Project Number 839-MR18-05

FY2018 M&R Projects

at the

Culpeper National Cemetery

Technical Specifications

TECHNICAL SPECIFICATION
TABLE OF CONTENTS

May 16, 2018

SECTIONS:

01 00 02	General Requirements
01 33 23	Shop Drawings, Product Data, and Samples
01 35 26	Safety Requirements
01 42 19	Reference Standards
02 41 10	Demolition and Site Clearing
04 01 00	Maintenance of Masonry
04 05 13	Masonry Mortaring
07 60 00	Flashing and Sheet Metal
07 92 22	Joint Sealants – Electrical Work
09 91 00	Painting
23 10 10	Facility Fuel Control Systems
26 05 11	Requirements for Electrical Installations
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 33	Raceway and Boxes for Electrical Systems
26 05 41	Underground Electrical Construction
26 56 00	Exterior Lighting
31 20 12	Earthwork (Utility Trenching)
32 01 17	Asphalt Pavement Repair
32 05 23	Cement & Concrete for Exterior Improvements

DRAWINGS:

839-MR18-05-001	Site Plan / Project Location
839-MR18-05-002	Site Plan – Admin Bldg.
839-MR18-05-003	Site Plan – Annex Site

SECTION 01 00 02
GENERAL REQUIREMENTS

1.1 STATEMENT OF BID ITEM(S)

A. Contractor shall provide all labor, tools, materials, equipment, services, submittals, supervision, approvals, and related work to make noted repairs and replacements for the FY2018 Maintenance and Repair (M&R) Projects at the Culpeper National Cemetery (839). The work includes five (5) unique and separate Projects as outlined below.

B. The Contractor shall comply with the following General Project Requirements:

1. CONTRACTOR SHALL READ AND COMPLY WITH ALL CONDITIONS OF THIS CONTRACT INCLUDING THE TECHNICAL SPECIFICATION AS IT RELATES TO ALL REQUIREMENTS, PRODUCTS & MATERIALS, SUBMITTALS, TESTING, AND EXECUTION.

2. CONTRACTOR SHALL HAVE HARD COPIES OF ALL CONTRACT DOCUMENTS, DRAWINGS, TECHNICAL SPECIFICATIONS, AND ALL PERMIT APPROVALS AT THE PROJECT SITE AT ALL TIME.

3. CONTRACTOR SHALL NOT BEGIN ANY EXCAVATION UNTIL ALL THE APPROPRIATE UNDERGROUND UTILITES HAVE BEEN LOCATED AND MARKED IN THE FIELD.

4. CONTRACTOR SHALL MINIMIZE THE NEED FOR RESTORATION TO THE LAWNS, PAVEMENT, OR OTHER FEATURE ALONG THE PATH OF THE WORK.

5. CONTRACTOR SHALL CONDUCT WORK WITH THE SPECIAL CARE, REVERENCE, DIGNITY, AND RESPECT THAT ACKNOWLEDGE THE CEMETERY AS THE FINAL RESTING PLACE THAT COMMEMORATES THE SERVICE AND SACRIFICE THAT SERVICE MEMBERS, VETERANS AND THEIR FAMILIES MADE FOR OUR NATION.

6. CONTRACTOR SHALL KEEP THE PROJECT WORK SITE CLEAN AND TIGHTY AT ALL TIME. AT THE END OF EACH WORK DAY, ALL MATERIAL AND EQUIPMENT SHALL BE STORED IN A DESIGNATED PLACE PER THE CEMETARY DIRECTOR.

C. The Contract Work is for the Contractor to make noted repairs and replacements for the FY2018 Maintenance and Repair (M&R) Projects at the Culpeper National Cemetery (839). There are three (3) Project Locations as shown on the Contract Drawings. There is a total of five (5) Projects divided amongst the three Project Locations. The five (5) Projects are identified as **Project "A"**, **Project "B"**, **Project "C"**, **Project "D"**, and **Project "E"** on the Drawings and are further described as follows:

D. **Project "A", "Admin. BLDG. - Site Lighting Improvements":** is located at the Administration Building located in the older cemetery track of land north of US Avenue. The FY2018 M&R work required for Project "A" includes the removal, furnishing and replacement of the existing exterior Site Lighting Pole, concrete base, and Light Fixture. The Decorative Light Fixture will use LED lighting technology. The work for Project "A" also includes the removal, furnishing and replacement of the existing walkway Bollard Light fixtures with up to two (2) new reduced height Light Pole fixtures with LED lighting technology.

E. **Project "B", "Public Restroom – Women's Room & Roof Improvements":** is located at the Public Restroom Building at the newer "Annex" cemetery track of land located on the south side of East Chandler Street and on the west side of the cemetery access road. The FY2018 M&R work required for Project "B" includes the repair and restoration of the Women's Room wall and ceiling in the south corner of the room; the work includes the repair and replacement of building roof flashing in the area of the building roof above the Women's Room. The work includes all labor, materials, and equipment for a complete project.

F. **Project "C", "Public Restroom - HVAC Improvements":** is located at the Public Restroom Building at the newer "Annex" cemetery track of land located on the south side of East Chandler Street and on the west side of the cemetery access road.

NOTE: THIS WORK HAS BEEN REMOVED FROM THE STATEMENT OF WORK AND WILL BE CONDUCTED BY OTHERS UNDER A SEPARATE CONTRACT.

G. **Project "D", "Maintenance Garage – Building Security Light Improvements":** is located at the Maintenance Garage at the newer "Annex" cemetery track of land located at the top of the hill on the south side of the property. The FY2018 M&R work required for Project "D" includes the replacement of seven (7) Building wall mounted exterior security lights with LED light fixture technology. The work includes all electrical improvements, submittals, labor, materials, and equipment for a complete project.

H. **Project "E", "Maintenance Yard – Fuel Tank Monitoring Improvements":** is located at the Maintenance Garage at the newer "Annex" cemetery track of land at the top of the hill on the south side of the property. The FY2018 M&R work required for Project "E" includes the demolition, removal, and replacement of the existing Above Ground Fuel Storage Tanks fuel level and leak sensors, conduits, and alarm panel located at the Maintenance Garage Yard and Garage Bay. The work includes all electrical improvements, submittals, labor, materials, and equipment for a complete project.

1.2 SPECIFIC WORK ITEMS

The Contractor will be required to perform the following additional tasks as part of his work for this Project:

A. For **Project "A"**, the Contractor is responsible for removal and disposal of all three (3) existing light pole fixtures and fixture support structure along the drive as well as the removal and disposal of all sidewalk light bollards in front of the Building.

B. For **Project "A"**, The three (3) new light fixtures will be installed in the approximate same place as the existing light fixtures. The sidewalk light bollards will be replaced with up to two (2) reduced height light poles of the same type and decorative style and luminaire as the three (3) light poles along the drive.

C. For **Project "A"**, the Contractor will be required to work with a lighting manufacturer to prepare and submit to the COR up to two (2) Luminaire designs showing mounting height, luminance, and spacing to provide a minimum average horizontal illumination of 0.5 foot-candles on the driveway, parking area, and sidewalk along the front of the Administration Building.

D. For **Project "A"**, the Contractor will be required to make ALL necessary LED Light Fixture wiring connections at each LED Light Fixture back to the Electrical Panel in the Mechanical Room. Such work will include the installation of an electromechanical timer next to the Electrical Panel as directed by the Cemetery Director. All work shall be accordance with the approved Shop Drawing, and per the manufacture requirements.

E. For **Project "B"**, the Contractor shall ensure that all work related to the interior woman's room repair includes all sheet rock repair, repoint / repair grout joints on masonry, scrapping, priming, and painting to match the existing texture and color in the bathroom.

F. For **Project "B"**, the Contractor shall remove and dispose of the 39-step flashing on the roof prior to replacement of flashing.

G. For **Project "C"**, **(NOT APPLICABLE)**

H. For **Project "C"**, **(NOT APPLICABLE)**

I. For **Project "C"**, **(NOT APPLICABLE)**

J. For **Project "D"**, the Contractor shall make building security light improvements in conformance with the technical specifications including Division 1 – "General Requirements" and Division 26 – "Electrical" Requirements.

K. For **Project "D"**, the Contractor shall replace all seven (7) wall mounted security lights on the maintenance building with specified fixture and LED bulb. Fixtures shall be minimum 50W to maximum 75W consumption, minimum 400W equivalent output, minimum 6500 lumens, outdoor rated, waterproof, UL listed, and American made.

L. For **Project "D"**, the Contractor shall provide new electrical wiring in conduits for all fixtures and sensor. Install new photocell on the circuit to control new fixtures when it is dark. See Section 26 56 00 Item Number 2.6 – "LED Wall Mounted Security Lights".

M. For **Project "E"**, the Contractor shall make fuel tank monitoring system improvements in conformance with Section 23 10 10 "Facility Fuel Control System" technical specification including Division 1 - "General Requirements" and Division 26 – "Electrical" Requirements.

N. For **Project "E"**, the Contractor shall provide additional conduit as needed to ensure that sensor wires and power wires are installed in separate conduits for the fuel tank monitoring system and the new combination fuel pump and meter system.

O. For **Project "E"**, the Contractor shall replace all existing junction boxes of the fuel tank monitoring system with weatherproof junction boxes. All junction boxes shall be installed a minimum of two feet above grade.

P. For **Project "E"**, the Contractor shall furnish and install Clock Gauge with Overfill Alarm Box at each Fuel Storage Tank as outlined in Technical Specification Section 23 10 10.

Q. For **Project "E"**, the Contractor shall furnish and install Tank Mounted Fuel Pump, Meter, & Dispensing System (115-Volt AC) at each Fuel Storage Tank. Such Fuel Pumps shall be controlled by one (1) Emergency Fuel Shut-

Off Switch to be mounted on the exterior of the Maintenance Garage on the Northeast corner in a final location as determined by the COR and the Cemetery Director.

1.2 DRAWINGS

A. The following Drawings are made part of this Contract:

1. 839-MR18-05-001 "Site Plan / Project Location"

2. 839-MR18-05-002 "Site Plan – Admin. Bldg."

3. 839-MR18-05-003 "Site Plan – Annex Site"

1.3 SITE VISIT

A. Bidders may inspect the site, investigate by observation, and Request Information via (RFI) and responses through the Contracting Office to satisfy their understanding of the work to be done, all general, local and technical conditions that may affect the cost and the feasibility of their proposal.

B. In no event, shall failure of the Bidder to inspect the site constitute grounds for a claim after Award. Bidders planning to conduct a site visit shall contact the Cemetery Director or Foreman to make arrangements at the following:

Government POC:

Culpeper National Cemetery (Station #839)

Matthew Priest, Cemetery Director

(540)-825-0027

Matthew.Priest@va.gov

NCA District Engineer POC:

Ron Horton, P.E., Project Engineer / COR

North Atlantic District (NAD) Project Engineer

(215) 381-3787 (ext. 5799)

Ronald.Horton@va.gov

1.4 SAFETY REQUIREMENTS

A. Contractor foreman shall be onsite during all work activities and shall have completed OSHA 30-hour training. All other employees and sub-

contractors shall have as a minimum, 10-hour OSHA training. Prior to commencing work, general contractor shall provide proof that an OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.

B. Contractor shall 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.

C. Contractor shall ensure that all Fire and Safety Rules observed in performance of work: Wherever a cutting torch or other equipment that might cause a fire is used, the Contractor shall provide and maintain fire extinguishers nearby ready for immediate use. Contractor shall instruct all possible users in use of fire extinguishers.

1.5 PERFORMANCE DETAILS

A. Contractor shall complete all work within **90 calendar days** after receipt of Notice to Proceed, subject to all terms, conditions, provisions and schedules of the contract. No cost time extension will be considered for cold weather delays as requested by the Contractor.

B. Work Hours: Work may be performed between the normal hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. The following conditions also may applicable:

1. At the Contractor's request; with prior coordination with the Cemetery Director and with the written permission of the COR; work will also be permitted to be scheduled for weekends and/or Holidays, only in the following situations:

2. In emergency situations caused by the Contractor, or when severe adverse weather prohibits work during the week, the Contractor shall arrange to work on weekends and/or holidays to meet the contract performance period.

3. The Government will not compensate the Contractor for any alternate work schedules needed to complete all contract work within the contract performance period.

4. No work will be permitted during Memorial Day or Veteran's Day weekend activities or during any other Federal Holidays.

5. No work will be performed at the immediate site of a scheduled interment or ceremony.

6. Notwithstanding, if any work under this contract is required outside of the VA's normal working hours (8:00 a.m. to 4:30 p.m. Monday through Friday excluding holidays), the Contractor shall coordinate with the Cemetery Director and COR and request a deviation in writing to the COR at least 72 hours in advance.

C. When working on a Government site, the Contractor shall coordinate with the Cemetery Director daily, before start of work, the daily work schedule to ensure that no work is being performed at the immediate site of a scheduled interment or ceremony. The Contractor shall note the following:

1. Burial activities at a National Cemetery shall take precedence over Contractor activities. Cemetery interment services cannot be disturbed at any time.

2. To cause the least possible interference with cemetery activities, the Contractor shall cease all work in areas where burials are taking place.

3. Contractor equipment and personnel are prohibited from passing through the procession or service area during the burial period.

D. The Contractor shall execute daily work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of materials, debris, equipment and vehicles at all times. Materials and equipment shall not be stored in other than assigned areas. At the end of each day the Contractor shall maintain all Contractor and Government property impacted by the Contractor’s performance of work in a high standard of quality and cleanliness required for a national shrine.

E. Contractor personnel are subject to the cemetery rules of conduct. The Contractor is responsible for ensuring that no contract work causes any committal service, ceremony, procession or visitation to be delayed, altered, or otherwise impacted in such a way that the dignity, security, or safety of the event or visit is compromised.

F. Motor Vehicle Restrictions: Contractor, employees, and Sub-Contractors shall coordinate parking and access with the Cemetery Director.

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 Cemetery Director or 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. Contractor shall coordinate all work and obtain and pay for any required permits necessary for completion of this project.

B. The Contractor shall use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer Representative. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law 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 utilities, curbs, sidewalks, roads, or any other site feature.

C. Construction Fence shall be required only when noted on construction drawings or as directed by the COR. Before construction operations begin, Contractor shall provide a chain link construction fence, seven feet minimum height, around the construction area when 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. Remove the fence when directed by the COR.

D. 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 the Cemetery Director and COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, and the Cemetery Director’s prior knowledge and written approval.

E. Contractor shall submit a request to interrupt any such utility services to the COR, in writing, 7 days in advance of proposed interruption.

Request shall state reason, date, exact time of, and approximate duration of such interruption.

F. 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 Cemetery. Interruption time approved by Cemetery may not occur at other than Contractor's normal working hours.

G. Major interruptions of any other 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.

H. 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 at the main, branch or panel they originate from. 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.

