

1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.

1.13 SINGULAR NUMBER

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

1.15 ACCEPTANCE CHECKS AND TESTS

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

1.16 WARRANTY

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

1.17 INSTRUCTION

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 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 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

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 information to demonstrate compliance with drawings and specifications.
 - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
 - 2. Test Reports:
 - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR
 - 3. Certifications:
 - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and 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
- C. National Fire Protection Association (NFPA):
 - 70-20 National Electrical Code (NEC)
 - 70E-15 National Electrical Safety Code
 - 99-15 Health Care Facilities
 - 780-20 Lightning Protection
- E. Underwriters Laboratories, Inc. (UL):
 - 467-13 Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Bonding conductors shall be bare stranded copper.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

2.2 GROUND RODS

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

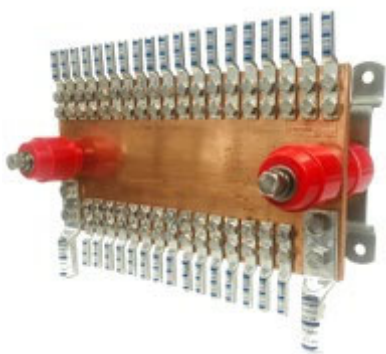
2.3 CONCRETE ENCASED ELECTRODE (NOT USED)

2.4 GROUND CONNECTIONS

- A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.
- B. Above Grade:
 - 1. Connection to Building Steel: Exothermic-welded type connectors.
 - 2. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors.
Use 2-hole mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS (NOT USED)**2.6 GROUND TERMINAL BLOCKS (NOT USED)****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, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets. Connecting cables shall use 2-hole connectors.

**PART 3 - EXECUTION****3.1 GENERAL**

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

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 (NOT USED)**3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS (NOT USED)****3.5 RACEWAY (NOT USED)****3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT (NOT USED)****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 (NOT USED)**3.9 LIGHTNING PROTECTION SYSTEM**

- A. Bond the lightning protection system to the electrical grounding electrode system as indicated on drawings.

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. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.11 EXTERIOR LIGHT POLES (NOT USED)**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.

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. 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.

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 24 hours before the connections are ready for inspection.

---END---

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of underground cables and test wells.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

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 ground grid with final arrangement of other utilities, site grading, and surface features.

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 information to demonstrate compliance with drawings and specifications.
 - b. Submit information on manholes, pullboxes, 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 any part of ground grid at locations other than required by NFPA 780, show the proposed locations accurately on scaled site drawings, and submit to the COR for approval prior to construction.
 - 2. Certifications: Two weeks prior to the final inspection, submit the following.

- a. Certification by the manufacturer 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
- F. National Fire Protection Association (NFPA):
 - 70-17 National Electrical Code (NEC)
 - 70E-15 National Electrical Safety Code
 - 780-20 Standard for Installation of Lightning Protection Systems
- 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 (NOT USED)

2.2 TEST WELLS

- A. General: Size as indicated on the drawings. Provide with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Covers shall have molded lettering, TEST as applicable. Test wells shall comply with the requirements of ANSI 77 Tier 5 loading.

2.3 DUCTS (NOT USED)

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.

2.6 PULL ROPE FOR SPARE DUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST WELL INSTALLATION

- A. Assembly and installation shall be per the requirements of the manufacturer.
 - 1. Install test wells level and plumb.
- B. Access: Ensure the top of frames and covers are flush with finished grade.

3.2 TRENCHING

- A. 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.
- B. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.
- C. Cut the trenches neatly and uniformly.
- D. Refill trenched area only after COR has inspected the depth and lay of cable therein. Pack fill and let rest for 3 weeks. After 3 weeks, refill any areas that show signs of "sinking". Only after this period sod or seed in accordance with other sections of specifications.

3.3 DUCT INSTALLATION(NOT USED)

3.4 ACCEPTANCE CHECKS AND TESTS

A. Before filling trench:

1. Invite COR with reasonable notice to inspect the depth of trench and installation of the 1/0 bare copper wire and connections.

---END---

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing and installation of a complete UL master labeled lightning protection system.

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 to ground for possible ground faults.
- C. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective device installed at the electrical service entrance.

