimode fiber optic cable a minimum size of 62 microns
 - 2) Video transmitter, installed at the camera that utilizes 12 VDC or 24 VAC for power.
 - 3) Video receiver, installed at the switcher.
- f. RG-59/U Technical Characteristics

AWG	22
Stranding	7x29
Conductor Diameter	.031 in.
Conductor Material	BCC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.145 in.
Outer Shield Type	Braid/Braid
Outer Jacket Material	PVC
Overall Nominal Diameter	.242 in.
UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.094 µH/ft
Nom. Capacitance	Conductor to Shield 17.0 pF/ft
Nom. Velocity of Propagation	80 %
Nom. Delay	1.3 ns/ft
Nom. Conductor DC Resistance @ 20°C	12.2 Ohms/1000 ft
Nom. Outer Shield DC Resistance @ 20°C	2.4 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

- g. RG-6/U Technical Characteristics:

AWG	18
Stranding	7x27
Conductor Diameter	.040 in.
Conductor Material	BC

Insulation Material	Gas-injected FHDPE
Insulation Diameter	.180 in.
Outer Shield Material	Trade Name Duofoil
Outer Shield Type	Tape/Braid
Outer Shield %Coverage	100 %
Outer Jacket Material	PVC
Overall Nominal Diameter	.274 in.
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.106 μ H/ft
Nom. Capacitance	Conductor to Shield 16.2 pF/ft
Nom. Velocity of Propagation	82 %
Nom. Delay	1.24 ns/ft
Nom. Conductor DC Resistance	6.4 Ohms/1000 ft
Nominal Outer Shield DC Resistance @ 20°C	2.8 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

h. RG-11/U Technical Characteristics:

AWG	15
Stranding	19x27
Conductor Diameter	.064 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.312 in.
Inner Shield Type	Braid
Inner Shield Material	BC - Bare Copper
Inner Shield %Coverage	95 %
Inner Jacket Material	PE – Polyethylene
Inner Jacket Diameter	.391 in.
Outer Shield Type	Braid
Outer Shield Material	BC - Bare Copper
Outer Shield %Coverage	95 %

Outer Jacket Material	Trade Name Belflex
Outer Jacket Material	PVC Blend
Overall Nominal Diameter	.520 in.
Operating Temperature Range	-35°C To +75°C
Non-UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.097 µH/ft
Nom. Capacitance	Conductor to Shield 17.3 pF/ft
Nom. Velocity of Propagation	78 %
Nom. Delay	1.30 ns/ft
Nom. Conductor DC Resistance	3.1 Ohms/1000 ft
Nom. Inner Shield DC Resistance	1.8 Ohms/1000 ft
Nom. Outer Shield DC Resistance	1.4 Ohms/1000 ft
Max. Operating Voltage Non-UL	300 V RMS

13. Power Cables

- a. Will be sized accordingly and shall comply with the NEC. High voltage power cables will be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables will be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.
- b. Will be utilized for all components of the CCTV System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed will be connected to a dedicated circuit breaker at a power panel that is primarily for the security system.
- c. All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used as a means of surge protection.
- d. Shall be rated for either 110 or 220 VAC, 50 or 60 Hz, and shall comply with VA Master Spec 26 05 21 Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- e. Low Voltage Power Cables
 - 1) Shall be a minimum of 18 AWG, Stranded and have a polyvinylchloride outer jacket.
 - 2) Cable size shall determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables.

2.3 INSTALLATION KIT

A. General:

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:
2. System Grounding:
 - a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
 - b. This includes, but is not limited to:
 - 1) Coaxial Cable Shields
 - 2) Control Cable Shields
 - 3) Data Cable Shields
 - 4) Equipment Racks
 - 5) Equipment Cabinets
 - 6) Conduits
 - 7) Cable Duct blocks
 - 8) Cable Trays
 - 9) Power Panels
 - 10) Grounding
 - 11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.4 and 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The CCTV System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a standalone or a complete network.
- E. A complete CCTV System shall be comprised of, but not limited to, the following components:
 1. Cameras
 2. Lenses
 3. Video Display Equipment
 4. Camera Housings and Mounts
 5. Controlling Equipment
 6. Recording Devices
 7. Wiring and Cables
- F. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.
- G. Existing Equipment

1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
 2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the CCTV System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
 3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
 4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
 5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacture numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.
- H. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 078400, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.
- I. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
- J. Interconnection of Console Video Equipment: The Contractor shall connect signal paths between video equipment as specified by the OEM. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.
- K. Cameras:
1. Install the cameras with the focal length lens as indicated for each zone.

2. Connect power and signal lines to the camera.
3. Set cameras with fixed iris lenses to the f-stop to give full video level.
4. Aim camera to give field of view as needed to cover the alarm zone.
5. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
6. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view; and synchronize all cameras so the picture does not roll on the monitor when cameras are selected. Dome cameras shall have all preset positions defined and installed.

L. Monitors:

1. Install the monitors as shown and specified in design and construction documents.
2. Connect all signal inputs and outputs as shown and specified.
3. Terminate video input signals as required.
4. Connect the monitor to AC power.

M. Video Recording Equipment:

1. Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video signal inputs and outputs as shown and specified.
3. Connect alarm signal inputs and outputs as shown and specified.
4. Connect video recording equipment to AC power.

N. Video Signal Equipment:

1. Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video or signal inputs and outputs as shown and specified.
3. Terminate video inputs as required.
4. Connect alarm signal inputs and outputs as required.
5. Connect control signal inputs and outputs as required.
6. Connect electrically powered equipment to AC power.

O. Camera Housings, Mounts, and Poles:

1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.
2. Provide a foundation for each camera pole as specified and shown.
3. Provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Division 26 of the VA Master Specification and the VA Electrical Manual 730.
4. Provide electrical and signal transmission cabling to the mount location via a hardened carrier system from the Access Control System and Database Management to the device.
5. Connect signal lines and AC power to the housing interfaces.
6. Connect pole wiring harness to camera.

P. System Start-Up

1. The Contractor shall not apply power to the CCTV System until the following items have been completed:
 - a. CCTV System equipment items and have been set up in accordance with manufacturer's instructions.
 - b. A visual inspection of the CCTV System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - c. System wiring has been tested and verified as correctly connected as indicated.
 - d. All system grounding and transient protection systems have been verified as installed and connected as indicated.
 - e. Power supplies to be connected to the CCTV System have been verified as the correct voltage, phasing, and frequency as indicated.
2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

Q. Supplemental Contractor Quality Control

1. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed CCTV System; and are approved by the Contracting Officer.
2. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
3. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
4. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.2 TESTING AND TRAINING

- A. All testing and training shall be compliant with the VA General Requirements, Section 010002, GENERAL REQUIREMENTS.

END OF SECTION 282300

SECTION 312000

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. Filling and backfilling.
4. Grading.
5. Soil Disposal.
6. Clean Up.

1.2 DEFINITIONS

- A. Unsuitable Materials:

1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 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 to 3 percent of optimum moisture content at time of compaction, as defined by ASTM D 1557.
2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
3. Existing Subgrade (Footings Only): Same as 1.2.A.1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

- B. Building Earthwork: Earthwork operations required in area enclosed by a line located 5 feet outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.
- C. Trench Earthwork: Trenchwork required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 5 feet outside of principal building perimeter and within new construction area.

- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the COR based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in Work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage Granular Fill course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated subgrade in a trench before laying pipe. Bedding course shall extend up to the spring line of the pipe.
- O. Base Course: Layer placed between the subgrade and asphalt paving or layer placed between the subgrade and a concrete pavement or walk.
- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- Q. Debris: Debris includes all materials located within the designated Work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- R. Contaminated soils: Soil that contains contaminants as defined and determined by the COR or the Government's testing agency.

1.3 RELATED WORK

- A. Materials testing and inspection during construction: Section 014529, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 010002, GENERAL REQUIREMENTS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 010002, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 010002, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Erosion Control: Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Site preparation: Section 024110, DEMOLITION AND SITE CLEARING.
- G. Paving subgrade requirements: Section 320523, CEMENT AND CONCRETE FOR EXTEIOR IMPROVEMENT, and 321216 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 013323, 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. On-site Engineer shall be licensed in the state of California.
 - 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. Pre-excavation photographs and videotape in the vicinity of the existing structures and improvements to document existing site features, including surfaces finishes, cracks, or other blemishes that might be misconstrued as damage caused by earthwork operations.
- d. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.
- e. Product data and certificates for all Products indicated.