I. The Contractor shall minimize interference of construction activities with flow of Cemetery traffic and 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.

2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be coordinated and approved by the Cemetery Director and the COR.

J. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor shall 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 interment 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 24 hours in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's

Day and/or Federal holidays, to ensure that all areas of operation adjacent to existing burial plots are clean and immaculate before these dates.

2. Daily Cleaning shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, safe, and neat condition.

K. The Contractor shall clean any Government property; including cemetery structures, headstones and monuments; that are soiled or stained because of Contractor's performance. The Contractor shall wash-down with water all soiled or stained structures, headstones and monuments at the end of each workday. Any such cleaning or washing shall be brought to the immediate attention of the COR prior to cleaning or washing. No hazardous chemicals shall be used at any time on Government property.

L. At the end of each work day, the Contractor shall remove all debris from the cemetery site resulting from the performance of the work. The Contractor shall ensure at all times that rubbish and trash generated by the Contractor is kept clear of vehicular and pedestrian traffic throughout the site. The Government will not provide receptacle(s) for disposal of debris related to this contract. The Contractor will be permitted to place trash receptacle dumpsters in the COR approved staging area at the National Cemetery.

1.7 Contractor Personnel Standards of Behavior (Work on a Government Installation)

A. Dignity Clause:

1. Every action by Contractor personnel at a national cemetery shall be performed with the special care, reverence, dignity, and respect that acknowledge the cemetery as the final resting place that commemorates the service and sacrifice that service members, Veterans and their families made for our Nation. Critically important is the awareness required of the Contractor employees of the remains buried in the grounds where the work is performed. The utmost care shall be given to these remains and the headstones and flat grave markers that mark those gravesites and memorialize the service of individuals.

2. Contractors shall not walk, stand, lean, sit or jump on headstones or markers. Nor shall they drive over them. Contractor personnel should use tools approved by the Contracting Officer Representative (COR), such as shovels, pry bars or pinch bars to lift flat markers out of the ground; pick axes are not an acceptable tool.

B. Smoking is prohibited inside any buildings at the cemetery. Possession of weapons is prohibited from any cemetery buildings and grounds. Enclosed containers, including tool kits, shall be subject to search. Violations

of VA regulations may result in citation answerable in the United States (Federal) District Court, not a local district, state, or municipal court

C. Contractor personnel are required to adhere to the following standards of dress, conduct, supervision and training while performing work on a Government Installation. Any violations shall be subject to immediate enforcement action by the Contracting Officer if these standards are not met. Contractor is responsible for training and safety precautions prescribed by OSHA regarding safety equipment and devices. Contractor personnel shall:

(1) Be fully clothed at all times, to include upper garment to cover body from the waist to the neck and long pants or slacks. Garments, which have a message, slogan or printing of any kind other than the Contractor's business attire, are prohibited. Uniforms are acceptable.

(2) Maintain a neat and professional appearance throughout its workforce, vehicles, equipment, and maintenance areas. Uniforms are acceptable. If uniforms are used, they must be in unison among all employees.

(3) Not engage in loud or boisterous behavior, angry outbursts or use profane or abusive language at any time on Government premises. Playing radios and/or electronic games/devices shall only be done at lunchtime and in a designated break area. Due to the sensitive mission of the cemetery, Contractor employees shall come into daily contact with grieving individuals, therefore Contractor employees shall exercise and exhibit absolute decorum, courtesy, and respect while within the cemetery or at its perimeter or entrances. Inquiries from cemetery visitors shall be politely referred to Government cemetery staff. Gratuities of any kind are strictly prohibited.

(4) Consume food and beverage only within areas designated by the cemetery director (or his/her designated representative). Intoxication, and violence or criminal acts of any kind shall not be tolerated and is cause for immediate removal from a Government Installation. Use or sale of intoxicating beverages and/or drugs is strictly prohibited and use of tobacco products is only allowed in specific areas designated by the Cemetery Director (or his/her designated representative).

(5) Only take breaks/rest periods, lunch breaks and bathrooms breaks in the Contractor Break Area, designated by the Cemetery Director (or his/her designated representative), not in the field. Misconduct shall form the basis for immediate contract enforcement action, to include immediate removal from the cemetery.

(6) The Contractor shall ensure that his/her employees (including Contractor Consultants, Sub-Contractors, etc.) are aware of all the terms and conditions set forth in the

contract regarding the "Dignity Clause", their performance, and conduct while at the Cemetery.

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

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

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those utilities, facilities, or any site condition including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer Representative will have the necessary work performed and charge the cost to the Contractor or withhold from any payments.

1.9 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified. The Contractor shall do not cut, alter or remove any structural work, disturb any ducts, plumbing, steam, gas, or electric systems 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 in the Contract.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result

of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.

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).

1.10 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, when indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Drawings.

B. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer Representative may replace them and deduct the expense of the replacement from any future payment.

1.11 TEMPORARY TOILETS

A. When necessary, Contractor shall provide temporary sanitary toilet accommodations. Coordinate location with Cemetery Director. Keep such places clean and free from flies. Failure to maintain satisfactory condition of Temporary Toilets will deprive Contractor of the privilege to use such toilets.

1.12 AVAILABILITY AND USE OF UTILITY SERVICES

A. 120 outlets may be available and shall be coordinated with the Cemetery Director or COR for use if necessary.

B. Water for Construction: Furnish temporary water service.

1. Contractor may obtain water by connecting to the Cemetery water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation at COR’s discretion of use of water from Cemetery's system.

1.13 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 described as such in the scope of work above. 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.

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SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer Representative (COR) may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor’s expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.

B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.

D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.

E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.

I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.

J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.

K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.

B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

C. The VA will provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a

complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.

D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

E. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.

4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the COR.

E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the COR, at no additional cost to the VA.

1.7 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.

B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.

C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

A. The COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.10 VA REVIEW OF SUBMITTALS AND RFIS

A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The COR for this project will review all submittals and determining contractual compliance.

B. Period of review for submittals begins when the COR receives submittal from the Contractor.

C. Period of review for each resubmittal is the same as for initial submittal.

D. VA review period is 15 working days for submittals.

E. VA review period is 10 working days for RFIs.

F. The VA will return submittals to the Contractor with the following notations:

1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the

satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

- - - E N D - - -

SECTION 01 35 26
SAFETY REQUIREMENTS – ELECTRICAL WORK

1.1 APPLICABLE PUBLICATIONS:

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

B. American Society of Safety Engineers **(ASSE):**

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

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

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

C. National Fire Protection Association **(NFPA):**

70-2014.....National Electrical Code

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

70E-2015 .....Standard for Electrical Safety in the Workplace

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

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

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

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

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

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

E. VHA Directive 2005-007

1.2 DEFINITIONS:

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

B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

C. High Visibility Accident. Any mishap which may generate publicity or high visibility.

D. Accident/Incident Criticality Categories:

"No impact" – near miss incidents that should be investigated but are not required to be reported to the VA;

"Minor incident/impact" – incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated but are not required to be reported to the VA;

"Moderate incident/impact" – Any work-related injury or illness that results in:

1. Days away from work (any time lost after day of injury/illness onset);
2. Restricted work;
3. Transfer to another job;
4. Medical treatment beyond first aid;
5. Loss of consciousness;
6. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
7. Any incident that leads to major equipment damage (greater than $5000).

These incidents must be investigated and are required to be reported to the VA;

"Major incident/impact" – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

F. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.3 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations.

B. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative (COR).

1.4 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific.

B. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

C. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.

2. Address both the Prime Contractors and the subcontractors work operations.

3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

4. Address all the elements/sub-elements and in order as follows:

   a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:

      1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

      2) Plan approver (company/corporate officers authorized to obligate the company);

      3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

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

      1) Contractor;

      2) Contract number;

      3) Project name;

      4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

   c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all

employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

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

1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;

2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;

4) Requirements that no work shall be performed unless a designated competent person is present on the job site;

5) Requirements for pre-task Activity Hazard Analysis (AHAs);

6) Lines of authority;

7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

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

1) Identification of subcontractors and suppliers (if known);

2) Safety responsibilities of subcontractors and suppliers.

f. **TRAINING.**

1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space,

etc.…) and any requirements for periodic retraining / recertification are required.

3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. **SAFETY AND HEALTH INSPECTIONS.**

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

2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. **ACCIDENT/INCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Contracting Officer Representative (COR).

1) Exposure data (man-hours worked);

2) Accident investigation reports;

3) Project site injury and illness logs.

1.5 ACTIVITY HAZARD ANALYSES (AHAS):

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.

   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 10 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the COR.

1.6 PRECONSTRUCTION CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

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

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

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role.

D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.8 TRAINING:

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

B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES within 10 calendar days prior to the date of the preconstruction conference for acceptance.

F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 INSPECTIONS:

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

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.

2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.

3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.

4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

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

A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least $20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162 (or equivalent), and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly.

E. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Mandatory PPE includes:

1. Hard Hats – shall be worn at all time.

2. Safety glasses – shall be worn at all time meeting the ANSI Z.87.1 standard must be worn by each person on site.

3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site.

4. Hearing protection - Use personal hearing protection at all time when performing noise hazardous tasks.

1.12 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be outlined in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or

circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.

3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity and permit for energized work has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate, or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

1.13 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than five (5) feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches five (5) feet in depth or greater shall require a written trenching and excavation permit (NOTE – some States and

other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the COR prior to proceeding with digging or drilling and prior to proceeding with entering the excavation.

C. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the COR. The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time
2. Specific location and nature of the work.
3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
4. Indication of whether soil or concrete removal to an offsite location is necessary.
5. Indication of whether soil samples are required to determined soil contamination.
6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
7. Indication of review of site drawings for proximity of utilities to digging/drilling.

The second section of the permit for excavations greater than eight (8) feet in depth shall include the following:

1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 – Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 – Type B, greater than 1.5 Tons/FT2 – Type A without condition to reduce to Type B).

2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer

designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.

3. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.

4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

C. As required by OSHA 29 CFR 1926.651(b)(1), the location of utility installations, such as sewer, electric, water lines, or any other underground installations that may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.

2. The American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.

3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.

4. Digging will not commence until all known utilities are marked.

5. Utility markings will be maintained

D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations are within five (5) feet of identified underground utilities.

E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

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

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

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

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

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

AAN American Nursery and Landscape Association
http://www.anla.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

ANLA American Nursery & Landscape Association
http://www.anla.org

ANSI American National Standards Institute, Inc.
http://www.ansi.org

ASAE American Society of Agricultural Engineers
http://www.asabe.org

ASTM American Society for Testing and Materials
http://www.astm.org

CSI Cast Stone Institute
http://www.caststone.org

EGSA Electrical Generating Systems Association
http://www.egsa.org

EEI Edison Electric Institute
http://www.eei.org

EPA Environmental Protection Agency
http://www.epa.gov

ETL ETL Testing Laboratories, Inc.
http://www.et1.com

GSA General Services Administration
http://www.gsa.gov

ICEA Insulated Cable Engineers Association Inc.
http://www.icea.net

IEEE Institute of Electrical and Electronics Engineers
http://www.ieee.org\

IMSA International Municipal Signal Association
http://www.imsasafety.org

IPCEA Insulated Power Cable Engineers Association
http://www.icea.net/

NBS National Bureau of Standards
See - NIST

NEC National Electric Code
http://www.nfpa.org/nec

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

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

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

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

PPI The Plastic Pipe Institute
http://www.plasticpipe.org

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

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

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SECTION 02 41 10
DEMOLITION AND SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies all site preparation work, demolition and removal of buildings, portions of buildings, utilities, other structures and debris.

1.2 RELATED WORK

A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Disconnecting utility services prior to demolition: Section 01 00 02, GENERAL REQUIREMENTS.

C. Reserved items that are to remain the property of the Government: Section 01 00 02, GENERAL REQUIREMENTS.

1.3 PROTECTION

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 02, GENERAL REQUIREMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor 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. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 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 Project Engineer/Contracting Officer's Representative (PROJECT ENGINEER / COR).

H. Coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have PROJECT ENGINEER / COR's approval.

1.4 UTILITY SERVICES

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

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

C. Assume for bidding purposes that all buried (underground) pressurized piping is installed with concrete thrust blocks, which shall be demolished by the contractor as necessary for work required.

PART 2 – GENERAL NOTES

2.1 DEMOLITION GENERAL NOTES

A. Referenced standards contained herein and in other specification sections dictate the requirements for new work, and are not to be taken as assurance that existing work to be demolished meets these reference standards or specifications.

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 SWPPP, prior to any soil disturbance activities. Provide temporary seeding as required by the SWPPP.

C. Maintain site controls in accordance with Storm Water Pollution Prevention Plan and repair as directed by COTR to sustain compliance with SPDES permit. Maintain all records as required by the SWPPP. Perform inspections as required by the SWPPP.

D. Topsoil - On-site: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6-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 indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles to prevent wind erosion in accordance with the Storm Water Pollution Prevention Plan.
   a. Stockpile shall be contained with erosion and sediment controls (silt fence) and stabilized if undisturbed in accordance with the Storm Water Pollution Prevention Plan.
3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material only after approval of the Architect.

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.
   4. 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.

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 15 and 16 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 Storm Water Pollution Prevention Plan until the work is completed and the threat of erosion is gone by either around surface stabilizer or 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 buildings and structures, including all appurtenances related or connected thereto, as noted below:
   1. As required for installation of new utility service lines.
   2. To full depth within an area defined by hypothetical lines located 5-feet outside building lines of new structures.

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

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 5-feet below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 5-feet, or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications. 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 PROJECT ENGINEER / COR. When Utility lines are encountered that are not indicated on the drawings, the PROJECT ENGINEER / COR shall be notified prior to further work in that area.

F. Where electrical, mechanical, plumbing, fire protection, fire alarm, or security components or equipment are shown to be demolished, contractor shall demolish all piping, conduit, cables, ductwork, outlets, switches, local panels back to their point of origin. Demolition shall be done such that all national, state and local codes are met both in the process of demolition but also the finished work. As an example, demolition of electrical components shall be taken back to the panel where the circuit originates. Coordinate with the COR as necessary.

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 PROJECT ENGINEER / 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.

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SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Repointing existing damaged masonry joints.
   2. Replacing existing damaged masonry units.

1.2 RELATED REQUIREMENTS

A. Mortars for new masonry: Section 04 05 13, MASONRY MORTARING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. ASTM International (ASTM):
   1. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
   2. C144-11 - Aggregate for Masonry Mortar.
   3. C150/C150M-15 - Portland Cement.
   4. C207-06(2011) - Hydrated Lime for Masonry Purposes.
   5. C216-15 - Facing Brick (Solid Masonry Units Made from Clay or Shale).
   6. C270-14a - Mortar for Unit Masonry.
   7. C295/C295M-12 - Petrographic Examination of Aggregates for Concrete.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Replacement units indicating manufacturer recommendation for each application.
C. Samples:
   1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.
D. Test reports:
   1. Preconstruction test results of existing masonry mortar and units.
   2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Documented experience in completion of work, similar in design, material, and extent specified.