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 information to demonstrate compliance with drawings and specifications.
 - b. Show locations of air terminals, connections to required metal surfaces, down conductors, and grounding means.
 - c. Show the mounting hardware and materials used to attach air terminals and conductors to the structure.
 - 2. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturer that the lightning protection system conforms to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the lightning protection system has been properly installed and inspected.

- c. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

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. National Fire Protection Association (NFPA):
 - 70-20 National Electrical Code (NEC)
 - 780-20 Standard for the Installation of Lightning Protection Systems
- C. Underwriters Laboratories, Inc. (UL):
 - 96-16 Lightning Protection Components
 - 96A-16 Installation Requirements for Lightning Protection Systems
 - 467-13 Standard for Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Lightning protection components shall conform to NFPA 780 and UL 96, for use on Class I structures. Aluminum materials are not allowed.
 - 1. Class I conductors: Copper.
 - 2. Class I air terminals: Solid copper 24 inches long, not less than 9.5 mm (3/8 inch) diameter, with sharp bare copper points.
 - 3. Ground rods: Copper-clad steel, 0.75 in (19 mm) diameter by 3 m (10 feet) long.
 - 4. Bonding plates: Bronze, 50 square cm (8 square inches).
 - 5. Anchors and fasteners: Bronze bolt and clamp type shall be used for all applications except for membrane roof. Adhesive type are allowed only for attachment to membrane roof materials, using adhesive that is compatible with the membrane material.
 - 6. Connectors: Bronze clamp-type connectors shall be used for roof conductor splices, and the connection of the roof conductor to air terminals and bonding plates. Crimp-type connectors are not allowed.
 - 7. Exothermic welds: Exothermic welds shall be used for splicing the roof conductor to the down conductors, splices of the down conductors, and for connection of the down conductors to ground rods, ground plates, and the ground ring.

2.2 CONNECTORS

- 1. Tee Splice:



Use for connection for lateral runs of roof cable

2. Cross splice:



For cross splices of roof conductors.

3. In line splices:



4. In-line bi-metallic connector:



5. Parallel cable connector



Use only as indicated to connect parallel cables. Do not use for bonding to metal objects

6. 2-hole bonding strap for doors:



Mount in horizontal position.

Door Frame: drill hole and thread it for bolt.

Personnel door: drill hole thru door and place bolts with washers on inside and outside of door. If personnel door frame does not allow for 2-hole strap horizontally, rotate only that part of the bonding strap vertically and bolt to frame. Drill holes and thread it for bolts.

Heavy duty door: drill holes and thread it for bolts.

7. Bonding lug:



Must be able to withstand 200 lb pull test.

8. Pipe/vent bonding



2.2 LABELS



Provide a label for each air terminal, downconductor, bonding item similar to the above. Mounting by screw is preferred, but attachment to downconductors (at the point that downconductor attaches to roof conductors may be by chain. Label shall be as indicated for the item on drawing (i.e. Air terminal (L120), bonding (B56) and downconductor (DC31)).

For doors, labels shall be screwed to the door and/or door frame and shall be labeled as indicated on drawings (i.e. door frame bonding (D1), flex jumper between door frame and metal door (i.e. DSL1 & DSR1)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.
- B. Coordinate installation with the roofing manufacturer and roofing installer.
- C. Install the conductors as inconspicuously as practical.
- D. Most down conductors are existing and shall be reused. For new down conductors, they shall be routed on the outside of the building. New down conductors shall be routed and spaced in accordance with drawings.
- E. Where down conductors are subject to damage or are accessible near grade, protect with PVC 6 feet above grade. Transition from roof conductor to bare copper wire above the PVC. Extend the PVC at least 2 feet underground.
- F. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.

- G. Install ground rods not less than 600 mm (2 feet) deep and a distance not less than 900 mm (3 feet) nor more than 2.5 m (8 feet) from the nearest point of the structure. Exothermically weld the down conductors to ground rods in the presence of the COR.
- H. Connect roof conductors to all metallic projections and equipment above the roof as indicated on the drawings.
- I. Connect exterior metal surfaces, located within 900 mm (3 feet) of the conductors, to the conductors to prevent flashovers.
- J. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 200 mm (8 inches) radius and do not exceed 90 degrees.
- K. Conductors shall be rigidly fastened every 900 mm (3 feet) along the roof and down to the building to ground.
- M. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure.
- N. Install air terminal bases, cable holders and other roof-system supporting means without piercing membrane or metal roofs.
- O. A counterpoise or ground ring, where shown, shall be of No. 1/0 copper cable having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm (2 feet) deep at a distance not less than 900 mm (3 feet) nor more than 2.5 M (8 feet) from the nearest point of the structure.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Test the ground resistance to earth by standard methods, and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Test sheets have been provided for the recording of all air terminal and roof bonds to a down conductor resistive readings. These shall be filled out and provided as a submittal before the final inspection of the project.
- C. A UL representative shall inspect the lightning protection system. UL representatives usually create a list of discrepancies if the Lightning Protection system does not meet standards. Contractor shall correct these discrepancies at no additional cost to the VA.
- D. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative and the COR.