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. D448-08 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 2. D698-07 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))
 - 3. D1556-07 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 4. D1557-07 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
 - 5. D2167-08 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - 6. D2487-06 Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
 - 7. D2922-05 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - 8. 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. 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 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 110 pcf, a maximum Plasticity Index of 12, and a maximum Liquid Limit of 40.
1. On-site soils having an organic content of less than 3 percent by volume may be used as fill.
 2. Imported fill material shall have a resistivity no less than the resistivity for the onsite soils; pH between 6.0 and 8.5; a total water soluble chloride concentration less than 300 ppm; and a total water soluble sulfate concentration less than 500 ppm.
- 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 1 1/2-inch sieve and not more than 12 percent passing a No. 200 sieve, per ASTM D2940; complying with requirements of Fill in 2.1B.
- 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 1 inch sieve and not more than 8 percent passing a No. 200 sieve.
1. Sand: ASTM C33.
 2. Permeable Material: Caltrans Class 2 permeable material.
 3. Filter Fabric: Nonwoven geotextile of polypropylene fibers with the following characteristics:
 - a. Grab Tensile Strength: 120 lbs, ASTM D4632
 - b. Grab Tensile Elongation: 50%, ASTM D4632
 - c. Trapezoidal Tear Strength: 50 lbs, ASTM D4533
 - d. CBR Puncture Strength: 310 lbs, ASTM D6241
 - e. Apparent Opening Size (AOS): 70 U.S Sieve, ASTM D4751
 - f. Permittivity: 1.7/sec, ASTM D4491

- g. Flow Rate: 135 gal/min/sf, ASTM D4491
 - h. UV Resistance: 70% retained, ASTM D4355
 - i. For use in wrapping rock bedding and initial backfill if sand or Caltrans Class 2 permeable material are not used for this purpose.
- E. Trench Plug: Clay, low strength concrete, or sand/cement slurry.
- F. Base: State Highway Standard, Division IV, Section 26, complying with Class II aggregate base, 1 1/2 inch maximum gradation.
- G. 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 1 1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- H. Granular Fill:
 - 1. Under concrete slab, crushed stone or gravel graded from 1 inch to No. 4200, per ASTM D2940, complying with California Department of Transportation Class 2 aggregate base material for 3/4 inch maximum.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of turf lawn, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Cemetery Property.
- B. Grubbing: Remove stumps and roots 3 inch and larger diameter. Undisturbed sound stumps, roots up to 3 inch diameter, and nonperishable solid objects a minimum of 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 15 feet of new construction and 7.5 feet of utility lines when removal is approved in advance by COR. Remove materials from Cemetery Property. 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 1/2 cubic foot in volume from soil as it is stockpiled. Retain topsoil to reuse in re-

planting; dispose of all excess material off of the Cemetery Property. Remove foreign materials larger than 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 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 Cemetery Property.
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 010002, GENERAL REQUIREMENTS, shall establish lines and grades.
 - 1. Grades shall conform to elevations indicated on Drawings 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 approximate . Proposed spot elevations and contour lines have been developed utilizing the existing conditions record information and may be approximate. 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.
- 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 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.
1. Dispose of dewatering water in accordance with NPDES and the state of California CGP requirements. Do not dispose untreated water to the storm drain. Do not dispose into the sewer system.
- 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 at no additional cost to the Government.
- D. Blasting: Not permitted.
- E. Building Earthwork:
1. Excavation shall be accomplished as required by Drawings and Specifications.
 2. Excavate footing foundation excavations to solid undisturbed subgrade.
 3. Remove loose or soft materials to a solid bottom.
 4. Fill excess cut under footings or foundations with 3000 psi concrete poured separately from the footings.
 5. Do not tamp earth for backfilling in footing bottoms, except as specified.
- F. Trench Earthwork:
1. Sanitary and storm sewer trenches:
 - a. Trench width below a point 6 inches above top of pipe shall be 24 inches maximum for pipe up to and including 12 inches diameter, and four-thirds diameter of pipe plus 8 inches for pipe larger than 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 granular fill.
 - 1) Granular Fill: Depth of fill shall be a minimum of 6 inches below pipe to 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.
- G. 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 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, Contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL REQUIREMENTS 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 1 inch.
 - 2) Walks: Plus or minus 1 inch.
 - 3) Pavements: Plus or minus 1 inch.

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 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 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly to required elevations and uniformly. 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 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 structures, building slabs and paved areas, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material in accordance ASTM D1557, 95 percent.
 - b. Curbs, curbs and gutters, ASTM D1557, 95 percent.
 - c. Under Sidewalks, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill material in accordance with ASTM D1557, 95 percent.
 - d. Landscaped areas, top 16 inches, ASTM D1557, 85 percent.
 - e. Landscaped areas, below 16 inches of finished grade, ASTM D1557, 90 percent.
 - 2. Natural Ground (Cut or Existing)
 - a. Under building slabs and paved areas, top 12 inches, ASTM D1557, 95 percent.
 - b. Curbs, curbs and gutters, ASTM D1557, 95 percent.
 - c. Under sidewalks, top 12 inches, ASTM D1557, 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. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 6 inches unless otherwise shown.
- C. 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.

- D. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 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 Cemetery property.
- B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- C. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 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 Cemetery Property.

END OF SECTION 312000

SECTION 320523

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section shall cover site Work concrete constructed upon the prepared subgrade or base per Drawings and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:
 - 1. Combination curb and gutter.
 - 2. Pedestrian Pavement: Walks, wheelchair curb ramps.
 - 3. Vehicular Pavement: Driveways.

1.2 RELATED WORK

- A. Laboratory and Field Testing Requirements: Section 014529, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 312000, EARTH MOVING.
- C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 033053, CAST-IN-PLACE CONCRETE.

1.3 DESIGN REQUIREMENTS

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

1.4 WEATHER LIMITATIONS

- A. Placement of concrete shall be as specified under Article for Cold Weather Placement in this Section and Articles Cold Weather Placement and Hot Weather Placement of Section 033053, CAST-IN-PLACE CONCRETE.

1.5 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion joint filler
2. Hot poured sealing compound
3. Reinforcement
4. Curing materials

C. Data and Test Reports:

1. Job-mix formula.
2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
3. Base material.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

B. American Association of State Highway and Transportation Officials (AASHTO):

- | | | |
|----|---------|--|
| 1. | M31-07 | Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A) |
| 2. | M147-04 | Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996) |
| 3. | M148-05 | Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A) |
| 4. | M171-05 | Sheet Materials for Curing Concrete (ASTM C171) |
| 5. | M182-05 | Burlap Cloth Made from Jute or Kenaf |
| 6. | M213-05 | Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751) |
| 7. | T99-09 | Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop |
| 8. | T180-09 | Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop |

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

- | | | |
|----|---------------|------------------------------------|
| 1. | C94/C94M-09 | Ready-Mixed Concrete |
| 2. | C143/C143M-08 | Slump of Hydraulic Cement Concrete |

PART 2 - PRODUCTS

2.1 GENERAL

- A. Concrete shall be air-entrained 4,000 psi as specified in Section 033053, CAST-IN-PLACE CONCRETE, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Curb & Gutter	3"
Pedestrian Pavement	3"
Vehicular Pavement	2" (Machine Finished) 4" (Hand Finished)
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

- B. Provide 4% +/- 1.5% air.

2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the Drawings and in the Specifications.
- B. 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.
- C. Reinforcing bars shall be plain steel bars conforming to ASTM A615.

2.3 AGGREGATE BASE

- A. Base material shall be per 312000, EARTH MOVING.