B. Preconstruction Testing:
   1. Existing Brick: according to ASTM C67.
   2. Existing Mortar: according to ASTM C295/C295M.
      a. Recommend mortar mix compatible with existing color and texture.

C. Mockups: Prepare mockup in size indicated on Drawings, demonstrating quality and aesthetics of tuck pointing, masonry unit replacement and cleaning.

1.6 DELIVERY

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

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

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

1.7 STORAGE AND HANDLING

A. Store materials covered, protected from weather, and elevated above grade. Prevent contamination of aggregates.

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

1.8 FIELD CONDITIONS

A. Environment:
   1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
   2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Components:
   1. Hydrated Lime: ASTM C207, Type S.
   2. Aggregate: ASTM C144.
   3. Portland Cement: ASTM C150/C150M, Type I.

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

2.2 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Provide each product from one manufacturer and from one production run.

2.3 REPLACEMENT MASONRY UNITS

A. Face Brick:

1. ASTM C216, Grade SW, Type FBS matching existing.
2. Efflorescence: Rated slight efflorescent when tested according to ASTM C67.

B. Other Masonry Units: Match existing.

2.4 MIXES

A. Tuck Pointing Mortar: ASTM C270; Appendix X3.

1. Contractor to provide appropriate Type N, Type O, or Type K.
2. Type K: 1 part Portland cement, 4 parts hydrated lime and 11-1/4 to 15 parts fine sand.

2.5 ACCESSORIES

A. Cleaning Agent: Soap less, non-acidic, detergent, specially prepared for cleaning the appropriate surface: brick, stone, concrete, or masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

1. Protect from mortar droppings and cleaning operations.

C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.

B. Remove dust and debris from joints.

1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.

B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.

C. Allow layer to become slightly hardened before applying next layer.

D. Pack final layer flush with surfaces of masonry units.

3.4 MASONRY UNIT REPLACEMENT

A. Cut out mortar joints surrounding masonry units requiring replacement.

1. Remove existing masonry units creating opening for replacement masonry unit installation.
2. Remove mortar, dust, and debris from opening perimeter surfaces.
3. Prevent debris from falling into cavity.

B. Dampen surfaces of surrounding existing masonry before installing replacement masonry units.

1. Allow existing masonry to absorb surface moisture before installing replacement units.
2. Butter contact surfaces of existing masonry and replacement masonry units with mortar.
3. Center replacement masonry units in opening and press into position.
4. Remove excess mortar.
5. Tuck point replacement masonry units to ensure full head and bed joints.

3.5 JOINT TOOLING

A. Tool repointed and replaced masonry joints when mortar becomes slightly hardened. Produce smooth, compacted, joint matching existing.

3.6 CLEANING

A. Remove mortar splatter from exposed surfaces immediately.

B. Clean exposed masonry surfaces on completion.

C. Remove mortar droppings and other foreign substances from wall surfaces.

D. Wet surfaces with clean water.

E. Wash with cleaning agent.

F. Brush masonry surfaces with stiff fiber brushes while washing.

G. Immediately after washing, rinse with clean water.

1. Remove traces of detergent, foreign streaks or stains.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies mortar materials and mixes.

1.2 RELATED WORK:

A. Mortar Color: Submit to COR for approval.

1.3 TESTING LABORATORY-CONTRACTOR RETAINED

A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.

B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

1.4 TESTS

A. Test 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:

   Type M: Minimum 2500 psi at 28 days.

   Type S: Minimum 1800 psi at 28 days.

   Type N: Minimum 750 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 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Certificates:

1. Testing laboratory's facilities and qualifications of its technical personnel.
2. Indicating that following items meet specifications:

a. Portland cement.
b. Masonry cement.
c. Mortar cement.
d. Hydrated lime.
e. Fine aggregate (sand).
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):

C40-11.....Organic Impurities in Fine Aggregates for Concrete
C91-12.....Masonry Cement
C109-11.....Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
C144-04.....Aggregate for Masonry Mortar
C150-12.....Portland Cement
C207-06(2011).....Hydrated Lime for Masonry Purposes
C270-12.....Mortar for Unit Masonry
C595-13.....Blended Hydraulic Cement
C780-10.....Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C979-10.....Pigments for Integrally Colored Concrete

C1329-12.....Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing and laying of structural facing tile units except that 100 percent passes No. 8 sieve, and not more than 5 percent retained on No. 16 sieve.

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

2.3 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

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

B. Use white masonry cement whenever white mortar is specified.

2.5 MORTAR CEMEMT

ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

A. ASTM C150, Type I.

B. Use white Portland cement wherever white mortar is specified.

2.7 LIQUID ACRYLIC RESIN

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

2.8 WATER

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

2.9 POINTING MORTAR

A. For Cast Stone or Precast Concrete: Proportion by volume; One part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

B. Pointing Mortar for Glazed Structural Facing Tile:

1. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.
2. Pointing mortar in shower: Add aluminum tri-stearate, calcium stearate, or ammonium stearate in amount of two percent of weight of cement used.

2.10 MASONRY MORTAR

A. Conform to ASTM C270.

B. Admixtures and mixes:

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.
4. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
5. Do not use calcium chloride.
6. Limit cementitious materials in mortar to Portland cement and lime.
7. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
8. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not re-temper or use partially hardened material.

C. Colored Mortar:

1. Maintain uniform mortar color for exposed work throughout.
2. Match mortar color in approved sample or mock-up.
3. Color of mortar for exposed work in alteration work to match color of existing mortar unless specified otherwise. Submit to COR for approval.

D. Color Admixtures:

1. Proportion as specified by manufacturer.

2. For color, reference submitted/approved products.

2.11 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 mortar mixer.

1. Mix mortar for at least three minutes but not more than five minutes.

B. Measure ingredients by volume. Measure by the use of a container of known capacity.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar that has stiffened because of loss of water through evaporations:

1. Re-tempered by adding water to restore to proper consistency and workability.

2. Discard mortar that has reached its initial set or has not been used within two hours.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.

2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.

3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

A. Use Type M mortar for precast concrete panels, and waterproof parging below grade.

B. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered), masonry below grade, masonry solar screens, and setting cast stone and engineered reinforced unit masonry work.

C. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.

D. Use Type N mortar for other masonry work, except as otherwise specified.

E. Use Type N mortar for tuck pointing work involving non-structural masonry walls. Use Type S mortar for tuck pointing work involving structural masonry walls.

F. Use pointing mortar for items specified.

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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 01 00 02 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. Aluminum Association (AA):

AA-C22A41	Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
AA-C22A42	Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
AA-C22A44	Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American Architectural Manufacturers Association (AAMA):

AAMA 620	High Performance Organic Coatings on Coil Coated Architectural Aluminum
AAMA 621	High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

D. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

ANSI/SPRI ES-1-03	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

E. ASTM International (ASTM):

A167-99(R2009)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653/A653M-09	Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot-Dip Process
B32-08	Solder Metal
B209-10	Aluminum and Aluminum-Alloy Sheet and Plate
B370-09	Copper Sheet and Strip for Building Construction
D173-03	Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
D412-06	Vulcanized Rubber and Thermoplastic Elastomers-Tension
D1187-97(R2002)	Asphalt Base Emulsions for Use as Protective Coatings for Metal
D3656-07	Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
D4586-07	Asphalt Roof Cement, Asbestos Free

F. FM Approvals: RoofNav Approved Roofing Assemblies and Products:

1-49-09	Loss Prevention Data Sheet: Perimeter Flashing

G. International Code Commission (ICC):
International Building Code, Current Edition

H. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06	Metal Finishes Manual

I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual 2012

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq.

ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.

B. Wind Design Standard: Fabricate and install copings, roof-edge flashings tested per ANSI/SPRI ES-1.

1.5 SUSTAINABILITY REQUIREMENTS

A. Materials in this section may contribute towards contract compliance with sustainability requirements.

1.6 SUBMITTALS

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

B. Shop Drawings: For all specified items, including:

1. Flashings.
2. Gutter and Conductors.
3. Expansion joints.
4. Fascia-cant.

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing.
2. Thru wall flashing.
3. Non-reinforced, elastomeric sheeting.
4. Copper clad stainless steel.
5. Polyethylene coated copper.
6. Bituminous coated copper.
7. Fascia-cant.

D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

1.7 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 FLASHING AND SHEET METAL MATERIALS

A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

B. Copper ASTM B370, cold-rolled temper.

C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf); bituminous coating weight not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Provide crimped exposed fabric surface.

D. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.

E. Aluminum Sheet: ASTM B209, Alloy 3003-H14 except alloy used for color anodized aluminum to be as required to produce specified color. Alloy required to produce specified color must have the same structural properties as Alloy 3003-H14.

F. Galvanized Sheet: ASTM A653.

G. Non-reinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick.

1. Tensile Strength: Minimum 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412.
2. No cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Rosin Paper: Sheathing paper, weighing minimum 141 g m²(3 lbs/100 sf).

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.

3. Rivets: Not less than 3 mm (1/8 inch) diameter.

F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. Lock and solder copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick to be done by lapping, riveting and soldering.
3. Provide joints conforming to following requirements:
   a. Finish flat-lock joints not less than 19 mm (3/4 inch) wide.
   b. Finish lap joints subject to stress not less than 25 mm (one inch) wide; soldered and riveted.
   c. Finish unsoldered lap joints not less than 100 mm (4 inches) wide.
4. Make flat and lap joints in direction of flow.
5. Edges of bituminous coated copper, non-reinforced elastomeric sheeting and polyethylene coated copper to be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:

a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
b. Wire brush to produce a bright surface before soldering lead coated copper.
c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:
1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.

2. Except as otherwise specified, fabricate edge strips of minimum 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) thick stainless steel, 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz.) copper 0.8 mm (0.031 inch) thick stainless steel 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:
1. Turn up edges of flashings concealed in masonry joints and opposite drain side 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges must meet requirements of IBC, current edition.

G. Metal Options:
1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.

1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Use copper, stainless steel, or copper clad stainless steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.

1. Use plan flat sheet of stainless steel.
2. Form exposed portions with drip as specified or receiver.

E. Window Sill Flashing and Lintel Flashing:

1. Use copper, stainless steel, copper clad stainless steel plane flat sheet, or non-reinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

F. Door Sill Flashing:

1. Where concealed, use 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Use copper or stainless steel, unless specified otherwise.
B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
   1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
   2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
   3. Two-piece, lock in type flashing may be used instead of one piece counter-flashing.
   4. Manufactured assemblies may be used.
   5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
   6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
C. One-piece Counterflashing:
   1. Back edge turned up and fabricate to lock into reglet in concrete.
   2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
D. Two-Piece Counterflashing:
   1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
   2. Counterflashing upper edge designed to snap lock into receiver.
E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

2.8 HANGING GUTTERS

A. Fabricate gutters of not less than the following:
   1. 0.5 Kg 20 oz.) copper.
   2. 0.6 mm (0.025 inch)thick stainless steel.
   3. 0.8 mm (0.032 inch) thick aluminum.
B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
C. Provide building side of gutter not less than 38 mm (1 1/2 inches) higher than exterior side.
D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately19 mm (3/4 inch) unless shown otherwise.
E. Gutter Spacers:
   1. Fabricate of same material and thickness as gutter.
   2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
   3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
   4. Rivet and solder to gutter except rivet and seal to aluminum.
F. Outlet Tubes:
   1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).

2. Lock and solder longitudinal seam except use sealant instead of solder with aluminum.
3. Solder tube to gutter. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:

1. Fabricate of same metal as gutter. Use the following:
   a. 6 by 25 mm (1/4 by 1 inch) copper.
   b. 3 by 40 mm (1/8 by 1 1/2 inch) stainless steel.
   c. 6 by 25 mm (1/4 by 1 inch) aluminum.
2. Fabricate to gutter profile.
3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.9 CONDUCTORS (DOWNSPOUTS)

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long with 19 mm (3/4 inch) wide flat locked seams.

1. Fabricate open face channel shape with hemmed longitudinal edges.

B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum instead of solder. Lap upper section to the inside, of the lower piece.

C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (1 inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.

2.10 REGLETS

A. Fabricate reglets of one of the following materials:

1. 0.4 Kg (16 ounce) copper.
2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Anchor sheet metal flashing and trim and other components of the work securely in place with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required, to complete flashing and trim assemblies.
4. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
5. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
6. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
7. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.

8. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nails not over 100 mm (4 inches) on center unless specified otherwise.
9. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
10. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
11. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
12. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
13. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
14. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
15. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
16. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
17. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof

cement to column. Lap base flashing with cotton strip 38 mm (1-1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where Concrete is Exposed: Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
   1. Install near line of finish floors over shelf angles or where shown.
   2. Turn up against sheathing.
   3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
   4. At concrete backing, extend flashing into reglet as specified.
   5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel flashing when not part of shelf angle flashing:
   1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
   2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
   3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:
   1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
   2. Turn back edge up to terminate under window frame.
   3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:
   1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.

2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:
1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      1) Locate fasteners in masonry mortar joints.
      2) Use screws to sheet metal or wood.
   b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:

a. Secure to face construction in accordance, with manufacturer's instructions.
b. Completely fill space at the top edge of receiver with sealant.

3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.
B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above can't strip.
C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
   1. Coordinate reglets for anchorage into concrete with formwork construction.
   2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 HANGING GUTTERS

A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.
C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.
   1. For copper or copper clad stainless steel gutters use brass or bronze brackets.
   2. For stainless steel gutters use stainless steel brackets.
   3. For aluminum gutters use aluminum brackets or stainless steel brackets.
   4. Use brass or stainless steel screws.

5. Support downspouts to exterior wall of building at not more than 10’ vertical spacing, or per manufacturer’s instructions, whichever is more stringent.

D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.

E. Gutter Expansion Joint:
   1. Locate expansion joints midway between outlet tubes.
   2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
   3. Install a cover plate over the space at expansion joint.
   4. Fasten cover plates to gutter section on one side of expansion joint only.
   5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.

F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

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SECTION 07 92 22
JOINT SEALANTS – ELECTRICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONNECTORS AND CABLES
C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
D. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

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

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color.

D. Manufacturer's Literature and Data: Sealing compound, each type, including compatibility when different sealants are in contact with each other.

E. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:

a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).

b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 WARRANTY:

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

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.9 APPLICABLE PUBLICATIONS:

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

B. ASTM International (ASTM):

C1193-16.....Standard Guide for Use of Joint Sealants.

C. All Sealants Products used shall be validated by the Sealant, Waterproofing and Restoration Institute (SWRI). Submit such validation as part of Item 1.05 Submittals.