---END---

SECTION 26 43 13 SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of Type 2 Surge Protective Devices, as defined in NFPA 70, and indicated as SPD 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.

1.3 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS 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 information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings and device nameplate data.
 - 2. Manuals:
 - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
 - 3. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturer that the SPD conforms to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the SPD has been properly installed.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- B. Institute of Engineering and Electronic Engineers (IEEE):
 - IEEE C62.41.2-02 Characterization of Surges in Low-Voltage (1000 V and Less)
AC Power Circuits
 - IEEE C62.45-08 Surge Testing for Equipment Connected to Low-Voltage (1000
V and Less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
 - 70-20 National Electrical Code (NEC)
 - 780-20 National Fire Prevention Association
- D. Underwriters Laboratories, Inc. (UL):
 - UL 1283-15 Electromagnetic Interference Filters
 - UL 1449-14 Surge Protective Devices

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD/PANELBOARDS SPD

- A. General Requirements:
 1. Comply with IEEE and UL.
 2. Modular design with field-replaceable modules, or non-modular design.
 3. Bolted compression lugs for internal wiring.
 4. Integral disconnect switch.
 5. Redundant suppression circuits.
 6. LED indicator lights for power and protection status of each phase.
 7. Audible alarm, with silencing switch, to indicate when protection has failed.
 8. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
 9. Four-digit transient-event counter.
- B. Surge Current per Phase: Minimum 240kA per phase.

2.2 PANELBOARD SPD (NOT USED)

2.3 ENCLOSURES

- A. Enclosures: NEMA 1 except for B37 which requires a NEMA 3R enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

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

- B. Field-installed SPD: Contractor shall install Type I SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Attachment shall be to the lugs of the main breaker/main lugs only.
- D. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests, and reconnect SPD immediately after insulation resistance tests are complete.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

3.3 FOLLOW-UP VERIFICATION

- A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that SPD are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

- A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the SPD, on the date requested by the COR.

`---END---

SECTION 32 12 16 ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness to match existing conditions. Each course shall be constructed to the depth, section, or elevation required and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

- A. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

1.3 INSPECTION OF PLANT AND EQUIPMENT

The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

- A. The Contractor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades and elevations.

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. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
 2. Job-mix formula.
- C. Certifications:
1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
 2. Asphalt cement certificate of conformance to State Highway Department requirements.
 3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.
- D. One copy of State Highway Department Specifications.
- E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the COR.

2.2 AGGREGATES

- 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 State Highway Specifications, the State 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:

<u>Sieve Sizes</u>	<u>Percentage Passing</u>
19mm(3/4")	100
9.5mm(3/8")	67 to 85
6.4mm(1/4")	50 to 65
2.4mm(No. 8 mesh)	37 to 50
600µm(No. 30 mesh)	15 to 25
75µm(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 ASPHALTS

- A. Comply with provisions of Asphalt Institute Specification SS2:
1. Asphalt cement: Penetration grade 50/60
 2. Prime coat: Cut-back type, grade MC-250
 3. Tack coat: Uniformly emulsified, grade SS-1H

2.4 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 State Highway Specifications, the State Specifications shall control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
 - 1. Temperature leaving the plant: 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 Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

- A. Subbase (when required)
 - 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 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 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 on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 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. 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.
- C. When sealing new asphalt paving wait an entire year to allow for the expansion and contraction of a year's cycle of both warm and cool temperatures. This allows for the asphalt's oils to properly cure and begin oxidation before applying a seal coat.
- D. When seal coating in less than a year apply two coats, spray applied. This application method is preferred for less than a year application when there is still plenty of asphalt cement present for the seal coat to bond to.
- E. When seal coating existing paving that has new asphalt patches, apply two coats sprayed to the existing asphalt and a single lighter coat on new patch work, just enough to make the color of the new patches match the rest of the reseal coated paving.
- F. When resealing existing paving 5, 10, 15 years and older, that is oxidized and is very light in color, squeegee apply the first coat of seal coat and spray on a second coat. Two coats are preferred in older paving when the asphalt cement has oxidized leaving the seal coat with nothing to bond to other than the aggregate that in many cases has polished over time leaving less than a desirable surface to bond to.