2.4 FORMS

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the Work involved.
- B. Do not use forms if they vary from a straight line more than 1/8 inch in any ten foot long section, in either a horizontal or vertical direction.
- C. Wood forms shall be at least 2 inches thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.5 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
 - 1. Burlap conforming to AASHTO M182 having a weight of seven ounces or more per square yard when dry.
 - 2. Impervious Sheeting conforming to AASHTO M171.
 - 3. Liquid Membrane Curing Compound conforming to Type 2 and shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

- A. Joint filler shall be a preformed non-extruded resilient filler, saturated with bituminous materials and conforming to ASTM D1751. Products shall be equivalent to Burke "Fiber Expansion Joint", W.R. Meadows "Fibrated Expansion Joint Filler", or approved equal.

2.7 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 JOINT SEALANT

- A. ASTM C920 polyurethane, Type M, Class 25, Grade P, Shore A hardness of 35 to 50.
- B. Color
 - 1. Sealants used with unpainted concrete shall match color of adjacent concrete.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Prepare, construct, and finish the subgrade as specified in Section 312000, 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.
- C. Place base materials over prepared subgrade as required by Section 312000, EARTH MOVING. Do not exceed 8 inches in loose thickness. Compact in accordance with ASTM D1557, 95 percent.

3.2 SETTING FORMS

- A. Base Support:
 - 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
 - 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
 - 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
 - 2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
 - 3. Forms shall conform to line and grade with an allowable tolerance of 1/8 inch when checked with a straightedge and shall not deviate from true line by more than 1/4 inch at any point.
 - 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
 - 5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor, specified in Section 010002, GENERAL REQUIREMENTS, 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 base has become unstable, reset and recheck the form before placing concrete.

3.3 EQUIPMENT

- A. The COR shall approve equipment and tools necessary for handling materials and performing all parts of the Work prior to commencement of Work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

3.4 PLACING REINFORCEMENT

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

3.5 PLACING CONCRETE - GENERAL

- A. Obtain approval of the COR before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade or base appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's Work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.6 PLACING CONCRETE FOR CURB AND GUTTER AND PEDESTRIAN PAVEMENTS

- 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 pavements shall be constructed with sufficient slope to drain properly.

3.7 PLACING CONCRETE FOR VEHICULAR PAVEMENT

- A. Deposit concrete into the forms as close as possible to its final position.
- B. Place concrete rapidly and continuously between construction joints.
- C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.
- D. Finish the surface to the elevation and crown as shown.
- E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes/areas without approval by the Resident Engineer.

3.8 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.

3.9 CONCRETE FINISHING CURB AND GUTTER

- A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/4 inch or as otherwise detailed.
- B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
- C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
- D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have

been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.

- E. Except at grade changes or curves, finished surfaces shall not vary more than 1/8 inch for gutter and 1/4 inch for top and face of curb, when tested with a 10 foot straightedge.
- F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
- G. Correct any depressions which will not drain.
- H. Visible surfaces and edges of finished combination curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.10 CONCRETE FINISHING PEDESTRIAN PAVEMENT

- A. Walks, mow strips, wheelchair curb ramps:
 - 1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
 - 2. Brooming shall be transverse to the line of traffic.
 - 3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
 - 4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 1/16 inch in depth.
 - 5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 3/16 inch when tested with a 10 foot straightedge.
 - 6. The thickness of the pavement shall not vary more than 1/4 inch.
 - 7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

3.11 CONCRETE FINISHING FOR VEHICULAR PAVEMENT

- A. Accomplish longitudinal floating with a longitudinal float not less than 10 feet long and 6 inches wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.
- B. After the longitudinal floating is completed, but while the concrete is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 5 feet in length, and straightedges, 10 feet in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.

- C. Test the surface for trueness with a 10 foot straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.
- D. The finished surface of the pavement shall not vary more than 1/4 inch in both longitudinal and transverse directions when tested with a 10 foot straightedge.
- E. The thickness of the pavement shall not vary more than 1/4 inch.
- F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 18 inches wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in character and width, and not more than 1/8 inch in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.
- G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

3.12 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. Match joints to adjacent curb pattern and/or adjacent panel pattern when adjoining existing concrete pavements.

3.13 CONTRACTION JOINTS

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.
- B. Construct joints in curbs and gutters by inserting 1/8 inch steel plates conforming to the cross sections of the curb and gutter.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

3.14 EXPANSION JOINTS

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.
- E. Form expansion joints as follows:
 - 1. With dowels, about structures and features that project through, into, or against any site Work concrete construction.
 - 2. Adjacent to / abutting existing hardened concrete.
 - 3. At a spacing of 10 feet on center, each direction, or as required to match adjacent panels.
 - 4. Using joint filler of the type, thickness, and width as shown.
 - 5. Installed in such a manner as to form a complete, uniform separation between the structure and the site Work concrete item.

3.15 CONSTRUCTION JOINTS

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.
- B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- C. Use a butt-type joint with dowels in.

3.16 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.

3.17 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect

unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the COR.

- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 6 inches.
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 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 12 inches. Securely anchor sheeting.
- D. Liquid Membrane Curing:
 - 1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 200 square feet per gallon for both coats.
 - 2. Do not allow the concrete to dry before the application of the membrane.
 - 3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
 - 4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.18 CLEANING

- A. After completion of the curing period:
 - 1. Remove the curing material (other than liquid membrane).
 - 2. Sweep the concrete clean.
 - 3. After removal of all foreign matter from the joints, seal joints as herein specified.
 - 4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.19 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 COR, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the COR.

3.20 FINAL CLEAN-UP

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

END OF SECTION 320523

SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement and Cold Milling. The hot asphalt concrete pavement shall consist of an aggregate base and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the Drawings and shall be rolled, finished, and approved before the placement of the next course.
- B. The Contractor shall retain and reimburse a laboratory to perform said duties; or to obtain a certification from the authorized representative of the State; or to obtain certification from the asphalt paving producer. Certificate of compliance shall cover quality and gradation of aggregate base, quality and grades of asphalt course materials, and that the job-mixture meets or exceeds the State requirements.

1.2 RELATED WORK

- A. Section 010000, GENERAL REQUIREMENTS.
- B. Laboratory and field testing requirements: Section 014529, TESTING LABORATORY SERVICES.
- C. Subgrade Preparation: Section 312000, EARTH MOVING.
- D. Pavement Markings: Section 321723, PAVEMENT MARKINGS.

1.3 INSPECTION OF PLANT AND EQUIPMENT

- A. The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

- A. The Contractor's Registered Professional Land Surveyor specified in Section 010002, GENERAL REQUIREMENTS shall establish and control the pavement (aggregate

base and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
 - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
 - 2. Asphalt Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
 - 3. Job-mix formula.
 - 4. All other specified Products.
- C. Certifications:
 - 1. Asphalt tack coat material certificate of conformance to State Highway Department requirements.
 - 2. Asphalt cement certificate of conformance to State Highway Department requirements.
 - 3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.
- D. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. HM29M Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 29th Edition and AASHTO Provisional Standards, 2009 Edition
 - 2. MP1 Specification for Performance Graded Asphalt
 - 3. T 283 Standard Method of Test for Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage
- C. American Society for Testing and Materials (ASTM):
 - 1. C29-07 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

- | | | |
|----|----------|---|
| 2. | C977-03 | Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization |
| 3. | D3786 | Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method |
| 4. | D4355-07 | Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus |
| 5. | D4632-08 | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles |
| 6. | D6390-05 | Standard Test Method for Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures |

PART 2 - PRODUCTS

2.1 GENERAL

- A. Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA COR.

2.2 AGGREGATES ASPHALT PAVING

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Base aggregate maximum size:
1. Base course over 6" thick: 1-1/2";
 2. Other base courses: 3/4".
 3. Complying with the State Highway Standard, Division IV, Section 26, for Class II aggregate base.
- C. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve Sizes	Percentage Passing
1"	100
3/4"	90 – 100
1/2"	70 – 90

No. 4	45 – 55
No. 8	32 – 40
No. 30	12 – 21
No. 200	2 – 7

- D. Complying with the State Highway Standard for Hot Mix Asphalt (HMA) Type A for 3/4 inch gradation.

2.3 ASPHALTS

- A. Comply with provisions of State Highway Standard and Asphalt Institute Specification SS2:

1. Asphalt cement: Performance Graded PG 64-10
2. Tack coat: Uniformly emulsified, grade SS-1H

PART 3 - EXECUTION

3.1 GENERAL

- A. The asphalt concrete paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
 1. Temperature leaving the plant: 290 degrees F minimum, 320 degrees F maximum.
 2. Temperature at time of placing: 280 degrees F minimum.