2.1 SEALANTS:

A. Exterior Sealants:

1. Provide location(s) of exterior sealant as follows:

a. Provide sealant at exterior surfaces of exterior wall penetrations.

b. Voids where electrical improvements penetrate exterior walls.

B. Interior Sealants:

1. Provide location(s) of interior sealant as follows:

a. Interior surfaces of exterior wall penetrations.

b. Voids where electrical improvements penetrate interior walls.

2.2 COLOR:

A. Color of sealants to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2.4 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

3.3 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions. Test sealants for compatibility with each other and substrate.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in **ASTM C1193-16 "Standard Guide for Use of Joint Sealants"** unless shown or specified otherwise in construction documents.
8. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
9. Replace sealant which is damaged during construction process.

C. For application of sealants, follow requirements of **ASTM C1193-16 "Standard Guide for Use of Joint Sealants"** unless specified otherwise.

D. Interior Sealants:

1. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.

3.4 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

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SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field and shop painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes shellacs, stains, varnishes, and coatings specified.

1.2 RELATED WORK

A. NA

1.3 SUSTAINABILITY REQUIREMENTS

A. Materials in this section may contribute towards contract compliance with sustainability 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.

1.4 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/conserve/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.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, 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, 150 by 150 (6 inch by 6 inch).
3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.

D. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire retardant paint.
5. Plastic floor coating.

E. Manufacturer’s letter of recommendation:

1. Provide a letter addressed to the National Cemetery Administration from the manufacturer of the paint/coating, detailing their understanding of the substrate to be painted, preparations required before painting, the application, and the national shrine aesthetically-pleasing appearance expected of the finished product.

This letter shall be signed by a "Paint Specialist" or other approved equal or greater qualifications.

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 30 degrees C (65 and 85 degrees F).

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):

ACGIH TLV-BKLT-2009	Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2009	Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. Master Painters Institute (MPI):

No. 4-13	Interior/ Exterior Latex Block Filler
No. 5-13	Exterior Alkyd Wood Primer
No. 7-13	Exterior Oil Wood Primer
No. 8-13	Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
No. 9-13	Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

No. 10-13	Exterior Latex, Flat (AE)
No. 11-13	Exterior Latex, Semi-Gloss (AE)
No. 31-13	Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 36-13	Knot Sealer
No. 43-13	Interior Satin Latex, MPI Gloss Level 4
No. 44-13	Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-13	Interior Primer Sealer
No. 46-13	Interior Enamel Undercoat
No. 47-13	Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-13	Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 50-13	Interior Latex Primer Sealer
No. 51-13	Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-13	Interior Latex, MPI Gloss Level 3 (LE)
No. 53-13	Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-13	Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 60-13	Interior/Exterior Latex Porch & Floor Paint, Low Gloss
No. 68-13	Interior/ Exterior Latex Porch & Floor Paint, Gloss
No. 71-13	Polyurethane, Moisture Cured, Clear, Flat (PV)
No. 90-13	Interior Wood Stain, Semi-Transparent (WS)
No. 94-13	Exterior Alkyd, Semi-Gloss (EO)
No. 95-13	Fast Drying Metal Primer
No. 114-13	Interior Latex, Gloss (LE) and (LG)
No. 119-13	Exterior Latex, High Gloss (acrylic) (AE)
No. 134-13	Primer, Galvanized, Water Based
No. 138-13	Interior High Performance Latex, MPI Gloss Level 2 (LF)
No. 139-13	Interior High Performance Latex, MPI Gloss Level 3 (LL)
No. 140-13	Interior High Performance Latex, MPI Gloss Level 4
No. 141-13	Interior High Performance Latex (SG) MPI Gloss Level 5

D. Steel Structures Painting Council (SSPC):

SSPC SP 1-04	Solvent Cleaning

SSPC SP 2-04 Hand Tool Cleaning

SSPC SP 3-04 Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Sealer: Thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.

B. Plastic Tape:

1. Pigmented vinyl plastic film in colors as specified.
2. Pressure sensitive adhesive back.
3. Widths as shown.

C. Interior/Exterior Latex Block Filler: MPI 4.

D. Exterior Alkyd Wood Primer: MPI 5.

E. Exterior Oil Wood Primer: MPI 7.

F. Exterior Alkyd, Flat (EO): MPI 8.

G. Exterior Alkyd Enamel (EO): MPI 9.

H. Exterior Latex, Flat (AE): MPI 10.

I. Exterior Latex, Semi-Gloss (AE): MPI 11.

J. Polyurethane, Clear Gloss: MPI 31.

K. Knot Sealer: MPI 36.

L. Interior Satin Latex: MPI 43.

M. Interior Low Sheen Latex: MPI 44.

N. Interior Primer Sealer: MPI 45.

O. Interior Enamel Undercoat: MPI 46.

P. Interior Alkyd, Semi-Gloss (AK): MPI 47.

Q. Interior Latex Primer Sealer: MPI 50.

R. Interior Alkyd, Eggshell: MPI 51

S. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

T. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

U. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

V. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.

W. Interior/ Exterior Latex Porch & Floor Paint, gloss: MPI 68.

X. Polyurethane, Moisture Cured, Clear, Flat (PV): MPI 71.

Y. Interior Wood Stain, Semi-Transparent (WS): MPI 90.

Z. Exterior Alkyd, Semi-Gloss (EO): MPI 94.

AA. Fast Drying Metal Primer: MPI 95.

BB. Interior latex, Gloss (LE) and (LG): MPI 114.

CC. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.

DD. Waterborne Galvanized Primer: MPI 134.

EE. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.

FF. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

GG. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.

HH. 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.

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 3 degrees C (5 degrees F) above dew point.
   b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer.
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.
7. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

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

B. General:

1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.

3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with Knot Sealer before applying paint.
   b. Apply two coats of Knot Sealer over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with Wood Filler Paste, colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up

steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.

a. This includes flat head countersunk screws used for permanent anchors.

b. Do not fill screws of item intended for removal such as glazing beads.

4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.

5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).

2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with Organic Zinc Rich Coating. Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) depending on finish coat compatibility.

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

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.

2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.

3. Remove loose mortar in masonry work.

4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar.

5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals.

6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

G. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. All conduit used on this project is to be shop painted prior to delivery to the project site. Limited touch up in the field will be permitted by the VA. 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 RE/COR.

E. Finish surfaces to show solid even color, free from runs, lumps, brush marks, laps, holidays, or other defects.

F. Apply by brush or roller, except as otherwise specified. No spray painting will be permitted at the project location.

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. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
    a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where Interior Wood Stain, Semi-Transparent (WS) is scheduled.
    b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
    c. Transparent finishes as specified under Transparent Finishes on Wood.
2. Apply one coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
3. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.

F. Metals:

1. Steel and Iron: MPI 95 (Fast Drying Metal Primer).
2. Zinc-coated Steel and Iron: MPI 134 (Waterborne Galvanized Primer).
3. Machinery Not Factory Finished: MPI 9 (Exterior Alkyd Enamel (EO)).

G. Gypsum Board or and Hardboard or:

1. Surfaces scheduled to have or MPI 10 (Exterior Latex, Flat (AE))or MPI 11 (Exterior Latex, Semi-Gloss (AE)) or MPI 119 (Exterior Latex, High Gloss (acrylic) (AE)) or MPI 53 (Interior Latex, Flat) or, MPI Gloss Level 1 LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) finish: Use or MPI 10 (Exterior Latex, Flat (AE)) or MPI 11 (Exterior Latex, Semi-Gloss (AE)) or MPI 119 (Exterior Latex, High Gloss (acrylic)(AE)) or MPI 53 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) respectively or.
2. Primer: MPI 50(Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.

H. Gypsum Plaster and Veneer Plaster:
1. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.
2. Surfaces scheduled to have MPI 10 (Exterior Latex, Flat (AE)) or MPI 11 (Exterior Latex, Semi-Gloss (AE)) or MPI 119 (Exterior Latex, High Gloss (acrylic) (AE)) or MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) or finish: Use MPI 10 (Exterior Latex, Flat (AE)) or MPI 11 (Exterior Latex, Semi-Gloss (AE)) or MPI 119 (Exterior Latex, High Gloss (acrylic) (AE)) or MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 LE)) or MPI 52 Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) or respectively.

I. Concrete Masonry Units except glazed or integrally colored and decorative units:
1. MPI 4 (Block Filler) on interior surfaces.

J. Cement Plaster or stucco or Concrete Masonry, Brick Masonry or and Cement board or Interior Surfaces of Ceilings and Walls:
1. or MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex,

Gloss (LE) and (LG)) or except use two coats where substrate has aged less than six months.

3.6 EXTERIOR FINISHES

A. Apply following finish coats where specified.

B. Steel and Ferrous Metal, or Including Tern or:

1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) or MPI 9 (Exterior Alkyd Enamel (EO)) or MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

C. Machinery without factory finish except for primer: One coat MPI 8 (Exterior Alkyd, Flat (EO)) or MPI 9 (Exterior Alkyd Enamel (EO)) or MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) or.

3.7 INTERIOR FINISHES

A. Apply following finish coats over prime coats in spaces or on surfaces specified.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
   a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
   b. Two coats of or MPI 48 (Interior Alkyd Gloss (AK)) or MPI 51 (Interior Alkyd, Eggshell (AK)).
   c. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).

C. Gypsum Board:

1. One coat of or MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) or plus one coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).
2. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF)).
3. One coat of or MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) or plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).
4. One coat of or MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) or plus one coat of MPI 48 (Interior Alkyd Gloss (AK)).

D. Plaster:
   1. One coat of MPI 50 (Interior Latex Primer Sealer).
   2. Two coats of MPI 51 (Interior Alkyd, Eggshell) (AK).
   3. One coat of MPI 50 (Interior Latex Primer Sealer).

E. Masonry and Concrete Walls:
   1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
   2. Two coats of or MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) or.

F. Wood:
   1. Sanding:
      a. Use 220-grit sandpaper.
      b. Sand sealers and varnish between coats.
      c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
   2. Sealers:
      a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
      b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
      c. Sand as specified.
   3. Paint Finish:
      a. One coat of or MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) or plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).
      b. One coat of MPI 45 Interior Primer Sealer.
      c. Two coats of MPI 51 (Interior Alkyd, Eggshell) (AK)).
   4. Transparent Finishes on Wood Except Floors.
      a. Natural Finish:
         1) One coat of sealer as written in 2.1 E.
         2) Two coats of or MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV)or Polyurethane, Moisture Cured, Clear Gloss (PV) or MPI 31 Polyurethane, Moisture Cured, Clear Gloss (PV)or.
      b. Stain Finish:

1) One coat of MPI 90 Interior Wood Stain, Semi-Transparent (WS).
2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
3) One coat of sealer as written in 2.1 E.
4) Two coats of or MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV)or MPI 31 Polyurethane Moisture Cured, Clear Gloss (PV)or.

c. Varnish Finish:
1) One coat of sealer as written in 2.1 E.
2) Two coats of or MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV) or MPI 31 Polyurethane Moisture Cured, Clear Gloss (PV)or.

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 or Polyurethane, Moisture Cured, Clear Gloss or Polyurethane, Moisture Cured, Clear Flat (PV) or.
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 by COR.

B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 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.

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APPENDIX

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections. 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 Paint	FR
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

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SECTION 23 10 10
FACILITY FUEL CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies demolition, removal, and replacement of the existing Above Ground Fuel Storage Tanks sensors, conduits, and alarm panel located at the Annex Cemetery Maintenance Yard located at Culpeper National Cemetery.

B. This section also includes providing related services and products for a complete control and alarm system for fuel level and leak detection. Work to include submittals, furnishing, installation, and connection of control wiring, emergency Shut-off Switch, and power supply. Refer to related Work and Contract Drawings for additional information.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATION.

D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

E. SECTION 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

F. SECTION 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

H. Section 31 20 12, EARTHWORK (UTILITY TRENCHING).

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. Where conflicts occur these specifications and the VHA standard will govern.

B. National Electrical Manufacturers Association (NEMA):

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

C. National Fire Protection Association (NFPA):

30-2015.....Flammable and Combustible Liquids Code

31-2016.....Standard for the Installation of Oil-Burning Equipment

70-2014.....National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 10 00, FACILITY FUEL CONTROL SYSTEMS", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Leak Detection System:
   1. Drawings, description and performance data on sensors, control units.
   2. Description of operation.
   3. Layout of system.
   4. Installation and operating instructions.
   5. Data on interconnecting wiring systems to be furnished.

E. Tank Fluid Level Monitoring Instrumentation System:
   1. Drawings showing instruments and in-tank sensing units, with dimensions.
   2. Design and construction of all elements of system.
   3. Installation instructions.

F. Tank and Piping Accessories:
   1. Design, construction, and dimensions of vent caps, fill boxes, fill caps, spill containers and other accessories.

G. Fuel Pumps & Meter System:
   1. Drawings and description of all products and components of the system.
   2. Design and performance of pumps, meter, nozzle, hose, and filters.
   3. Catalog data and operation of Fuel Pump & Meter system.
   4. Operation and Installation instructions.

H. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.

3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

I. Completed System Readiness Checklist provided by the Panel Manufacturer and completed by the Contractor, signed by a qualified Manufacturer Representative and dated on the date of completion.

1.5 QUALITY ASSURANCE

A. Approval by Contracting Officer Representative (COR) is required of products or services of proposed manufacturers, suppliers and installers, and will be based on Contractor's certification that:
   1. Manufacturers regularly and currently manufacture tank fluid level monitoring and leak detection systems, and fuel quality management systems.
   2. The design and selection of each item of equipment provided for this project is of current production and has been in satisfactory operation on at least ten installations for approximately two years.
   3. Current models of fluid level and leak detection systems with less than two years' service experience are acceptable if similar previous models from the same manufacturer have at least three years' service experience.

B. Apply and install materials, equipment and specialties in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the COR for resolution. Provide copies of installation instructions to the COR two weeks prior to commencing installation of any item.

C. All equipment shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components or overall assembly.

D. Entire installation shall conform to requirements of local and state pollution control authorities.

E. Label of Conformance (definition): Labels of accredited testing laboratories showing conformance to the standards specified.

F. 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 safe, complete and fully operational system which conforms to contract requirements and in which no item is subject to conditions beyond its design capabilities.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD inserted into a three-ring binder.

C. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual.

D. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished.

E. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

F. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing.

G. As-built drawings are to be provided, with a copy of them on AutoCAD version 2015 or later provided on CD. The CAD drawings shall use multiple line layers as needed.

H. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc.