3.7 PROTECTION

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.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

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SECTION 32 17 23 PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Paint on pavement surfaces, in form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings.

1.2 RELATED REQUIREMENTS (not used)

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. Master Painters Institute (MPI):
 - 1. No. 97 - Traffic Marking Paint, Latex.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show pavement marking configuration and dimensions where cutting has damaged existing lines/markings and area to be remarked.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Application instructions.
- D. Samples:
 - 1. Paint: 200 mm (8 inches) square, each type and color.
- E. Certificates: Certify products comply with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Installer with project experience list.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.

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 products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 13 degrees C (55 degrees F) for minimum 48 hours before installation.
 - a. Surface to be painted and ambient temperature: Minimum 10 degrees C (50 degrees F) and maximum 35 degrees C (95 degrees F).
- B. Field Measurements: Verify field conditions affecting traffic marking installation. Show field measurements on Submittal Drawings.

1.9 WARRANTY

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

PART 2 - PRODUCTS**2.1 SYSTEM PERFORMANCE**

- A. Design paint complying with specified performance:
 - 1. Application: Fed. Spec. TT-P-1952.

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 SANDBLASTING EQUIPMENT (not used)**2.4 PAINT APPLICATOR**

- A. Apply marking paint with approved mechanical equipment. Provide equipment with constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in case of skip lines. Equipment to have manual control to apply continuous lines of varying length and marking widths as indicated on Drawings.

Provide pneumatic spray guns for hand application of paint in areas where mobile paint applicator cannot be used.

2.5 PAINT

- A. Paint: MPI No. 97. For obliterating existing markings comply with Fed. Spec. TT-P-1952. Provide minimum 18 L (5 gallons) containers.

2.6 REFLECTIVE GLASS BEADS (not used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Allow new pavement surfaces to cure for period of minimum 14 days before application of marking materials.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
 - 1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or combination of these methods.
 - 2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by Contracting Officer's Representative.
 - 3. As an option, comply with Fed. Spec. TT-P-1952 for removal of existing paint markings on asphalt pavement. Apply black paint in as many coats as necessary to completely obliterate existing markings.
 - 4. Scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application, where oil or grease are present on old pavements to be marked,
 - a. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through new paint.
 - 5. Clean and dry surface before pavement marking. Do not begin any marking until COR inspects surface and gives permission to proceed.

3.2 TEMPORARY PAVEMENT MARKING

- A. Apply Temporary Pavement Markings of colors, widths and lengths shown on drawings or directed by COR. After temporary marking has served its purpose and when so ordered by COR,

remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method to prevent damage on applied surface.

- B. As an option, provide approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of required colors, widths and lengths in lieu of temporary painted marking. Continuous durability and effectiveness of such marking is required during period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted markings.

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 - 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
 - 2. Specification is only for remarking of existing markings that were demolished or marred during construction.

3.4 PAINT APPLICATION

- A. Apply uniformly painted pavement marking of required colors, length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces.
- B. Comply with established control points.
- C. Apply paint at wet film thickness of 0.4 mm (0.015 inch). Apply paint in one coat. When directed by COR, apply additional coats at markings showing light spots. Comply with paint manufacturer's maximum drying time requirements to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic.
- D. When deficiency in marking drying occurs, discontinue paint operations until cause of slow drying is determined and corrected.
- E. Remove and replace marking applied less than minimum material rates, deviates from true alignment, exceeds stipulated length and width tolerances, or shows light spots, // faulty distribution of beads, // smears, or other deficiencies or irregularities.
- F. Remove marking by carefully controlled sandblasting, approved grinding equipment, or other approved method to prevent damage on applied surface.

3.5 DETAIL PAVEMENT MARKING APPLICATION

- A. Apply Detail Pavement Markings, exclusive of actual traffic lane marking as follows:
 - 1. At exit and entrance islands and turnouts.
 - 2. On curbs.
 - 3. At crosswalks.
 - 4. At parking bays.