3.3 TRENCHING

- A. Hot Mix Asphalt Pavement: Sawcut perimeter of trench and excavate existing pavement section to subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material.
- B. Tack Coat: After backfilling trench and prior to trench paving, apply uniformly to vertical and horizontal surfaces abutting area to receive new hot mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure before applying hot mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, remove spillage and clean affected surfaces.

3.4 COLD MILLING

- A. Clean existing pavement surface of loose or deleterious material immediately before cold milling. Remove existing asphalt pavement to grades and cross sections indicated.

1. Mill to a depth of 1 1/2 inches.

3.5 SUBGRADE

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the base, it shall be reworked to bring to line and grade.

3.6 BASE COURSES

- A. Base
 1. Spread and compact to the thickness shown on the Drawings.
 2. Compact to minimum 95 percent relative compaction.
 3. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
 4. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
- B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0 inch to plus 0.5 inch.
- C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/16 inch in 10 feet.
- D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.7 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials from the compacted base.

- B. Apply the specified tack coat where required and allow to dry in accordance with the manufacturer's recommendations as approved by the COR.
- C. Receipt of asphaltic concrete materials:
 - 1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.
 - 2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, not during fog, rain, or other unsuitable conditions.
- D. Spreading:
 - 1. Spread material in a manner that requires the least handling.
 - 2. Where thickness of finished paving will be 3 inches or less, spread in one layer.
- E. Rolling:
 - 1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.
 - 2. Roll in at least two directions until no roller marks are visible.
 - 3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 1/8 inch in 6 feet.

3.8 PROTECTION

- A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.9 FINAL CLEAN-UP

- A. Remove all debris, rubbish, and excess material from the Work area.

END OF SECTION 321216

SECTION 321723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Work shall consist of furnishing and applying paint on pavement surfaces, in the form of traffic lanes, parking bays, accessible areas, crosswalks, and other detail pavement markings, in accordance with the details as indicated or as prescribed by the COR. Conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, published by the U.S. Department of Transportation, Federal Highway Administration, for details not shown.

1.2 SUBMITTALS

- A. In accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.

- 1. Paint.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Master Painters Institute (MPI):
 - 1. No. 97-09 Latex Traffic Marking Paint

PART 2 - PRODUCTS

2.1 PAINT

- A. Paint for marking pavement shall conform to MPI No. 97, color as indicated. Paint shall be in containers of at least 5 gallons. A certificate shall accompany each batch of paint stating compliance with the applicable publication.

2.2 PAINT APPLICATOR

- A. Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as indicated. Provide pneumatic spray guns for hand application of paint in areas where a mobile paint applicator cannot be used. An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by the COR. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint. Pavement marking shall follow as closely as practicable after the surface has been cleaned and dried, but do not begin any marking until the COR has inspected the surface and gives permission to proceed. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals. The Contractor is responsible to preserve and apply marking in conformance with the established control points.

3.2 APPLICATION

- A. Apply uniformly painted pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and established control points. The length and width of lines shall conform within a tolerance of plus or minus 3 inches and plus or minus 1/8 inch, respectively. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 50 degrees F and less than 95 degrees F. Apply the paint at a wet film thickness of 0.015 inch. Apply paint in one coat. At the direction of the COR, markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If

there is a deficiency in drying of the marking, discontinue paint operations until cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved method to remove marking so that the surface to which the marking was applied will not be damaged.

3.3 PROTECTION

- A. Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Government.

3.4 DETAIL PAVEMENT MARKING

- A. Use Detail Pavement Markings, exclusive of actual traffic lane marking, on curbs. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

3.5 TEMPORARY PAVEMENT MARKING

- A. When shown or directed by the COR, apply Temporary Pavement Markings of the color(s), width(s) and length(s) shown or directed. After the temporary marking has served its purpose and when so ordered by the COR, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that the surface to which the marking was applied will not be damaged. As an option, an approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of the required color(s), width(s) and length(s) may be furnished and used in lieu of temporary painted marking. The Contractor shall be fully responsible for the continued durability and effectiveness of such marking during the period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted markings at no additional cost to the Government.

3.6 FINAL CLEAN-UP

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

END OF SECTION 321723

SECTION 329000

PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION and Requirements

- A. This work consists of furnishing and installing all turfgrass sod materials for sod restoration specified in locations as shown. The landscape contractor shall be required to visit the site prior to submitting Bid Proposal to become familiar with all conditions affecting the proposed work. The contractor shall identify and review all underground utility locations prior to commencing work and shall exercise caution when working close to utilities and shall notify the Contracting Officer's Representative (COR) of apparent conflicts with construction and utilities so that adjustment can be planned prior to installation.
- B. Agronomic consultation on the appropriateness of sod material proposed for installation during this project must be obtained from the MSN Agronomist and/or NCA Chief Agronomist via coordination through the COR prior to project initiation and actual sod installation. In general, sod material must be regionally adapted to the climate of the site.
- C. Any exceptions to these species exclusions must be approved by the MSN Agronomist and/or NCA Chief Agronomist via coordination through the COR prior to project initiation.

1.2 EQUIPMENT

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

1.3 RELATED WORK

- A. Section 312000, EARTH MOVING, Stripping Topsoil, Topsoil Materials, and Stock Piling.
- B. Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS.

1.4 SUBMITTALS

- A. Samples: Submit the following samples for approval before work is started:

All pesticides required such as preemergence	EPA approved labeling and
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or post emergence herbicides, insecticides, or fungicides.	MSDS sheet for each such product selected for use.
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- B. Certificates of Conformance or Compliance: Before delivery, notarized certificates attesting that the following materials meet the requirements specified shall be submitted to the COR for approval:
1. Plant Materials (Department of Agriculture certification by State Nursery Inspector from the state in which the plant material originates declaring material to be free from insects and disease).
 2. Fertilizers.
 3. Sod
- C. Manufacturer's Literature and Data:
1. Pre-emergent herbicide
 2. Fertilizer: Submit certificate of analysis for each type of fertilizer.

1.5 DELIVERY AND STORAGE

- A. Delivery:
1. Notify the COR of the delivery schedule in advance so the sod material may be inspected upon arrival at the job site. Remove unacceptable sod from the job site immediately.
 2. Protect sod during delivery to prevent damage..
 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. In lieu of containers, fertilizer may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.
 4. During delivery: Protect sod from drying out.
- B. Storage:
1. Sprinkle sod with water and cover with moist burlap, straw or other approved covering, and protect from exposure to wind and direct sunlight. Covering should permit air circulation to alleviate heat development.
 2. Keep fertilizer in dry storage.

1.6 TURFGRASS SOD INSTALLATION CONDITIONS

- A. No work shall be done when the ground is too wet, air temperature exceeds 90 degrees, or in an otherwise unsuitable condition for sodding.