I. Certification documentation shall be provided to COR at least ten (10) working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation / certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 UNDERGROUND STEEL TANKS (NOT PART OF THIS CONTRACT)

2.2 ABOVEGROUND STEEL TANKS (NOT PART OF THIS CONTRACT)

2.3 ABOVEGROUND CONCRETE-INSULATED STEEL VAULT TANKS (NOT PART OF THIS CONTRACT)

2.4 UNDERGROUND FIBERGLASS REINFORCED PLASTIC TANKS (NOT PART OF THIS CONTRACT)

2.5 SOIL SEPARATOR MAT (NOT PART OF THIS CONTRACT)

2.6 TANK AND PIPING ACCESSORIES (NOT PART OF THIS CONTRACT)

2.7 PIPING, VALVES, FITTINGS (NOT PART OF THIS CONTRACT)

2.8 SECONDARY CONTAINMENT FOR UNDERGROUND FUEL PIPING SYSTEMS (NOT PART OF THIS CONTRACT)

2.9 LEAK DETECTION SYSTEMS

A. Automatic continuous monitoring systems responsive to the presence of water and hydrocarbons in the interstitial space of the double-wall tanks. System shall distinguish the location of leak as to individual tank.

B. There are two tanks that need Leak Detection. One Tank is a 250-gallon waste oil tank and the second is a twin 500-gallon fuel tank with Diesel on one side and gasoline on the other half.

C. Detection System Functions and Arrangement:

1. Single control station to monitor all sensing probes.
2. Visual indicator to monitor and identify leaks as water or hydrocarbon and location.
3. Indicators showing system status including faults and alarms.
4. Panel circuit test button.
5. 95 dB audible alarm with silencing control to sound when leak is detected.
6. NEMA 250 Type 3R cabinet. Alarm Panel cabinet shall be located in the same location of the existing alarm panel once the old panel has been removed.
7. Panel shall be UL listed.

D. Leak Detection Sensors:

1. Compatible with the existing tanks and designed for required locations for insertion between walls of double-wall tanks. Sensing points shall be at lowest point of each tank or sump. Intrinsically safe design.

2. The Sensor shall be stainless steel float-actuated sensor capable of detecting the presence of liquid in containment areas. Teflon® coated wires in Teflon® coated jacket Fuel compatible Nitrophyl float or COR "Approved Equal".
3. Sensors shall be arranged to allow replacement of individual sensors without disturbing other portions of leak detection system or fuel storage and piping system. Underground sensors shall be accessed through caps in the existing tanks.
4. Normally Closed, Approved Use Locations for UL/ULC Class I, Division 1, Group D.
5. Transmit status signal to control unit. Electric Switch Ratings 5-watt resistive load, 100VAC-250mA max.
6. Underground wiring between probes and control unit: Place in water-tight corrosion-resistant conduit system conforming to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

2.10 TANK FLUID LEVEL MONITOR AND ALARM SYSTEMS

A. Automatic continuous monitoring systems for central monitoring of fuel and water levels in all fuel oil storage tanks in the project. High and low level visual and audible alarms. Complete with all transducing, transmitting, and receiving devices.

B. There are three locations that need Fluid Level Monitoring. One location is at the 250-gallon waste oil tank and the second and third location are at the twin 500-gallon fuel tank with Fluid Level monitoring at the Diesel tank and Fluid Level monitoring on the Gasoline tank.

C. High and Low Fluid Level Alarm System:
   1. Automatic continuous on-line monitoring of all tanks.
   2. Visual and audible indicators combined with fluid level monitor. Identify the tank that is in alarm condition.
   3. Manual alarm test and silencing controls.
   4. Low level alarm actuation adjustable 0-25 percent of tank capacity. High level alarm actuation adjustable 75-100 percent of tank capacity.

D. Locate all indicators, selector switches, alarms on face of common wall-mounted NEMA 250, Type 3R panel used for Leak Detection.

E. Alarm Panel shall be located in the same location of the existing alarm panel once the old panel has been removed.

F. Multi-Level Sensors:
   1. Float-activated simple switch device capable of sensing liquid levels from 1 to 3 specified set points. Intrinsically safe design.
   2. Sensing points shall be set at the 10% (LOW LEVEL) and 90% (HIGH LEVEL) tank capacity. Provide 2” to 4” stem height adjustability (downward) to assist in desired set point alignment.
   3. Sensors shall be arranged to allow replacement of individual sensors without disturbing other portions of leak detection system or fuel storage and piping system. Underground sensors shall be accessed through caps in the existing tanks.
   4. Wires shall be Teflon® jacketed wires. Stem, bushing, and Floats shall be 316 stainless steel or COR “Approved Equal”.
   5. Normally Closed, Approved Use Locations for UL/ULC Class I, Division 1, Group D.
   6. Transmit status signal to control unit. Electric Switch Ratings 100-watt resistive load, 300VAC - 700mA max.
   7. Underground Wiring and Piping: Enclose in water-tight corrosion-resistant conduit system sized and arranged as recommended by system manufacturer and conforming to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

2.11 CLOCK GAUGE WITH OVERFILL ALARM BOX

A. Provide one Clock Gauge with Overfill Alarm on each Fuel Tank (Diesel & Gas). The Audible “high-level” Alarm Box shall be manufactured by the same manufacturer as the Clock Gauge.
B. The Clock Gauge Alarm Box shall be located adjacent to tank fill box locations. Alarm Box shall be NEMA 250 Type 4X weatherproof that is corrosion resistant and water resistant intrinsically safe for Class I, Division 1 and 2, Group D hazardous location.
C. Clock Gauge body shall be Teflon® coated aluminum with stainless steel cable and float. Gauge readout in feet and inches: Hour hand (short hand) = feet and Minute hand (long hand) = inches.
D. Clock Gauge shall be a minimum six-inch diameter glass face vapor tight and fog-free, easy to read and accurate to 1/4 of an inch.
E. Clock Gauge float shall fit through a 2-inch pipe opening and be compatible with the existing Above Ground Fuel Storage Tanks.
F. Clock Gauge Alarm Box shall include sign: "WHEN ALARM SOUNDS - FUEL TANK FILLED TO CAPACITY - DO NOT OVERFILL".

G. Clock Gauge Alarm Box shall be AC powered console design and have both audible and visual indicators and can accommodate at least two Clock Gauge sensors. One sensor for the Diesel Tank and one for the Gasoline Tank.
H. Alarm Box Audible alarm shall be heard at least 20 feet away.

2.12 TANK MOUNTED FUEL PUMP, METER, & DISPENSING SYSTEM (115-VOLT AC)

A. Provide and install Tank Mounted Combination Fuel Pump with Meter System for Diesel Tank and one for Gasoline Tank. Submit all product information and Warranties to COR as part of Submittal Requirements.
B. Combination Fuel Pump with Meter shall be powered by 115-volt AC power. Each Combination Fuel Pump with Meter shall have separate breaker and electrical wire. KEEP FUEL PUMP CONDUIT FREE FROM TANK SENSOR WIRES.
C. Fuel Pump shall have corrosion resistant housing, valves, and fittings. Pumping rate of Fuel Pump shall be a minimum of 20 gallons per minute.
D. Fuel Pump Motor shall be UL Listed, thermally protected, with minimum two (2) year Warranty.
E. Each Fuel Pump and Meter System shall have minimum 3/4 - inch Dispensing Hose. Total Length of Hose shall be eighteen (18) feet and made of heavy duty non-collapsible hardwall Nitrile High-Tensil Wire Braid with BLACK abrasion oil and weather resistant cover.
F. Fuel Nozzle shall be Automatic with Automatic Shut-OFF, "Heavy Duty", vacuum breaker ready with lockable non-corrosive Nozzle Holder.
G. Color of Diesel and Gas Nozzle shall be different and will be finalized during the Submittal process.
H. Fuel Pump Meter shall be "Easy to Read" four-digit display in Gallons. Meter shall be accurate within plus or minus half of one percent (00.5%)at a flow range of 2 to 20 gallons per minute.
I. Fuel Pump Meter shall be mechanical and resettable with a separate master six-digit totalizer. Meter housing shall be corrosive resistant and weather resistant with a minimum five (5)- year WARRANTY on performance.

2.13 EMERGENCY FUEL SHUT-OFF SWITCH (115-VOLT AC)

A. Provide and install one (1) Emergency Fuel Shut-Off Switch to control 115-volt AC power to the two (2) proposed Tank Mounted Combination Fuel Pump with Meter System for Diesel Tank and Gasoline Tank.
B. Provide Shut-Off Switch with large heavy duty mushroom operator with pull to reset. Submit all product information and Warranties to COR as part of Submittal Requirements prior to order or installation.

C. Emergency Fuel Shut-OFF Switch shall be push button type with weather resistant cover and housing. The Shut-Off Switch shall be mounted on the exterior of the Maintenance Garage on the northeast corner in a final location to be determined by the COR and Cemetery Director.

D. Emergency Fuel Shut-Off Switch shall be wall mounted non-metallic NEMA 4X enclosure with stainless steel screws and fittings. Enclosure shall allow up to four contact blocks.

E. The Emergency Fuel Shut-Off Switch shall be UL Listed, color yellow with the text "EMERGENCY FUEL SHUT-OFF" clearly visible on the enclosure.

F. Related work includes all interior and exterior conduit work from the Electrical Panel to the Emergency Fuel Shut-Off Switch and then to the proposed Fuel Pumps located on the existing 1000-gallons combo fuel tank.

G. Related work includes saw cutting of pavement and concrete, installation of conduit and restoration of pavement and concrete. See Section 1.2 RELATED SECTIONS.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to installation the Contractor shall provide a schematic drawing of the complete layout of the Facility Fuel Control System to the COR as part of the Submittal Requirements.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 INSTALLATION AND TESTING, ABOVEGROUND TANKS (NOT PART OF THIS CONTRACT)

3.3 INSTALLATION AND TESTING, UNDERGROUND PIPING SYSTEMS (NOT PART OF THIS CONTRACT)

3.4 INSTALLATION AND TESTING, LEAK DETECTOR SYSTEMS FOR TANKS

A. Wiring shall conform to NFPA 70.

B. Locate Tank Sensor Alarm Panel in same location as the existing Alarm Panel upon removal and disposal of the existing Alarm Panel located in the Maintenance Garage.

C. Test operation of each probe, and monitoring system with fuel and water. If type of probe utilized is damaged by exposure to fuel, provide temporary probe for testing monitoring system.

3.5 INSTALLATION, TANK FLUID LEVEL INDICATOR AND ALARM SYSTEM

A. Wiring shall conform to NFPA 70.

B. Locate Tank Sensor Alarm Panel in same location as the existing Alarm Panel upon removal and disposal of the existing Alarm Panel located in the Maintenance Garage.

C. Test operation of each probe, and monitoring system with fuel and water. If type of probe utilized is damaged by exposure to fuel, provide temporary probe for testing monitoring system.

3.6 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements.

B. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

C. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

D. The COR will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.

3.7 DEMONSTRATION, TRAINING, & MANUFACTURE CERTIFICATION

A. Provide services of manufacturer’s technical representative for a minimum of two (2) hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit Operating & Maintenance Manual of all Products listed in this Technical Specification to COR as part of Submittals.

C. Provide COR with letter from Manufacturer that Products were installed in compliance with the Manufacturer’s requirements.

D. Work under this Technical Specification will not be considered complete unless all Demonstrations, Training, and Manufacture Certifications have been provided to the COR.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, applies to all sections of Division 26.

B. Furnish and install electrical systems and accessories in accordance with the specifications and drawings.

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.

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 COTR/Resident Engineer 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 00 00 72, GENERAL CONDITIONS and Section 01 33 23, 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 COTR/Resident Engineer, 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 COTR/Resident Engineer. 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. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 02, GENERAL REQUIREMENTS.
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 01 00 02, GENERAL REQUIREMENTS.
F. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 00 72 00, GENERAL CONDITIONS.

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 6 mm (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 01 33 23, 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.

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

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient calculations, cut-sheets, and related information to demonstrate compliance with Drawings and Specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.

2. Certifications: One week prior to final inspection, the Contractor shall submit the following Certifications.
   a. Certification by a license Electrician in the state of where the work was performed stating that the conductors and cables conform to the requirements of the Drawings, Specifications, and Local and State Electrical Code Requirements.
   b. Certification by the Contractor that the conductors and cables have 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 reference in the text by designation only.

B. American Society of Testing Material **(ASTM)**:

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association **(NEMA)**:

WC 70-09.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association **(NFPA)**:

70-17.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. **(UL)**:

44-14.....Thermoset-Insulated Wires and Cables

83-14.....Thermoplastic-Insulated Wires and Cables

467-13.....Grounding and Bonding Equipment

486A-486B-13.....Wire Connectors

486C-13.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the Drawings.

B. All conductors shall be copper.

C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, when supported by calculations.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Direct Burial Cable: Contractor shall use UF (Underground Feeder) cable for all underground installation where a conduit is not provided.

E. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

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

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

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

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped conductors.
   3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
   1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.
   4. All bolts, nuts, and washers used with splices shall be hot dipped galvanized when exposed to the weather and zinc-plated when protected from the weather.

D. Above Ground Splices for 250 kcmil (MCM) and Larger:
   1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.

E. Underground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped conductors.

3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

F. Underground Splices for No. 8 AWG and Larger:
1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be hot dipped galvanized when exposed to the weather and zinc-plated when protected from the weather.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

2.6 FIRE STOPPING SYSTEM

A. Firestopping system or devices used for penetrations by wire insulation, plastic pipe conduits, cables, or other non-metallic materials shall be suitable for use with the type of penetrating material.

B. Firestopping systems shall allow unrestricted cable changes without damage to the seal.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Install all conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor and Cable Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. No more than three branch circuits shall be installed in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

B. Fireproofing:

1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.
2. Use fireproofing tape as specified in Section 26 05 13, MEDIUM-VOLTAGE CABLES, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer’s published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

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

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pull box and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their

circuit identification and voltage. The tags shall be the embossed type, 1-1/2 inches in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

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

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the Drawings.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.9 DIRECT BURIAL CABLE INSTALLATION

A. Tops of the cables:

1. Below the finished grade: Minimum (24 inches) unless greater depth is required by Local / State Code.
2. Below road and other pavement surfaces: In conduit as specified, minimum 30 inches unless greater depth is required by Local / State Code.
3. Do not install cables under railroad tracks.

B. Under road and paved surfaces:

1. When depth of cover over top of conduit is 24 inches or less: Install cables in concrete-encased galvanized steel rigid conduits. Size shall be minimum 2-inch ID with bushings at each end of each conduit run.
2. When depth of cover over the top of the conduit is greater than 24 inches: Install minimum 3-inch PVC Schedule 40 conduit that extends a minimum of 5 feet beyond the edge of pavement or gravel shoulder.

3. Provide a Fiberglass Splice / Pull Box, meeting the specifications of Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS, at each end of the galvanized steel rigid or PVC Schedule 40 conduit.
4. Provide size of conduit required to accommodate cables plus one spare.

C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.