- 5. Other locations as indicated on drawings.
- B. Install detail pavement markings of colors, widths and lengths, and design pattern at required locations.

3.6 TOLERANCES

- A. Length and Width of Lines: Plus or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in case of skip markings.
- B. Length of intervals exceeding line length tolerance are not acceptable.

3.7 CLEANING

- A. Remove excess paint before paint sets.

3.8 PROTECTION

- A. Protect pavement markings from traffic and construction operations.
 - 1. Protect newly painted markings from vehicular traffic until paint is dry and track free.
 - 2. Place warning signs at beginning of wet line, and at points well in advance of marking equipment for alerting approaching traffic from both directions.
 - 3. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
- B. Repair damage.

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SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plants, soils, edging, turf, and landscape materials.

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

- A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.
- B. Planter Bed: An area containing one or combination of following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and mulch topdressing, excluding turf. Trees may also be found in planter beds.
- C. Stand of Turf: 100 percent of established species.

1.4 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI):
 - 1. Z60.1-2014 - Nursery Stock.
- C. American Society for Testing And Materials (ASTM):
 - 1. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. C33/C33M-16-Concrete Aggregates.
 - 4. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
 - 5. C602-13a - Agricultural Liming Materials.
 - 6. D977-13e1 - Emulsified Asphalt.
 - 7. D5268-13 - Topsoil Used for Landscaping Purposes.
- D. Hortus Third: Concise Dictionary of Plants Cultivated in United States and Canada.
- E. Tree Care Industry Association (TCIA):
 - 1. A300P1-2008 - Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance Standard Practices (Pruning).

2. Z133.1-2012 - Arboricultural Operations - Safety Requirements.
- F. Turfgrass Producers International (TPI):
 1. 2006 Guideline Specifications to Turfgrass Sodding.
- G. United States Department of Agriculture (USDA):
 1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
 2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.5 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Contractor.
 - c. Installer.
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Inspection of planting materials.
 - b. Installation schedule.
 - c. Installation sequence.
 - d. Preparatory work.
 - e. Protection before, during, and after installation.
 - f. Installation.
 - g. Inspecting.
 - h. Environmental procedures.
 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 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. Installation instructions.
 3. Warranty.
- C. Certificates: Certify products comply with specifications.
 1. Seed and Turf Materials: Notarized certificate of product analysis.

- D. Operation and Maintenance Data:
 - 1. Care instructions for each plant material.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
- B. Contracting Officer's Representative may review plant materials either at place of growth or project site before planting for compliance with requirements. Contracting Officer's Representative retains right to inspect trees and shrubs to determine if any unacceptable conditions exist and to reject any trees or shrubs at any time during Project. All rejected trees and shrubs must be immediately removed from Project site.
 - 1. Submit plant material source information to Contracting Officer's Representative seven days in advance of delivery to Project site.
- C. Material Test Reports: For standardized ASTM D5268 topsoil, existing native surface topsoil, existing in-place surface soil, and imported or manufactured topsoil.
 - 1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of soil.
 - 2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
 - 3. Soil-testing laboratory to oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer's Representative. Take minimum 3 representative samples from varied locations for each soil to be used or amended for planting purposes.
 - 4. Report suitability of tested soil for plant growth.
 - 5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 92.9 sq. m (1000 sq. ft.) or volume per 0.76 cu. m (1 cu. yd.) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.8 DELIVERY

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

B. Bulk Products:

1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
2. Install erosion control materials to prevent erosion or displacement of bulk products.

1.9 STORAGE AND HANDLING

A. Store seeds and other packaged materials in dry locations away from contaminants.

B. Plant Storage and Protection: Store and protect plants not planted on day of arrival at Project site as follows:

1. Shade and protect plants in outdoor storage areas from wind and direct sunlight until planted.
2. Heel-in bare root plants.
3. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering that allows air circulation.
4. Keep plants in moist condition until planted by watering with fine mist spray.
5. Do not store plant materials directly on concrete or bituminous surfaces.

C. Topsoil: Before stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks before stockpiling existing topsoil.

D. Root Control Barrier and Weed Control Fabric: Store materials on site in enclosures or under protective covering in dry location out of direct sunlight. Do not store materials directly on ground.