1.7 TURFGRASS SOD ESTABLISHMENT PERIOD

- A. The Establishment Period for landscape turfgrass shall begin immediately after installation, with the approval of the PM or COR and continue for a period of time during the growing season sufficiently long (optimally a minimum of 3 months) for the turfgrass materials to achieve an establishment condition and appearance satisfactory to the MSN Agronomist and NCA. These conditions and appearance are described as follows: Turfgrass shall have obtained a minimum of 98% surface cover that is generally weed-free. The contractor shall be responsible for the health and maintenance of turfgrass during the establishment period. Turfgrass sod will not be accepted until after completion of an acceptable establishment period. During the Turfgrass Establishment Period the Contractor shall:
1. Water turfgrass to maintain a moist soil surface at all times until the plants and turfgrass are well established. An adequate supply of moisture must also be maintained within the root zone. Apply water at a moderate rate so as not to create any water ponding or runoff from the soil supporting the turfgrass. The actual quantity of applied water required to achieve and maintain these conditions is best determined on site by the MSN Agronomist in consultation with the COR.
 2. Spray with approved insecticides and fungicides to control pests and ensure plant survival in a healthy growing condition, as directed by the COR in coordination with the MSN Agronomist.
 3. Provide the following during turfgrass establishment:
 - a. Eradicate all weeds. Water, fertilize, and perform any other operation necessary to promote the growth of turfgrass.
 - b. Mow the turfgrass as often as necessary to maintain the NCA specified mowing height for each type of turfgrass prior to final acceptance. Begin mowing when cool season turfgrass is 4 inches high. For warm season turfgrasses mow at heights as appropriate for species and cultivar as directed by the COR in consultation with the MSN Agronomist. Final mowing height is 3.0 inch for cool season turfgrasses and as appropriate for warm season turfgrasses and mow as often as necessary to maintain the proper height while never removing more than 1/3 of the total height of grass leaves in a single mowing. Mow any portion of the newly developing turfgrass stand that requires mowing without waiting for other areas of slowly developing seedlings to catch-up.
 4. Replace dead, missing or defective sod material during the establishment period and an active growing season.
 5. Replant any areas void of turfgrass during an active growing season only.
 - a. Sod shall be evaluated for species and health thirty (30) days after laying the last piece of sod and reevaluated each 15 days during the establishment period. A satisfactory stand of grass plants from the sod operation shall be living sod uniform in color and leaf texture. Bare spots shall be a maximum two square inches. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

6. Complete remedial measures directed by the COR in consultation with the MSN Agronomist to ensure turfgrass survival.
7. Repair damage caused while making turfgrass replacements.

1.8 TURFGRASS ACCEPTANCE.

- A. Turfgrass acceptance will occur after completion of the TURFGRASS ESTABLISHMENT PERIOD. The Contractor shall have completed, located, and installed all turfgrass according to the plans and specifications. All turfgrass is expected to be living and in a healthy condition at the time of inspection and acceptance. The Contractor shall make a written request two weeks prior to final inspection of the turfgrass. Upon inspection when work is found to not meet the specifications, the TURFGRASS ESTABLISHMENT PERIOD shall be extended at no additional cost to the Government until work has been satisfactorily completed, inspected and accepted.
- B. Criteria for acceptance of turfgrass shall be as follows:
 1. A satisfactory stand of grass plants from the sod operation shall be living sod uniform in color and leaf texture and well rooted into the soil below so that gentle pulling of the turfgrass leaves by hand does not dislodge the sod. Bare spots shall be a maximum two square inches. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

1.9 TURFGRASS WARRANTY

- A. All work shall be in accordance with the terms of the Paragraph, "Warranty" of Section 007200, GENERAL CONDITIONS, including the following supplements:
 1. A One Year Turfgrass Warranty will begin on the date that the Government accepts the turfgrass but not before the end of the Turfgrass Establishment Period.
 2. The Contractor will replace any areas void of turfgrass immediately during the warranty period and during an active growing season. A one year warranty for the plants and turfgrass that are replaced will begin on the day the replacement work is completed and accepted.
 3. The Government will reinspect all replacement turfgrass at the end of the One Year Warranty. The Contractor will replace any dead or defective turfgrass immediately and during an active growing season. The Warranty will end on the date of this inspection provided the Contractor has complied with the work required by this specification.

1.10 APPLICABLE PUBLICATIONS

- A. NCA Handbook 3420 – Turfgrass Maintenance in VA National Cemeteries re-certified 2011. The Agronomic and Horticultural practices specified in this handbook shall serve

as the contractor's official reference guide to all establishment and preliminary maintenance practices employed during this construction project.

- B. 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.
- C. American National Standards Institute (ANSI) Publications:
 - 1. ANSI Z60.1-04 Nursery Stock
 - 2. ANSI Z133.1-06 Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush- Safety Requirements
- D. Hortus Third, most current edition. A Concise Dictionary of Plants Cultivated in the U.S. and Canada.
- E. Turfgrass Producers International: Turfgrass Sodding.
- F. U. S. Department of Agriculture Federal Seed Act.
 - 1. Amended July 2011 Rules and Regulations

PART 2 - PRODUCTS

2.1 GENERAL

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

2.2 ORGANIC SOIL AMENDMENT

- A. All areas to receive turfgrass seeding, sodding or sprigging may require an organic soil amendment to increase organic content and water retention as well as enhance turfgrass growth. If native topsoil has an organic matter content below 4% it should be amended in-place after grading activities are completed to effectively create a satisfactory topsoil horizon.
- B. Organic soil amendment will be spread and incorporated into the finished subgrade at the depths indicated on the Contract Drawings in order to raise the organic content of the soil to a minimum of four percent and a maximum of six percent. Contractor will allow for additional depth of the organic soil amendment to bring all grades to the required finished grades as per the grading plans.
 - 1. Organic Soil Amendment shall be dark brown or black in color and capable of enhancing plant growth. Ninety-eight percent of the material should pass a one inch screen. There shall be no admixture of refuse (i.e. noticeable inert contamination) or other materials toxic to plant growth.

2. Acceptable types of Organic Soil Amendments include peat moss, humus or peat, well rotted manure, various mature composts, and commercially available combinations thereof. Acceptable compost may be derived from natural organic sources such as food or animal residuals, yard trimmings, or biosolids. Organic Soil Amendment shall be free of all woody fibers, seeds, and leaf structures, plastic and other petroleum products, and free of toxic and non-organic matter. Unacceptable sole sources of organic matter include untreated sludge from wastewater treatment plants, fresh manure, sawdust, and immature composts.
3. Organic Soil Amendment shall conform to the following minimum material requirements:

Test Parameter	Acceptable Ranges (%)
Organic Matter	27 - 80
pH	5.5 – 8.5
Ash	20 – 65
Nitrogen	0.4 – 3.5
Phosphorus	0.2 – 1.5
Potassium	0.4 – 1.4
C:N Ratio	25 – 30:1
CEC	50 – 150 meg/100 g
Heavy Metals	Less than maximum limits established by EPA 503
Inert Contents	< 1% by weight
Water-Holding Capacity	150 – 200
Pathogen/Weed Seed Destruction	Proof of EPA minimum heating requirements

4. Organic content to be determined by the loss of ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 110 °C, plus or minus 5°C.
5. Any topsoil stripped and stockpiled on the site may be used provided that, after testing and addition of necessary additives, it meets the above specification. The Contractor shall provide additional Organic Soil Amendment as required to complete the required work.
6. All Organic Soil Amendment proposed for use shall be tested for conformance to the specifications and results provided to the COR/MSN Agronomist.

2.3 TOPSOIL

- A. Topsoil shall be a well-graded soil of good uniform quality. It shall be a natural, friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than one inch in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall have a pH value of not less than 6.0 nor more than 7.0, and should be best suited to the region, climate and plant material specific to the project.

- B. Obtain material from stockpiles established under Section 312000, EARTH MOVING, subparagraph, Stripping Topsoil that meet the general requirements as stated above. Amend topsoil not meeting the pH range specified by the addition of pH Adjusters.

2.4 TURFGRASS FERTILIZER

- A. Provide turfgrass fertilizer that is commercial grade, free flowing, uniform in composition, and conforms to applicable state and federal regulations. Granular fertilizer shall bear the manufacturer's warranted statement of analysis. Granular fertilizer shall contain a minimum percentage by weight of 20% nitrogen (of which 50 percent shall be from a controlled release source such as sulfur coated urea), 5% available phosphoric acid, and 15% potash. Liquid starter fertilizer for use in the hydro mulch slurry will be commercial type with 50 percent of the nitrogen from a controlled release source.

2.5 WATER

- A. Water shall not contain elements toxic to plant life. It shall be obtained as specified in Section 010002, GENERAL REQUIREMENTS, paragraph, Temporary Services at no cost to the Contractor.

2.6 SOD

- A. Sod shall be nursery grown, certified sod as classified in the TPI Guideline Specifications to Turfgrass Sodding. Sod to match existing sod type currently used at the Cemetery.

2.7 HERBICIDES AND OTHER PESTICIDES

- A. All herbicides and other pesticides shall be properly labeled and registered with the U.S. Environmental Protection Agency. Keep all pesticides in the original labeled containers indicating the analysis and method of use.