D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
1. Place minimum of 3-inches of bedding sand in the trenches before installing the conduit or UF cable.
2. Place minimum of 3-inches of shading sand over the installed conduit or UF cable.

E. Provide horizontal slack in the cables for cold weather contraction.

F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted without the use of a Splice / Pull Box.

G. Connections and terminations shall be listed submersible-type designed for the cables being installed.

H. Warning tape shall be continuously placed 12 inches above the buried cables.

3.10 ACCEPTANCE CHECKS AND TESTS

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

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Item 1.12 SUBMITTALS provided for in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following additional requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with Drawings and Specifications.
   b. Submit for approval plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports: One week prior to the final inspection, submit ground resistance field test reports prepared by a licensed professional to the COR.

3. Certifications: Contractor shall submit a Certification document stating that the grounding equipment has been properly installed 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. American Society for Testing and Materials **(ASTM):**

B1-13.....Standard Specification for Hard-Drawn Copper Wire

B3-13.....Standard Specification for Soft or Annealed Copper Wire

B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. **(IEEE):**

81-12.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association **(NFPA):**

70-17.....National Electrical Code (NEC)

70E-15.....National Electrical Safety Code

99-15.....Health Care Facilities

E. Underwriters Laboratories, Inc. **(UL):**

44-14 .....Thermoset-Insulated Wires and Cables

83-14 .....Thermoplastic-Insulated Wires and Cables

467-13 .....Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall

be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

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

2.2 GROUND RODS

A. Stainless steel, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.

B. Quantity of rods shall be as shown on the Drawings, and as required to obtain the specified ground resistance.

2.3 CONCRETE ENCASED ELECTRODE

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

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes, smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use hot dipped galvanized bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with hot dipped galvanized bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with hot dipped galvanized bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

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. Ground bars shall have

minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required by Code or as shown on the Drawings.

B. Provide insulators and mounting brackets.

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 mechanical type lugs, with hot dipped galvanized bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the Drawings or per Code, with hole size, quantity, and spacing per detail shown on the Drawings or by Code. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

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

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS (WHEN SHOWN ON DRAWINGS)

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

B. Duct Banks and Manholes: When shown on Drawings provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.

C. Pad-Mounted Transformers:

1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
2. Ground the secondary neutral.

D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS (WHEN SHOWN ON DRAWINGS)

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
2. 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.

3.5 RACEWAY

A. Conduit Systems:

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

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:

1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

A. Fences shall be grounded as shown on the Drawings.

B. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post.

C. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence.

D. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375 inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.7 CORROSION INHIBITORS

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

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.10 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the Drawings.

B. Connect to pigtail extensions of the building grounding ring, as shown on the Drawings.

3.11 EXTERIOR LIGHT POLES

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

3.12 GROUND RESISTANCE

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

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.13 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal

joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.14 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the COR prior to backfilling. The Contractor shall notify the COR 48 hours before the connections are ready for inspection.

---END---

SECTION 26 05 33
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 the raceway types specified.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION

E. Section 31 20 12, EARTHWORK (Utility Trenching)

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

A. Submit four (4) copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. Size and location of main feeders.
   b. Size and location of panels and pull-boxes.
   c. Layout of required conduit penetrations through structural elements.
   d. Submit the following data for approval:
      1) Raceway types and sizes.
      2) Conduit bodies, connectors and fittings.
      3) Junction and pull boxes, types and sizes.
2. Certifications: One week prior to final inspection, submit the following:

a. Certification by the licensed Electrician or Electrical Engineer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.
b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

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. American National Standards Institute **(ANSI):**

C80.1-05.....Electrical Rigid Steel Conduit
C80.3-05.....Steel Electrical Metal Tubing
C80.6-05.....Electrical Intermediate Metal Conduit
ANSI/SCTE 77-14.....Underground Enclosure Integrity

C. National Fire Protection Association **(NFPA):**

70-11.....National Electrical Code **(NEC)**

D. Underwriters Laboratories, Inc. **(UL):**

1-05.....Flexible Metal Conduit
5-11.....Surface Metal Raceway and Fittings
6-07.....Electrical Rigid Metal Conduit - Steel
50-15.....Enclosures for Electrical Equipment
360-13.....Liquid-Tight Flexible Steel Conduit
467-13.....Grounding and Bonding Equipment
514A-13.....Metallic Outlet Boxes
514B-12.....Conduit, Tubing, and Cable Fittings
514C-07.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07.....Electrical Metallic Tubing
1242-06.....Electrical Intermediate Metal Conduit – Steel

E. National Electrical Manufacturers Association **(NEMA)**:

TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-13.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-12.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-13.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-12.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. American Iron and Steel Institute **(AISI)**:

S100-2007.....North American Specification for the Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit Material:

1. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.
2. Rigid Aluminum: Shall conform to UL 6A and ANSI C80.5.
3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
5. Flexible Metal 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 Intermediate Metallic Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, 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, conduit bodies, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4% 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 and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.

c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats for outdoor installation. Setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding can be used in dry and dust free environments.

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 Metal 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 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: Fittings shall meet the requirements of UL 514C and NEMA TC3.
7. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
   1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.
   2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
   3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
   4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet and Junction Boxes:
   1. UL-50 and UL-514A.
   2. Rustproof cast metal where required by the NEC or shown on drawings.
   3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Pull Boxes and Enclosures:
   1. UL-50, UL-50E, NEMA 250, ANSI/SCTE 77.
   2. Indoor Enclosures shall be NEMA Type 12 or NEMA Type 13.
   3. Outdoor Enclosures installed above grade shall be NEMA Type 4.
   4. Outdoor Enclosures installed at grade shall be NEMA Type 4X.
   5. Size for Enclosure installed at or below grade shall have a minimal nominal dimension of 12” L x 12” W x 12” H.
   6. Outdoor Enclosures subject to occasional non-deliberate heavy vehicular traffic shall be Tier 15 (15,000 lbs. vertical load).
   7. Outdoor Enclosures subject to deliberate vehicular traffic applications shall be AASHTO H-20 rated.
   8. All other Outdoor Enclosures not subject to vehicular traffic shall be Tier 5 (5,000 lbs. vertical load).
   9. All outdoor Enclosure hardware shall be Stainless Steel Type 316.

G. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: 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.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight.

3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:
1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut conduits square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.

9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel 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.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
14. Do not use aluminum conduits in wet locations.

D. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors Above 600 V: Rigid steel or rigid aluminum. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.
6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors Above 600 V: Rigid steel or rigid aluminum. Mixing different types of conduits in the system is prohibited.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits in the system is prohibited.

D. Align and run conduit parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

G. Surface Metal Raceways: Use only where shown on Drawings.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

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

3.7 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless as shown on drawings.

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. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or re-tape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.8 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. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.9 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings as shown or Drawings or as required by Local / State Code.

3.10 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs.). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. 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 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
      b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
      c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pull boxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the 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.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams when shown on Drawings; for example, "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast manholes and pull boxes to form a complete underground electrical raceway system.

B. The terms "duct" and "conduit" are used interchangeably in this section.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONNECTORS AND CABLES

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

E. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

F. Section 31 20 12, EARTHWORK (UTILITY TRENCHING).

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts, manholes, and pull boxes with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit in accordance with SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

a. Submit sufficient information to demonstrate compliance with drawings and specifications.

b. Submit information on manholes, pull boxes, ducts, and hardware. Submit manhole plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories.

c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes, pull boxes, or duct banks at locations other than shown on the Drawings, show

the proposed locations accurately on scaled site Drawings, and submit to the COR for approval prior to construction.

2. Certifications: One week prior to the final inspection, submit the following.
   a. Certification by the licensed Electrician or Electrical Engineer that the materials conform to the requirements of the Drawings and Specifications.
   b. Certification by the Contractor that the materials have been properly installed, connected, 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. American Concrete Institute **(ACI):**

Building Code Requirements for Structural Concrete

318-14/318M-14.....Building Code Requirements for Structural Concrete & Commentary

SP-66-04.....ACI Detailing Manual

C. American National Standards Institute **(ANSI):**

77-14.....Underground Enclosure Integrity

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

C478 REV A-15.....Standard Specification for Precast Reinforced Concrete Manhole Sections

C858-10.....Underground Precast Concrete Utility Structures

C990-09.....Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association **(NEMA):**

TC 2-13.....Electrical Polyvinyl Chloride (PVC) Conduit

TC 3-15.....Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

TC 6 & 8-13.....Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations

TC 9-04.....Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association **(NFPA):**

70-17.....National Electrical Code (NEC)

70E-15.....National Electrical Safety Code

G. Underwriters Laboratories, Inc. **(UL):**

6-07.....Electrical Rigid Metal Conduit-Steel

467-13.....Grounding and Bonding Equipment

651-11.....Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

651A-11.....Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE MANHOLES AND HARDWARE

A. Structure: Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole.

B. Cable Supports:

1. Cable stanchions shall be hot-rolled, heavy duty, hot-dipped galvanized "T" section steel, 56 mm (2.25 inches) x 6 mm (0.25 inch) in size, and punched with 14 holes on 38 mm (1.5 inches) centers for attaching cable arms.
2. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot-dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.
3. Insulators for cable supports shall be porcelain, and shall be saddle type or type that completely encircles the cable.
4. Equip each cable stanchion with one spare cable arm, with three spare insulators for future use.

C. Ladder: Fiberglass with 400 mm (16 inches) rung spacing. Provide securely-mounted ladder for every manhole over 1.2 M (4 feet) deep.

D. Ground Rod Sleeve: Provide a 75 mm (3 inches) PVC sleeve in manhole floors so that a driven ground rod may be installed.

E. Sump: Provide 305 mm x 305 mm (12 inches x 12 inches) covered sump frame and grated cover.

2.2 PULL BOXES

A. General: Size as indicated on the Drawings or as required an approved by Shop Drawing submission. Provide pull boxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pull box

material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Provide pulling irons, 22 mm (0.875 inch) diameter galvanized steel bar with exposed triangular-shaped opening. Other general requirements include:

1. UL-50, UL-50E, NEMA 250, ANSI/SCTE 77.
2. Indoor Enclosures shall be NEMA Type 12 or NEMA Type 13.
3. Outdoor Enclosures installed above grade shall be NEMA Type 4.
4. Outdoor Enclosures installed at grade shall be NEMA Type 4X.
5. Size for Enclosure installed at or below grade shall have a minimal nominal dimension of 12” L x 12” W x 12” H.
6. Outdoor Enclosures subject to occasional non-deliberate heavy vehicular traffic shall be Tier 15 (15,000 lbs. vertical load).
7. Outdoor Enclosures subject to deliberate vehicular traffic applications shall be AASHTO H-20 rated.
8. All other Outdoor Enclosures not subject to vehicular traffic shall be Tier 5 (5,000 lbs. vertical load).
9. All outdoor Enclosure hardware shall be Stainless Steel Type 316.

B. Polymer Concrete Pull boxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both.

C. Fiberglass Pull boxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Concrete Pull boxes: Shall be monolithically reinforced concrete.

2.3 DUCTS

A. Number and sizes shall be as shown on the Drawings.

B. Ducts (concrete-encased):
   1. Plastic Duct:
      a. Provide NEMA TC6 & 8 and TC9 plastic utilities duct or UL 651 and 651A Schedule 40 PVC conduit.
      b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.
   2. Conduit Spacers: Prefabricated plastic.

C. Ducts (direct-burial):
   1. Plastic duct:
      a. Provide NEMA TC2 and TC3 or UL 651, 651A, and 651B, Schedule 40 PVC or HDPE conduit Schedule 80 PVC or HDPE conduit.
      b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.

2. Rigid metal conduit: UL 6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape.

2.4 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.5 WARNING TAPE

A. 4-mil polyethylene 75 mm (3 inches) wide detectable tape, red with black letters, imprinted with **"CAUTION - BURIED ELECTRIC CABLE BELOW"** or similar shall be provided continuously throughout the trench.

2.6 PULL ROPE FOR SPARE DUCTS

A. Plastic with 200-pound minimum tensile strength.

PART 3 - EXECUTION

3.1 MANHOLE AND PULLBOX INSTALLATION

A. Assembly and installation shall be per the requirements of the manufacturer and Local / State Codes.
   1. Install manholes and pullboxes level and plumb.
   2. Units shall be installed on a 300 mm (12 inches) thick level bed of 90% compacted granular fill, well-graded from the 25 mm (1 inch) sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.

B. Access: Ensure the top of frames and covers are flush with finished grade.

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

D. Manhole Lighting: When shown on Drawings or as outlined in Section 01 00 02 General Requirements the Contractor shall provide a NEMA 3R lighting switch mounted no more than 600 mm (2 feet) from top of ladder and a 27 W compact fluorescent wet location light fixture in manhole. Provide dedicated 20 mm (0.75 inch) direct-buried conduit and conductors to nearest electrical panelboard.

E. Sump Pump: When shown on Drawings or as outlined in Section 01 00 02 General Requirements the Contractor shall provide a 120V cord and plug connected sump pump complete with float switch, thermal overload protection, and GFCI receptacle mounted in NEMA 4X enclosure in the manhole. Provide dedicated one-inch minimum direct-buried conduit and conductors to nearest electrical panelboard.

3.2 TRENCHING

A. Refer to Section 31 20 11 EARTH MOVING (SHORT FORM) for trenching, backfilling, and compaction.

B. Before performing trenching work at existing facilities, a Ground Penetrating Radar Survey shall be carefully performed by a certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems. The cost of such GPR Survey shall be included in the Lump Sum Contract Price submitted by the Contractor.

C. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.

D. Cut the trenches neatly and uniformly.

E. For Concrete-Encased Ducts:

1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 1.2 M (4 feet) intervals to establish the grade and route of the duct bank.
2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
3. The walls of the trench may be used to form the side walls of the duct bank, if the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the COR.

3.3 DUCT INSTALLATION

A. General Requirements:

1. Ducts shall be in accordance with the NEC, as shown on the Drawings, and as Specified.
2. Join and terminate ducts with fittings recommended by the manufacturer.
3. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inches) in 30 M (100 feet).
4. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) outside the building foundation. Tops of conduits below building slab shall be minimum 610 mm (24 inches) below bottom of slab.
5. Stub-ups and sweeps to equipment mounted on outdoor concrete slabs shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) away from the edge of slab.
6. Install insulated grounding bushings on the conduit terminations.
7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 1.5 M (5 feet). Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, chilled water.
10. Clearances between individual ducts:
    a. For similar services, not less than 75 mm (3 inches).
    b. For power and signal services, not less than 150 mm (6 inches).

11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
15. Duct Identification: Place continuous strip of warning tape approximately 12-inches above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Concrete-Encased Ducts:
   1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
   2. Duct banks shall be single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
   3. Tops of concrete-encased ducts shall be:
      a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
      b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
      c. Additional burial depth shall be required to accomplish NEC-required minimum bend radius of ducts.
      d. Conduits crossing under grade slab construction joints shall be installed a minimum of 1.2 M (4 feet) below slab.
   4. Extend the concrete envelope encasing the ducts not less than 75 mm (3 inches) beyond the outside walls of the outer ducts.
   5. Within 3 M (10 feet} of building and manhole wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.