PART 3 - EXECUTION

3.1 FINE GRADING AND ORGANIC SOIL AMENDMENT INCORPORATION

- A. Contractor shall obtain COR's written approval of previously completed rough grading work prior to commencing organic soil amendment incorporation work.
- B. Immediately prior to dumping and spreading the approved organic soil amendment, the subgrade shall be cleaned of all stones greater than two inches and all debris or rubbish. Such material shall be removed from the site. Prior to spreading of the organic soil amendment, subgrades which are too compact to drain water and too compact based upon compaction tests shall be ripped with a claw one foot deep,

pulled by a bulldozer two feet on center, both directions. Contractor shall then regrade surface.

- C. Organic soil amendment material shall be placed and uniformly spread over approved finish sub-grades to a depth sufficiently greater than the specified depth so that after natural settlement and light rolling, the specified minimum compacted depth will have been provided and the completed work will conform to the lines, grades and elevations indicated. Incorporate organic soil amendment by disc harrowing, rototilling or other means in a uniform manner. The depth of incorporation shall be based upon the organic content of the tested and approved organic soil amendment, so as to produce a finished soil with an organic matter content of between four and six percent. Supply additional organic soil amendment material, after in-place testing and approval (see paragraph 1.4. E.1d), as may be needed to give the required organic matter content and finished grades under the Contract without additional cost to the Government.
- D. Disturbed areas outside the limit of work shall be spread with four inch minimum depth of organic soil amendment material to the finished grade.
- E. No subsoil or organic soil amendment material shall be handled in any way if it is in a wet or frozen condition.
- F. After organic soil amendment material has been incorporated into the subsoil, it shall be carefully prepared by scarifying or harrowing and hand raking. Remove all large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove all stones over one and one half inch diameter from the amended soil bed. The amended soil shall also be free of smaller stones in excessive quantities as determined by the COR.

3.2 TILLAGE FOR TURFGRASS AREAS

- A. Thoroughly till the soil to a depth of at least 6 inches by scarifying, disking, harrowing, or other approved methods. This is particularly important in areas where heavy equipment has been used. Remove all debris and stones larger than one inch remaining on the surface after tillage in preparation for finish grading. To minimize erosion, do not till areas of 3:1 slope ratio or greater. Scarify these areas to a one inch depth and remove debris and stones.

3.3 FINISH GRADING

- A. After tilling the soil for bonding of topsoil with the subsoil, spread the topsoil evenly to a minimum depth 6 inches Incorporate topsoil at least 2 to 3 inches into the subsoil to avoid soil layering. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic. Complete lawn work only after areas are brought to finished grade.

3.4 APPLICATION OF FERTILIZER TURFGRASS AREAS

- A. Apply turfgrass fertilizer at a rate that will deliver 1 pound of nitrogen per 1000 sq. ft. In addition, adjust soil acidity as recommended by soil test results and add any soil conditioners as specified herein for suitable topsoil under PART 2, Paragraph 2.2 A and B, and 2.3 TOPSOIL.

3.5 SODDING

- A. Accomplish sodding in accordance with the ASPA Guideline Specifications for sodding. Lay sod at right angles to slope or the flow of water. On slope areas, start at the bottom of the slope.
- B. After completing the sodding operation, blend the edges of the sodded area smoothly into the surrounding area. All sod should be rolled with a light- weight roller after being laid to eliminate air spaces between the sod and the firmed soil.

3.6 WATERING

- A. Apply water to the turfgrass areas immediately following installation at a rate sufficient to ensure thorough wetting of the soil to a depth of at least 2 inches. Supervise watering operation to prevent run-off. Supply all pumps, hoses, pipelines, and sprinkling equipment. Repair all areas damaged by water operations. Keep soil surface constantly moist, not wet, until turfgrass plants are well established.

3.7 PROTECTION OF TURFGRASS AREAS

- A. Immediately after installation of the turfgrass areas, protect against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.8 RESTORATION AND CLEAN-UP

- A. Where existing or new turfgrass 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 turfgrass work have been completed, clear the area of all debris, spoil piles, and containers. Clear all other paved areas when work in adjacent areas are completed. Remove all debris, rubbish and excess material from the station.

3.9 ENVIRONMENTAL PROTECTION

- A. All work and Contractor operations shall comply with the requirements of Section 015719, TEMPORARY ENVIRONMENTAL CONTROLS.

END OF SECTION 329000

SECTION 333000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines, pressure (force) lines, manholes, cleanouts, frames, covers, structures, appurtenances, and connections to existing building service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 010002, GENERAL REQUIREMENTS.
- B. Section 033053, CAST-IN-PLACE CONCRETE.
- C. Power system for lift station: Division 26.
- D. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 312000, EARTH MOVING.
- E. Seeding, Topsoil: SECTION 329000 PLANTING

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:
 - 1. Pipe, Fittings, and Appurtenances.
 - 2. Jointing Material.
 - 3. Manhole and Structure Material.
 - 4. Frames and Covers.
 - 5. Steps and Ladders.
- C. Contractor-Delegated Design: All details and requirements of connecting to the existing sewer system in Cabrillo Memorial Drive are the responsibility of the Contractor, including, but not limited to, determining existing sewer system capacity; plans, details, and calculations for pressure (force) sewer line and pump system; appurtenances required for pressure (force) sewer line and pump system; connection to the existing system; determining and obtaining permits required, including preparation and submittal of application and payment of fee, for new sewer system and for connection to existing sewer; determining and obtaining permits required for construction within Cabrillo Memorial Drive; coordination of inspections during connection Work with authorities having jurisdiction; and all other requirements of this Work. Design shall be performed by a Civil Engineer licensed in the state in which the Project occurs. Submit design and details to COR for approval.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - 1. A48/A48M-03 Gray Iron Castings
 - 2. A536-84(2004) Ductile Iron Castings
 - 3. A615/A615M-09 Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement
 - 4. A625/A625M-08 Tin Mill Products, Black Plate, Single Reduced
 - 5. A746-09 Ductile Iron Gravity Sewer Pipe
 - 6. C76-08b/C76M-08b Reinforced Concrete Culvert, Storm Drain and
Sewer Pipe
 - 7. C139-05 Concrete Masonry Units for Construction of Catch
Basins and Manholes
 - 8. C150-07 Portland Cement
 - 9. C478-09a/C478M-09a Precast Reinforced Concrete Manhole Sections
 - 10. C857 Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures

11. D698-07ae1 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
12. D2321-08 Underground Installation of Thermoplastic Pipes for Sewers and Other Gravity-Flow Applications
13. D2412-02(2008) Determination of External Loading Characteristics of Plastic Pipe by Parallel- Plate Loading
14. D3034-08a Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
15. D3212-07 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
16. D3261-03 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
17. D3350-08 Polyethylene Plastics Pipe and Fittings Materials
18. F477-08 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
19. F679-08 Poly (vinyl chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
20. F794-03 Poly (Vinyl Chloride)(PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
21. F894-0507 Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
22. F949-06a Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

C. American Water Works Association (AWWA):

1. C508-09 Swing Check Valves for Waterworks, 2 inches (50 mm) Through 24 inches (600 mm) NPS
2. C509-01 Resilient Seated Gate Valves for Water-Supply Service
3. C515-09 Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service
4. C512-04 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
5. C550-05 Protective Epoxy Interior Coatings for Valves and Hydrants
6. C605-05 Underground Installation of Polyvinyl (PVC) Pressure Pipe and Fittings for Water
7. C900-07 Polyvinyl Chloride (PVC) Pressure Pipe, 100 mm (4 inches) Through 300 mm (12 inches) for Water Distribution
8. C905-97 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm through 1,200 mm (14 Inches through 48 Inches), for Water Transmission and Distribution
9. C906-99 Polyethylene (PE) Pressure Pipes and Fittings, 100 mm through 1575 mm (4 Inches through 63 Inches), for Water Distribution

D. American Association of State Highway and Transportation Officials (AASHTO):

1. M198-08 Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants

E. Uni-Bell PVC Pipe Association:

1. Uni-B-6-98 Recommended Practice Low Pressure Air Testing of Installed Sewer Pipe

PART 2 - PRODUCTS

2.1 PIPING

A. Gravity Flow Lines (Pipe and Fittings):

1. Polyvinyl Chloride (PVC):
 - a. Pipe and Fittings, 4 to 15 inches in diameter, shall conform to ASTM D3034, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints shall not be permitted.
 - 1) Pipe and fittings shall conform to ASTM F949 corrugated sewer pipe with a smooth interior. The corrugated outer wall shall be fused to the smooth innerwall at the corrugation valley. Pipe and fitting shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 50 psi at 5 percent deflection, when tested in accordance with ASTM D2412. Corrugation shall be perpendicular to the axis of the pipe to allow gaskets to be installed on field cut sections of pipe without the requirement for special fittings.
 - 2) Ribbed wall PVC pipe and fittings shall conform to ASTM F794 ribbed sewer pipe with smooth interior pipe and fittings shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D 2412, at 5 percent vertical deflection. Joints shall not leak at 25 feet of head under 5 percent deflection.
 - 3) Solid wall pipe and fittings shall conform to ASTM F679, SDR 35, pipe and fittings shall include gaskets conforming to ASTM F477, and shall be able to withstand a hydrostatic pressure of 50 psi.