6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75 inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by the COR.

C. Direct-Burial Ducts:
1. Install direct-burial ducts only where shown on the Drawings. Provide direct-burial ducts only for low-voltage power and lighting branch circuits.
2. Tops of ducts shall be:
   a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
   b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
   c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
3. Do not kink the ducts. Compaction shall not deform the ducts.

D. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 300 mm (12 inches) in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

E. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the

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

F. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

G. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the COR.
4. Mandrel pulls shall be witnessed by the COR.

---END---

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies demolition and removal of existing light fixtures, furnishing, installation, and connection of exterior luminaries, controls, poles, anchor base supports, electrical conduits, and related lighting pole items as part of Project "A".

B. The FY2018 M&R work required for Project "D" includes the replacement of seven (7) Building wall mounted exterior security lights with LED light fixture technology at the Maintenance Garage located at the "Annex" Cemetery site. The work includes all electrical improvements, submittals, labor, materials, and equipment for a complete project.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Section 26 05 19, LOW-VOLTAGE ELECTRIC POWER CONDUCTORS AND CABLES.

C. SECTION 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

1.3 SUBMITTALS

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

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, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaries, lamps and controls and Product Warranties.

C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the COR. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement parts.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:
   1. Certification that the materials are in accordance with the drawings and specifications.
   2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

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.

A. Aluminum Association Inc. (AA):

AAH35.1-2006 .....Alloy and Temper Designation Systems for Aluminum

B. American Association of State Highway and Transportation Officials (AASHTO):

LTS-4-2006.....Structural Supports for Highway Signs, Luminaries and Traffic Signals

C. American Concrete Institute (ACI):

318-2008 .....Building Code Requirements for Structural Concrete

D. American National Standards Institute (ANSI):

ANSI C136.20.....American National Standard for Roadway and Area Lighting—Fiber-Reinforced Composite (FRC) Lighting Poles.

ANSI C136.16-2014 .....American National Standard for Roadway and Area Lighting Equipment—Enclosed, Post Top-Mounted Luminaires.

IEEE C57.12-2006.....General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

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

A123/A123M-2009 .....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-2009.....Zinc Coating (Hot-Dip) on Iron and Steel Hardware – AASHTO No.: M232

B108-03a-2008 .....Aluminum-Alloy Permanent Mold Castings

D3487-2008.....Mineral Insulating Oil Used in Electrical Apparatus

AC 150/5345-43E-1995....Specification for Obstruction Lighting Equipment

ASTM G 154—06 .....Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

G. Illuminating Engineering Society of North America (IESNA)

HB-9-2000.....Lighting Handbook

RP-8-2000 (R-2005).....Roadway Lighting

H. National Electrical Manufacturers Association (NEMA):

C81.61-2005 .....Electrical Lamp Bases

ICS 2-2008 .....Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts

ICS 6-2006 .....Industrial Control and Systems Enclosures

I. National Fire Protection Association (NFPA):

70-2008 .....National Electrical Code (NEC)

J. Underwriters Laboratories, Inc. (UL):

496-2008 .....Edison-Base Lamp holders

773-1995.....Plug-in, Locking Type Photo controls, for Use with Area Lighting

773A-2006 .....Non-industrial Photoelectric Switches for Lighting Control

1598-2008 .....Luminaries

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with manufacturer’s instructions.

B. Store in locations on site that are approved by the Cemetery Director.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

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

B. Obtain Submittal approval from the COR on all Products and related Submittals prior to any fabrication or delivery of any product.

2.2 DECORATIVE LAMP POST

A. Decorative Lamp Post shall minimum 11-gauge cast iron pole shaft. The shaft shall be round tapered with twelve (12) to sixteen (16) flutes. ASTM A48 Class 30 Cast Iron.

B. The pole shaft shall be constructed using an advanced manufacturing process to produce an ornamental pole with extremely precise detail on the shaft flutes. Aluminum Poles are not acceptable for this site.

C. The poles shall be designed with a minimum safety factor of 1.5:1 and have maximum deflection of 15% under full wind loading conditions. Poles shall be tested and rated per ANSI C136.20.

D. Lamp Post shall be one piece with decorative bottom Base and three inch (3”) outside diameter (OD)Tenon. Base diameter shall be between 17-inches and 24-inches.

E. Lamp Post height shall not be less than ten (10) feet or greater than fifteen (15) feet. Overall height with luminaire shall be limited to a total height of eighteen (18) feet.

F. Finish Lamp Post with minimum two coats of prime paint and two coats of finish coat. Black finish paint shall withstand salt or other de-icing agents. Submit primer and finish paint product as part of Submittals.

G. All necessary hardware and specified accessories shall be the product of the pole manufacturer.

H. Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.

I. Lamp Post shall be provided with Manufacture furnished Flag Pole holder made of similar material as the Pole. Submit material and cut sheet as part of Submittals to the COR.

2.3 POLE ANCHOR BASE

A. Anchor base shall be constructed of galvanized steel and be factory bonded to the post. All hardware shall be hot dipped galvanized.

B. The Anchor Base shall have four holes at ninety degrees to accommodate a bolt circle of 9 to 12 inches.

C. Anchor base shall be precast concrete 4000 psi, minimum 24-inch diameter, minimum depth below grade of six (6) feet.

D. Contractor shall submit calculations for the Pole Anchor Base Design as part of Submittals.

E. Top of precast concrete Pole Anchor Base shall be set at six (6) inches above finish grade.

F. Install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 LUMINAIRES

A. Luminaires shall comply with the Standards for Luminaires UL 1598, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products UL 8750, and ANSI C136.16-2014 American National Standard for Roadway and Area Lighting Equipment—Enclosed, Post Top–Mounted Luminaires.

B. Luminaries shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat and safe cleaning and relamping.

C. Luminaires shall be "Symphonic X-Series" LED System or approved equal. Submit Luminaires as part of Submittals. All request for "approved equal" will be accompanied with cost deduct for the Contract amount.

D. The Luminaire shall deliver a minimum of 121 lumens per watt. Maximum watt per luminaire shall not exceed 80 watts at 120 volts of current.

E. Globe shall be acorn style glass globe with "Washington" or "Gettysburg" style fitter or tenon adaptor piece.

F. Luminaire design shall be submitted by the Contractor to the COR showing mounting height, luminance, and spacing to provide a minimum average horizontal illumination of 0.5 foot-candles on the driveway, parking area, and sidewalk along the front of the Admin. Building.

G. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

H. LED Driver shall be Class One External, Constant Current Driver with an Ingress Protection of IP66 or better and minimum life expectancy of 50,000 hours. Submit cut-sheets as part of Submittals.

I. LED drivers should be paired with LEDs that use 20% less than their maximum rated wattage and have a minimum power factor of 0.9.

J. LED lights and LED Driver shall have a minimum ten (10) year Warranty. Submit Warranty along with cut-sheets as part of Submittals.

2.5 SITE LIGHTING CONTROLS

A. All exterior Site Lighting Lamp Post shall be controlled by one heavy duty Electromechanical Time Switch (ETS). ETS shall be located in the mechanical room near the electric circuit breaker panel board. Final location shall be approved by the Cemetery Director.

B. The Electromechanical Time Switch shall provide for direct 24-hour control with a minimum one (1) hour ON / OFF times; minimum four (4) ON / OFF operations per day; control electrical loads of up to 30 Amps at 120 VAC; and have manual override. The ETS shall be Agency Listed under Clock Operated Switches, Intermatic or COR Approved Equal.
C. Provide to COR as part of Submittals the Product information for the Electromechanical Time Switch. All request for "Approved Equal" will be accompanied with cost deduct for the Contract amount.
D. The time switch motor shall be a synchronous motor, which shall be designed to withstand a minimum of 6000 volt transients. The time switch motor shall be connected to the supply terminals with ring-type connectors and shall not require more than 5 Watts to operate.
E. The ETS enclosure shall be a Type 1 steel with lockable enclosure. The enclosure shall have a nonremovable cover, which shall swing open a full 180 degrees.
F. The ETS contact blades shall be a one-piece design with welded silver alloy contacts and shall be designed to provide wiping action on contacts during operation to ensure reliable load switching.
G. Terminal connections shall be made using teeter-type terminal screws to provide secure connections for wire sizes up to #8 AWG.

2.6 LED WALL MOUNTED SECURITY LIGHTS

A. The Contractor shall make building security light improvements in conformance with the technical specifications including Division 1 – "General Requirements" and Division 26 – "Electrical" Requirements.
B. The Contractor shall replace all seven (7) wall mounted security lights on the maintenance building with specified fixture and LED bulb. Fixtures shall be minimum 50W to maximum 75W consumption, minimum 400W equivalent output, minimum 6500 lumens, outdoor rated, waterproof, UL listed, and American made.
C. Provide new circuit in conduit for these fixtures. Install new photocell on this circuit such that the new fixtures only run when it is dark. Photocell shall be manufactured by the same manufacturer as the Wall Mounted LED Security Lights. Location of the Photocell shall be approved by the Cemetery Director.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Contractor shall not saw-cut any existing concrete sidewalks to install electric conduit or light pole fixture.

3.2 GROUNDING

A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

3.3 RESTORATION OF SITE

A. Contractor to restore all disturbed lawn areas in conformance with Section 31 20 12 EARTHWORK (Utility Trenching) Item 3.5 LAWN RESTORATION.

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SECTION 31 20 12
EARTHWORK (UTILITY TRENCHING)

PART 1 - GENERAL

1.1: DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill, compaction, testing, and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 30 and 15 respectively. Granular fills for asphalt paving shall not contain deleterious substances that would result in: prevention of the bituminous prime coat from adhering to the base course; a detriment to the finishing, strength or performance of the base; or a surface which is susceptible to distortion under construction traffic. Such substances include, but are not limited to: cherty or other extremely hard pieces, lumps, balls or packets of sand or clay size material or organic matter, loose sand, free shells, corals or skeletal remains of other marine invertebrates retained on the No. 4 sieve, or water sensitive clay materials.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, except for improvement by compaction, proof-rolling, or similar methods of improvement.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for structures and buildings and sewer and other utility trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D1556.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

B. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION

1.4 CLASSIFICATION OF EXCAVATION:

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

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

The measurement and payment for utility line excavation is incidental to the Lump Sum Bid Price of the Contract.

1.6 SUBMITTALS:

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

B. Qualifications of the commercial testing laboratory or Contractor's Testing facility shall be submitted.

1.7 APPLICABLE PUBLICATIONS:

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

B. American Association of State Highway and Transportation Officials **(AASHTO):**

T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb.) Rammer and a 305 mm (12 inch) Drop

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb.] Rammer and a 457 mm (18 inch) Drop

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

C33-03.....Concrete Aggregate

D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D. Standard Specifications of Maryland State Highway Administration Standard Specifications for Construction Material, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Suitable materials approved from on site and off site sources having a minimum dry density of 11682 kg/m3 (105 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 30.

B. Engineered fill: Soil classified as SM or more granular, in accordance with ASTM D 2487, with a Liquid Limit less than 30 and a Plasticity Index less than 15, having no more than 30 percent by weight of soil particles finer than the No. 200 sieve. Engineered fill shall be compacted to 95% of the soil’s maximum dry density.

C. Granular Fill:

1. Under concrete slab, crushed stone or gravel graded from 25 mm (1 inch) to 4.75 mm (No. 4).
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

D. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

E. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

F. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4

inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the COR. Work includes removal of incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Cemetery Property.

B. Grubbing: There shall be NO Grubbing as part of this Utility Line Trenching work.

C. Tree Protection: In cases where proposed utility lines conflict with existing tree roots or within the dripline of the Tree the Contractor shall perform trenchless methods to install the utility line.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of Utility Line Trench work shall be limited to a total three-foot width. The Contractor shall adhere to local / state requirements for Erosion & Sediment Control as it relates to disturbance caused by Utility Line Trenching work. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support under disturbed foundations, as directed by the COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by the COR.

B. Excavation Drainage: Operate pumping equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from the COR. COR approval

is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed, disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the COR should be contacted to consider the use of flowable fill.

C. Blasting: Blasting shall not be permitted as part of this Project.

D. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
   b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
   c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
   d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the COR.
   e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
   g. Bedding shall be of the type and thickness as shown on Drawings or as Specified in Part 2. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit.
   h. Backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent maximum density.
2. Sanitary and storm sewer trenches:
   a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for up to and including 300 mm (12

inches) diameter and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (l2 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.

b. The bottom quadrant of the pipe shall be bedded on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
   1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
   2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one-sixth of pipe diameter below the pipe of 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
d. Use granular fill for bedding where rock or rocky materials are excavated.
e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
f. When shown on the Drawings, provide and bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for

the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

E. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the 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, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on yardage in cut section only.

F. Finished elevation of subgrade shall be as follows:

1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Lawn Areas - 6 inches below the finished grade, unless otherwise specified or indicated on the drawings.
3. Planting Beds – As indicated on planting details.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded tri-axle

dump truck. Use suitable excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials.

B. Proof-rolling Existing Subgrade: Proof-roll with a fully loaded tri-axle dump truck. Make a minimum of one pass in each direction. Remove unstable un-compactable material and replace with engineered fill material compacted to 95% of the maximum dry density.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost. 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.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls or within 30 feet of crypts without the prior approval of the Contracting Officer’s Representative. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test methods:

   1. For granular engineered fill or backfill: ASTM D 1557.
   2. For cohesive (clayey) soils: ASTM D698.

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. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

C. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN RESTORATION:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width. **Seed type shall be 100% turf type Tall Fescue.**

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil. **Sod type shall be 100% turf Tall Fescue.**

F. Watering: The Contractor is responsible for having adequate water available at the site. As Lawn Restoration is completed in any one section, the entire area shall be thoroughly irrigated by the Contractor,

to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. Contractor will be responsible for watering a minimum of four (4) weeks after Seed or Sod is in place.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Cemetery Property.

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SECTION 32 01 17
ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.1 DESCRIPTION

A. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

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 SECTIONS

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

B. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

C. Section 31 20 12, EARTHWORK (UTILITY TRENCHING)

1.3 QUALITY ASSURANCE

A. The COR shall have access at all time to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

B. Comply with 2016 Virginia Road and Bridge Specifications or current edition.

1.4 MEASUREMENT AND PAYMENT

A. Payment will be full compensation for saw cutting, milling, grinding, removal, disposal, trimming of the existing pavement, subgrade preparation, placing all materials including tack coat, steel plates, emergency filler, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. After removal, steel plates and emergency filler will remain the property of the Contractor.