B. Pressure (Force) Lines (Pipe and Fittings):

1. All pipe and fittings used in the construction of force mains shall be rated for a minimum of 150 psi.

2. Lining shall be holiday tested in accordance with AWWA C116.
3. Pipe smaller than 4 inches shall conform to:
 - a. Polyvinyl Chloride (PVC): PVC, ASTM D1785 Schedule 80, suitable for solvent weld joints unless indicated otherwise.
 - b. High-Density Polyethylene (HDPE): ASTM D 3350, SDR9.
4. Pipe 4 to 12 inches shall conform to Polyvinyl Chloride (PVC): PVC, AWWA C900, Class 200 (DR 14). Fittings for PVC pipe shall be ductile iron.

2.2 JOINTING MATERIAL

A. Gravity Flow Lines:

1. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.

B. Pressure (Force) Main:

1. Shall conform to AWWA C900.
2. Polyvinyl Chloride (PVC) Pipe (Pressure Use):
 - a. Push-on joints shall conform to AWWA C900.
 - b. Push-on gaskets for pipe, ASTM F477.
 - c. Restrained joints shall comply with the following:
 - 1) Push-on bell and spigot joints shall be retained with retaining rings and thrust rods. The rings shall be ductile iron conforming to ASTM A536.

2.3 CONCRETE

- A. Concrete shall have a minimum compressive strength of 4,000 psi at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform with the provisions of Division 03 of these Specifications.

2.4 REINFORCING STEEL

- A. Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

2.5 SEWAGE WET WELL, PACKAGED PUMPING STATION, WITH SUBMERSIBLE GRINDER SEWAGE PUMP

- A. Factory fabricated, assembled, and tested with wet well for sewage pumps and collection of sanitary sewage and with dry equipment chamber for controls and accessories.

1. Orientation: Shell underground with dry equipment chamber above grade.
2. Shell: Factory fabricated from fiberglass.
3. Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches in diameter.
4. Cathodic Protection: exterior magnesium anode(s).
5. Sewage Pumps: One submersible grinder-type sewage pumps, with guide rail, quick-disconnect system, controls, and piping. Include stainless-steel grinder impeller and hermetically sealed motor with moisture-sensing probe, mechanical seals, and waterproof power cable.

B. Capacities and Characteristics:

1. Diameter or Dimensions of Shell: 36 inches, minimum. Wet well shall accommodate two (2) pumps as indicated in the Contract Drawings.
2. Height of Shell Base Section: As required to accommodate inverts in and out, alarm floats, and other appurtenances as required.
3. Pumping Station, Inlet Pipe Size: 4 inches.
4. Pumping Station, Discharge Pipe Size: To be determined by Contractor delegated design.
5. Sewage Pumps: One.
6. Each Sewage Pump:
 - a. Capacity: To be determined by Contractor delegated design.
 - 1) Refer to Plumbing Drawings for fixture unit counts.
 - 2) Normal Cemetery operating hours: 8:00 am – 5:00 pm.
 - b. Total Dynamic Head: To be determined by Contractor delegated design.
 - c. Speed: To be determined by Contractor delegated design.
 - d. Impeller: Grinder type.
 - e. Inlet Size: To be determined by Contractor delegated design.
 - f. Discharge Size: To be determined by Contractor delegated design.
 - g. Motor Size: hp to be determined by Contractor delegated design.
 - h. Electrical Characteristics:
 - 1) Volts: 480 V.
 - 2) Phases: Three.
 - 3) Hertz: 60.
 - i. Refer to drawings for additional requirements.

C. Controls:

1. Control Sequence of Operation: Cycle sewage pump on and off automatically to maintain wet-well sewage level. Automatic alternator, with manual disconnect switch, changes sequence of lead-lag sewage pumps at completion of each pumping cycle.
2. Self-Purging, Air-Bubbler System: Senses variations of sewage level in wet well. Include oilless air compressors to furnish bubbler air; filters; air-storage reservoir;

pipings; airflow meter with needle valve adjustment for airflow regulation; sewage depth gage; air-bubbler piping to wet well; and pressure-sensing, dustproof mercury switches.

3. Float-Switch System: Senses variations of sewage level in wet well. Include high and low adjustments capable of operating on 6-inch minimum differential of liquid level.
4. Motor Controllers: Magnetic, full voltage, nonreversing. Include undervoltage release, thermal-overload heaters in each phase, manual reset buttons, and hand-automatic selector switches. Include circuit breakers to provide branch-circuit protection for each controller.
5. 120-V accessory controls with 15-A, single-phase circuit breakers or fuses for each item.
6. Control Panel: Enclosure complying with UL 508A with separate compartments and covers for controllers, circuit breakers, transformers, alternators, and single-phase controls. Include 20-A duplex receptacle in NEMA WD 1, Configuration 5-20R mounted on exterior of control panel.
 - a. Mounting: Outside, on pedestal, at grade.
 - b. Enclosure: NEMA 250, Type 4X.
7. Install labels on panel face to identify switches and controls.
8. Wiring: Tin-copper wiring.
9. Connection for Portable Generator: Nonautomatic (manual) transfer switch with receptacle matching generator electrical power requirements.

D. Accessories:

1. Ventilation: Electrically powered ventilation system. Include centrifugal blower with 4-inch- round exhaust vent designed to keep out rain, insects, and other foreign matter; limit switch to start blower if entrance door or lid is opened; 0- to 15-minute timer; and separate manual switch.
 - a. Ventilating system capacity to change air in dry equipment chamber every two minutes.
2. High-Water Audio Alarm: Horn for audio indication of station high-water level, energized by separate level-detecting device. Include alarm silencer switch and relay in station.
3. Remote Alarm Circuit: Include contacts for connection to remote alarm panel.

E. Fabrication:

1. Fabricate shell from fiberglass with structural-steel reinforcement.
 - a. Attach structural-steel reinforcement to top and bottom heads.
 - b. Fabricate shell with continuous joints to make watertight and gastight construction.
 - c. Attach air vent to pump chamber.

2. Entrance Cover: Waterproof and corrosion resistant, with lock. Include way to open cover from inside tube if cover is locked.
3. Air Vent: Duct fabricated from corrosion-resistant material, extended to above grade, outlet turned down, and with insect screen in outlet.
4. Factory-fabricate piping between unit components.
 - a. Use galvanized-steel pipe and cast-iron fittings or ductile-iron pipe and fittings.
 - b. Use fittings for changes in direction and branch connections.
 - c. Flanged and union joints may be used instead of joints specified.
 - d. Use dielectric fittings for connections between ferrous- and copper-alloy piping.
5. Piping Connections: Unless otherwise indicated, make the following piping connections:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment having NPS 2 (DN 50) or smaller threaded pipe connection.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
6. Valves: Ferrous alloy.
 - a. Sewage Pump Piping: Include gate valve on each pump inlet and gate and check valves on each discharge pipe.
 - b. Compressed-Air Piping: Include ball and check valves on discharge pipe from each air compressor.
7. Wiring: Tin-coated copper.

F. Source Quality Control:

1. Test and inspect sewage pumps according to HI 1.6, "Centrifugal Pump Tests." Include test recordings that substantiate correct performance of pumps at design head, capacity, suction lift, speed, and horsepower.
2. Test accessories and controls through complete cycle. Include test recordings that substantiate correct performance.