1.5 SUBMITTALS

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

B. Data and Test Reports:

1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by Virginia Road and Bridge Specifications.
2. Porous Asphalt and Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by Virginia Road and Bridge Specifications.

C. Certifications:

1. Asphalt prime and tack coat material certificate of conformance with MDOT Standard Specifications for Construction and Materials.
2. Asphalt cement certificate of conformance to Virginia Road and Bridge Specifications.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the Virginia Road and Bridge Specifications.

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):**

HM-WB.....Standard Specifications for Transportation Materials and Methods of Sampling and Testing, and AASHTO Provisional Standards, Latest Edition

M-320.....Standard Specification for Performance-Graded Asphalt Binder, Latest Edition.

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

C29.....Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate, Latest Edition.

C977.....Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization, Latest Edition.

D3786.....Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method, Latest Edition.

D4355.....Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and

Heat in a Xenon Arc Type Apparatus, Latest Edition.

D4632.....Standard Test Method for Grab Breaking Load and Elongation of Geotextiles, Latest Edition.

D. Virginia Road and Bridge Specifications **(VDOT)**:

.....Standard Specifications for Construction and Materials, Latest Edition.

PART 2 - PRODUCTS

2.1 GENERAL

A. Aggregate base, Asphaltic base, Sealing Materials and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the Virginia Road and Bridge Specifications. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA Contracting Officer Representative (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. Subbase aggregate (where required) maximum size: 38mm(1-1/2").

C. Base aggregate maximum size:

1. Base course over 152mm(6") thick: 38mm(1-1/2");
2. Other base courses: 19mm(3/4").

D. Asphaltic base course:

1. Maximum particle size not to exceed 25.4mm(1”).
2. Where conflicts arise between this specification and the requirements in the latest version of the Virginia Road and Bridge Specifications, the **VDOT** Specifications shall control.

E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve Sizes	Percentage Passing
3/4"	100
3/8"	67 to 85
1/4"	50 to 65
No. 8 mesh	37 to 50

No. 30 mesh	15 to 25
No. 200 mesh	3 to 8

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 NON-WOVEN GEOTEXTILE FABRIC

A. Fabric shall consist of needled nonwoven polypropylene fibers and meet the following properties:
   1. Grab Tensile Strength (ASTM-D4632) ≥ 120 lbs.
   2. Mullen Burst Strength (ASTM-D3786) ≥ 225 psi
   3. Flow Rate (ASTM-D4491) ≥ 95 gal/min/ft2
   4. UV Resistance after 500 hours (ASTM-D4355) ≥ 70%
   5. Heat-set or heat-calendared fabrics are not permitted.
   6. Mirafi 140N, Amoco 4547, Geotex 451, or approved equal.

2.4 ASPHALT PATCH

A. Comply with the Virginia Road and Bridge Specifications.

1. Subbase Course	Section 308
2. Aggregate Base Course	Section 309
3. Tack Coat	Section 310
4. Asphalt Material	Section 313
5. Asphalt Placement	Section 315

2.5 SEALER

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.

B. Where conflicts arise between this specification and the requirements in the latest version of the Virginia Road and Bridge Specifications, the **VDOT** Specifications shall control.

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 Virginia Road and Bridge Specifications.

B. Full Depth Patching for Utility Trenching shall be in conformance with Virginia Road and Bridge Specifications.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant-mixed asphaltic concrete paving materials.
   1. Temperature leaving the plant: 143 degrees C (290 degrees F) minimum, 160 degrees C (320 degrees F) maximum.
   2. Temperature at time of placing: 138 degrees C (280 degrees F) minimum.

3.3 SUBGRADE

A. Shape to line and grade and compact with self-propelled rollers.

B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA COR. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

A. Subbase
   1. Spread and compact to the thickness shown on the drawings.
   2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
   3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

B. Base
   1. Spread and compact to the thickness shown on the drawings.
   2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
   3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings or to match existing conditions within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings or to match existing conditions within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material, has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
   a. No depressions which will retain standing water.
   b. No deviation greater than 3mm in 1.8m (1/8" in six feet)

3.6 APPLICATION OF SEAL COAT

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

B. Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

3.7 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 2-inches.

3.8 PATCHING

A. Hot Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12-inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing aggregate base course to provide new subgrade.

B. Tack Coat: 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.

C. Patching: Fill excavated pavement with hot mix asphalt base mix for full thickness of patch; while still hot compact flush with adjacent pavement surface.

3.9 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.

3.10 FINAL CLEAN-UP

A. Remove all debris, rubbish, and excess material from the work area.

B. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

- - - E N D - - -

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subbase for concrete pavements.
   2. Curbs, gutters, combination curbs and gutters, and wheel stops.
   3. Pedestrian Pavement: Walks, grade slabs, lawn mower strips, pedestrian crossings, wheelchair curb ramps, terraces, steps, patios, and healing gardens.
   4. Vehicular Pavement: Service courts, driveways, parking lots, and loading docks.
   5. Equipment Pads: Oxygen storage, transformers, propane tanks, and generator pads.

1.2 RELATED REQUIREMENTS

A. General Requirements: Section 01 00 02.
B. Shop Drawings, Product Data, and Samples: Section 01 33 23.
C. Reference Standards: Section 01 42 19.
D. Demolition and Site Clearing: Section 02 41 10.
E. Underground Electrical Construction: Section 26 05 41.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Association of State Highway and Transportation Officials **(AASHTO):**
   1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
C. American Concrete Institute **(ACI):**
   1. 305R-10 - Guide to Hot Weather Concreting.
   2. 306R-10 - Guide to Cold Weather Concreting.
D. American National Standards Institute **(ANSI):**
   1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).

E. ASTM International **(ASTM)**:

1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C33/C33M-16 - Concrete Aggregates.
5. C94/C94M-16 - Ready Mixed Concrete.
6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting with COR at project site minimum of ten (10) days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Inspection and Testing Agency.
   c. Contractor.
   d. Installer.
   e. Other Installers responsible for adjacent and intersecting work.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

a. Installation schedule.
b. Installation sequence.
c. Preparatory work.
d. Protection before, during, and after installation.
e. Installation.
f. Terminations.
g. Transitions and connections to other work.
h. Inspecting and testing.
i. Other items affecting successful completion.

3. Document and distribute "Draft" meeting minutes to participants to record decisions affecting installation within 48 hours.
4. Make corrections and forward "Final" Meeting Minutes within three (3) days of submission of "Draft" Meeting Minutes with appropriate edits and comments noted by all participants.

1.5 SUBMITTALS

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

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.
2. Show reinforcing.
3. Include jointing plan for concrete pavements, curbs and gutters.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.

D. Samples:
1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.
2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.

E. Test reports: Certify products comply with specifications.
1. Concrete materials.
2. Select subbase materials.
3. Field test reports.

F. Certificates: Certify products comply with specifications.
1. Expansion joint filler.
2. Reinforcement.
3. Curing materials.
4. Concrete protective coating.

G. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer // with project experience list //.
   2. Land surveyor.
H. Concrete mix design.
I. Select subbase job-mix design.
J. Proposed hot and cold weather concreting methods.
K. Land surveyor's construction staking notes, before placing concrete.
   1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations.
      a. Project Experience List: Provide contact names and addresses for completed projects.
B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.
C. Preconstruction Testing:
   1. Engage independent testing laboratory to perform tests and submit reports.
      a. Deliver samples to laboratory in number and quantity required for testing.
   2. Concrete mix design.
   3. Select subbase job-mix design. Report the following:
      a. Material sources.
      b. Gradation.
      c. Plasticity index.
      d. Liquid limit.
      e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.
B. Before installation, return or dispose of distorted or damaged steel reinforcement.
C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

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

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.

1. Use non-corrosive, non-chloride accelerator admixture.
2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

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

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
2. Slag: ASTM C989/C989M; Grade 100 or Grade 120.
3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; appropriate size to be determined as part of Submittal Requirement.

D. Fine Aggregate: ASTM C33/C33M.

E. Mixing Water: Fresh, clean, and potable.

F. Air-Entraining Admixture: ASTM C260/C260M.

G. Chemical Admixtures: ASTM C494/C494M.

H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, appropriate Grade of Steel to be shown on Drawing Details or determined as part of Submittal Requirements.

I. Welded Wire Fabric: ASTM A1064/A1064M, appropriate Grade of Steel to be shown on Drawing Details or determined as part of Submittal Requirements.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Color Pigment: ASTM C979/C979M, colored and powder pigments to be shown on Drawing Details or determined as part of Submittal Requirements.

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; appropriate Grade of Subbase to be shown on Drawing Details or determined as part of Submittal Requirements.

1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

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

1. Plywood: Exterior grade, free of defects and patches on contact surface.
2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.

1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:

1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
2. Sheet Materials for Curing Concrete: ASTM C171.
3. Curing Compound: ASTM C309, Type of Compound shall be provided on Drawing Details or determined as part of Submittal Requirements.

2.5 CONCRETE MIXES

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

B. Concrete Type: // Non-air-entrained // Air-entrained //. See Table I.

TABLE I - CONCRETE TYPES

Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:

1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP

APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.

B. Maintain equipment and tools in satisfactory working condition.

C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.

D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.

D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Placing:

1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.

B. Compaction:

1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
2. Maintain subbase at optimum moisture content for compaction.
3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK and or Section 31 20 12 EARTHWORK (Utility Trenching).

C. Subbase Tolerances:
   1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
   2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).

D. Protection:
   1. Protect subbase from damage until concrete is placed.
   2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

A. Form Substrate:
   1. Compact form substrate to uniformly support forms along entire length.
   2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:
   1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
   2. Remove forms when removal will not damage concrete and when required for finishing.
   3. Clean and oil forms before each use.
   4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms and slip forming machine operations.
   1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
   2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:
   1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
   2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install reinforcement shown on drawings.

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.
   1. Conform to details shown.
   2. Install joints perpendicular to finished concrete surface.
B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.
B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
C. Provide butt-type joint with dowels in curb and gutter at planned joint locations.
D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

3.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.
B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.
   1. Keep plates in place until concrete can hold its shape.
C. Finish joint edges with edging tool.
D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.
   1. Locate joints around perimeter of structures and features abutting site work concrete.
   2. Create complete, uniform separation between structure and site work concrete.
B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.
C. Cut and shape material matching cross section.
D. Anchor with approved devices to prevent displacing during placing and finishing operations.
E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:
   1. Obtain Contracting Officer's Representative approval.
   2. Remove debris and other foreign material.
   3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
   1. Vibrate concrete against forms and along joints.
   2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading when necessary and with approved mechanical finishing equipment when sufficient room is available.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints.

C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

G. Curb-Forming Machines: Curb-forming machines for constructing integral curbs or curbs and gutter will be approved based on trial use on the project. When equipment produces unsatisfactory results, discontinue use of the equipment at any time during construction and accomplish work by hand method construction. Remove unsatisfactory work and reconstruct full length between regularly scheduled joints. Dispose of removed portions off the project site.

3.12 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:

1. Consolidating, floating, striking, troweling, texturing, and joint edging.
2. Use edging tool with 6 mm (1/4 inch) radius, unless otherwise shown on Drawings Details.
3. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces, Healing Gardens, and other Pedestrian Pavements:

1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
2. Finish slab edges and formed transverse joints with edger.
3. Broom surfaces transverse to traffic direction.
   a. Use brooming to eliminate flat surface produced by edger.
   b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
5. Paving Tolerances:

a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

6. Replace paving within joint boundary when paving exceeds specified tolerances.

B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:
1. Remove riser forms sequentially, starting with top riser.
2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
3. Apply uniform brush finish to treads, risers, and sidewall.
a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.
4. Step Tolerance:
a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 CONCRETE FINISHING - VEHICULAR PAVEMENT

A. Align finish surfaces where new and existing pavements abut.
B. Longitudinally float pavement surface to profile and grade indicated on drawings.
C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.
D. Finish pavement edges and joints with edging tool.
E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.
1. Broom surface transverse to traffic direction.
a. Use brooming to eliminate flat surface produced by edger.
b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.
F. Pavement Tolerances:
1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.16 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.

B. Gutter and Curb Top:

1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
2. Finish surfaces, while still plastic, longitudinally with bristle brush.

C. Curb Face:

1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
2. Brush curb face, while still plastic, matching gutter and curb top.

D. Curb and Gutter Tolerances:

1. Variation from Indicated Plane and Grade:
   a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
   b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).

E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.

F. Correct depressions causing standing water.

3.17 CONCRETE FINISHING - EQUIPMENT PADS

A. Strike pad surface to elevation shown on Drawings.

B. Provide smooth, dense float finish, free from depressions or irregularities.

C. Finish pad edges with edger.

D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.

E. Pad Tolerances:

1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

F. Replace pads when pads exceed specified tolerances.

3.18 SPECIAL FINISHES

A. Exposed Aggregate Finish:

1. Prepare concrete base 10 to 13 mm (3/8 to 1/2 inch) lower than the finish grade.
2. Scatter aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.
3. Apply concrete mix and mark off surface as indicated on Drawings with surface joints at least 10 mm (3/8 inch) deep. Level off finish to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove mortar from top of colored aggregate. Continue washing and brushing until flush water runs clear and no noticeable cement film left on the aggregate.

B. Colored Concrete: Add integral color pigment to the pedestrian concrete paving mix at batch plant. Introduce sufficient quantities of carbon black or mineral oxide pigment to produce color specified or match the existing color.

3.19 CONCRETE CURING

A. Concrete Protection:
   1. Protect unhardened concrete from rain and flowing water.
   2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
   3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
      a. Replace pavement damaged by curing method allowing concrete cracking.
      b. Employ another curing method as directed by Contracting Officer's Representative.

B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:
   1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
   2. Sheet Materials:
      a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
      b. Overlap sheets minimum 300 mm (12 inches).
      c. Securely anchor sheet materials preventing displacement.

3. Curing Compound:
   a. Protect joints indicated to receive sealants preventing contamination from curing compound.
   b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
   c. Apply curing compound before concrete dries.
   d. Apply curing compound in two coats at right angles to each other.
   e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
   f. Immediately reapply curing compound to surfaces damaged during curing period.

3.20 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.

B. Complete backfilling and curing operation before applying protective coating.

C. Dry and thoroughly clean concrete before each application.

D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.

E. Protect coated surfaces from vehicular and pedestrian traffic until dry.

F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Compaction.
      a. Pavement subgrade.
      b. Curb, gutter, and sidewalk.
   2. Concrete:
      a. Delivery samples.

b. Field samples.

3. Slip Resistance: Steps and pedestrian paving.

3.22 CLEANING

A. After completing curing:

1. Remove burlap and sheet curing materials.
2. Sweep concrete clean, removing foreign matter from the joints.
3. Seal joints as specified.

3.23 PROTECTION

A. Protect exterior improvements from traffic and construction operations.

1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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