2.6 CONCRETE PROTECTIVE COATING

- A. Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

2.7 CLEANOUT FRAMES AND COVERS

- A. Frames and covers shall be gray iron casting conforming to ASTM A48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

2.8 WARNING TAPE

- A. Standard, 4mil polyethylene 3 inch wide tape, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES

- A. Intercept existing sanitary sewer service line at the location indicated outside of building and make connections. Field locate the size, invert and location of the service line.
- B. Connections of new sewer to building piping service line shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the COR. The Contractor shall install all temporary caps or plugs required for testing.

3.2 ABANDONED STRUCTURES AND PIPING

- A. Septic Tank:
 - 1. Comply with City and County of San Diego requirements for abandonment of septic tank, including procuring all requisite permits.
 - 2. Contract with certified waste hauler for tank cleanout.
 - 3. Photograph tank after cleanout.
 - 4. Fill tank after clean out with sand, gravel, or other clean fill material per City and County of San Diego requirements. Photograph tank upon completion of filling.
 - 5. Remove tank access frame and cover, cut and remove the top of an elevation of 18 inches below finished grade. Fill the remaining portion with compacted backfill material.
- B. Piping outside of building areas shall have all ends of the piping at the limit of the abandonment and within structures and manholes, plugged with concrete, and abandoned in-place.
- C. The Contractor shall comply with all OSHA confined space requirements while working within existing manholes and structures.

3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in re-graded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the Drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.4 CONNECTIONS TO EXISTING VA OWNED SEWER

- A. During construction of new connections to existing sewer, it shall be the sole responsibility of the Contractor to maintain continued sanitary sewer service to all buildings and users upstream. The Contractor shall provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All temporary measures required to meet this requirement shall be subject to the review of the COR.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY COMPANY SEWER OR SEWER OWNED BY OTHER ENTITIES

- A. Comply with all rules and regulations of the public utility or owning entity.
 - 1. Prior to any excavation activities, contact NAVFAC base utilities mark-out and US Dig Alert to confirm location of existing utilities.
 - 2. In case of any utility-related emergency, contact Navy Utilities Duty Desk: (619) 556-7349.
 - 3. Coordinate and schedule sewer force main tie-in and connection with NAVFAC Utilities. Utility tie-ins to distribution mains and connections shall be made in the presence of a representative (utility inter-connect specialist).
- B. The connection to the existing utility shall comply with the standard details and specifications of the public utility company or owning entity.
 - 1. Provide detail drawing to COR for connection of sewer force main into Navy-owned sewer transition manhole for review and approval. The existing sewer manhole into which the proposed sewer force main will tie currently has an existing stub in for VA sewer connection. Field-locate prior to construction.

- C. Pay all fees associated with connection to the existing sewer.

3.6 PIPE SEPARATION

A. Horizontal Separation - Water Mains and Sewers:

1. Existing water mains shall be at least 10 feet horizontally from any proposed gravity flow sanitary sewer or sewer service connection.
2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet but not closer than 6 feet to a water main when:
 - a. Local conditions prevent a lateral separation of 10 feet; and
 - b. The water main invert is at least 18 inches above the crown of the gravity sewer or 24 inches above the crown of the pressure (force) main; and
 - c. The water main is in a separate trench separated by undisturbed earth.
3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 24 inches above the crown of gravity flow sewer or 48 inches above the crown of pressure (force) mains. The vertical separation shall be maintained within 10 feet horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 24 inches of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches above or 12 inches below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein.
4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet.

3.7 GENERAL PIPING INSTALLATION

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.

- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 2 feet below water lines.
- H. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches over the crown of the pipe.
- I. Warning tape shall be continuously placed 12 inches above sewer pipe
- J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
 - 1. Polyvinyl Chloride (PVC) Piping: ASTM D2321.
- K. Installation of Pressure (Force) Mains
 - 1. Sections of piping listed on the Drawings shall be fully restrained using approved joint restraint devices. Joint restraint devices shall be installed in accordance with the manufacturer's recommendations. For devices with twist of nuts, the twist of nuts shall be placed on top of the fitting for the COR's inspection. The Contractor shall torque test all bolts, set screws, identified by the COR.
 - 2. Thrust blocks shall not be permitted.
 - 3. Install pressure (force) mains in accordance with the provisions of these specifications and the following standards:
 - a. Polyvinyl Chloride (PVC) Piping: AWWA C605.

3.8 WET WELLS

- A. Examination

1. Examine substrates and conditions, with Installer and COR present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 2. Examine roughing-in of sewerage piping systems to verify actual locations of piping connections before packaged sewage pumping station installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Install the wet well on 12 inches compacted aggregate base course or per manufacturer's recommendations.
- C. Set units level and plumb.
- D. Core openings for pipe penetrations and seal with a modular seal. Seal shall be "link-seal" or approved equal.
- E. Grout under and around shell and all joints and depressions. Fill voids between shell sidewalls, sleeves, and piping and make watertight seal with grout. Install protective coatings per the manufacturer's recommendations. The final coating shall be applied in two coats, providing a minimum thickness 6-8 mils dry film thickness per coat.
- F. Connect anode conductors to grounding lugs on steel housing.
- G. Join separate sections of housing by field welding.
- H. Field weld entrance tube to housing.
- I. Set top of wet well 1 inch above finish grade.
- J. All pipe penetrations through the walls of the wet well shall be sealed water tight.
- K. Connections:
1. Drawings indicate general arrangement of piping.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Ground equipment and connect wiring according to Sections of Division 26.
- L. Identification:
1. Install identifying labels permanently attached to equipment.
 2. Install operating instruction signs permanently attached to equipment or near equipment.
 3. Arrange for installing green warning tape over outside edges of underground packaged sewage pumping stations. Tape materials and their installation are specified in Section 312000 "Earth Moving."
- M. Painting:
1. Prepare and paint ferrous piping in wet wells, structural-steel supports, and anchor devices with coal-tar epoxy-polyamide paint according to SSPC-Paint 16.

2. Paint field-welded areas to match factory coating.

3.9 CLEANOUTS

- A. 6 inches in diameter and consisting of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 12 by 12 by 6 inches thick concrete slab set flush with adjacent finished grade. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 2 inches base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 24 inches in diameter.
- B. The top of the cleanout assembly shall be 2 inches below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.10 INSPECTION OF SEWERS

- A. Inspect and obtain the COR's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints on the inside of gravity sewer lines are not acceptable.

3.11 TESTING OF SANITARY SEWERS

- A. Gravity Sewers (Select one of the following):
 1. Air Test: PVC Pipe, Uni-Bell Uni-B-6. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 4 psi and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell Uni-B-6.
 2. Exfiltration Test:
 - a. Subject pipe to hydrostatic pressure produced by head of water at depth of 3 feet above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 3 feet above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 3.0 gallons per hour per 100 feet.
 - b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

3. Infiltration Test: If ground water level is greater than 3 feet above invert of the upper manhole, infiltration tests are acceptable. Allowable leakage for this test will be the same as for the exfiltration test.
- B. Pressure (Force) Mains: Test at 100 psi for two hours. Leakage shall be per the following:
1. $L = J \cdot D \cdot \bar{P} / 4500$
 2. Where:
 - a. L = Maximum Allowable Leakage in Gallons per Hour
 - b. J = Number of Joints in Test Area
 - c. D = Diameter of Pipe in Inches
 - d. P = Average Test Pressure (Psi)
- C. Testing of Wet Well:
1. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
 2. After installing packaged sewage pumping stations and after electrical circuitry has been energized, test for compliance with requirements. Furnish water required for pump tests.
 3. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist. No leakage with the wet well completely filled with water for a duration of 4 hours.
 4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 6. Remove and replace packaged sewage pumping stations that do not pass tests and inspections and retest as specified above.
 7. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Adjust pump, accessory, and control settings, and safety and alarm devices.
 - c. Engage a factory-authorized service representative to train Cemetery maintenance personnel to adjust, operate, and maintain packaged sewage pumping stations.

END OF SECTION 333000