E. Handling: Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle bare root plants carefully to avoid damaging or breaking earth ball or root structure. Do not handle plants by trunk or stem. Remove damaged plants from Project site.

1.10 FIELD CONDITIONS

A. Environment:

1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
2. Restrictions: Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceed 32 degrees C (90 degrees F).

B. Weather Limitations: Install plantings only during current and forecasted weather conditions that are comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.11 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warranty plantings against material defects.
 - 1. Warranty Period: Two years.
 - 2. Plant and Turf Warranty Periods will begin from date of planting completion.
 - 3. Contracting Officer's Representative will reinspect plants and turf at end of Warranty Period. Replace any dead, missing, or defective plant material and turf immediately. Warranty Period will end on date of this inspection provided Contractor has complied with warranty work required by this specification. Comply with following requirements:
 - a. Replace any plants more than 25 percent dead, missing or defective plant material before final inspection.
 - b. Only one replacement of each plant will be required except when losses or replacements are due to failure to comply with these requirements.
 - c. Complete remedial measures directed by Contracting Officer's Representative to ensure plant and turf survival.
 - d. Repair damage caused while making plant or turf replacements.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Provide each product from one source or manufacturer.
- B. Sustainable Construction Requirements:
 - 1. Select products with recycled content to achieve overall Project recycled content requirement.
 - a. Fertilizer.
 - b. Weed control fabric.
 - c. Root control barrier.
 - 2. Biobased Content:
 - a. Organic Mulch: 100 percent.
 - b. Peat: 100 percent.

2.2 PLANT MATERIALS (NOT USED)

2.3 SOD (NOT USED)

2.4 SEED

- A. Grass Seed: State-certified and/or State-approved seed of latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will not be acceptable. Field mixes will be acceptable when field mix is performed on site in presence of Contracting Officer's Representative.
- B. Seed Mixtures: Proportion seed mixtures by weight.
 - 1. Full Sun: Tall Fescue Blends, minimum of 3 cultivars.

2.5 TURF SELECTIONS (NOT USED)

2.6 SPRIGS (NOT USED)

2.7 PLUGS (NOT USED)

2.8 PLANTING SOILS

- A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 19 mm (3/4 inch), with maximum 3 percent retained on 6 mm (1/4 inch) screen. Mix topsoil with following soil amendments and fertilizers as recommended by soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Supplement with planting soil when quantities are insufficient.
 - 2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Contracting Officer's Representative of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil

is at least 100 mm (4 inches) deep. Topsoil from agricultural land, bogs, or marshes will be rejected.

2.9 INORGANIC SOIL AMENDMENTS

- A. Lime: Commercial grade hydrated or burnt limestone containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.
- B. Sulfur: 100 percent elemental.
- C. Iron Sulfate: 100 percent elemental.
- D. Aluminum Sulfate: Commercial grade.
- E. Perlite: Horticultural grade.
- F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.
- G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.
- H. Vermiculite: Horticultural grade for planters.
- I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.10 ORGANIC SOIL AMENDMENTS

- A. Organic Matter: Commercially prepared compost. Free of substances toxic to plantings and as follows:
 - 1. Organic Matter Content: Wood cellulose fiber, wood chips, ground or shredded bark, shredded hardwood, bark peelings, pine straw mulch, pine needles from project site when available. Biobased content 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to appropriate color to facilitate visual metering of materials application.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Natural product of sphagnum moss peat, peat moss, hypnum moss, peat reed sedge peat, peat humus derived from fresh-water site, conforming to ASTM D4427 and containing no invasive species, including seeds. Shred and granulate peat to pass 12.5 mm (1/2 inch) mesh screen and condition in storage pile for minimum 6 months after excavation. Biobased content minimum 100 percent.

- C. Composted Derivatives: Ground bark, nitolized sawdust, humus, or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having following properties:
 - 1. Particle Size: Minimum percent by weight passing:
 - a. 4.75 mm (No. 4) mesh screen: 95.
 - b. 2.36 mm (No. 8) mesh screen: 80.
 - 2. Nitrogen Content: Minimum percent based on dry weight:
 - a. Fir sawdust: 0.7.
 - b. Fir or pine bark: 1.0.
 - 3. Biobased Content: 100 percent.
- D. Manure: Well-rotted, horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

2.11 PLANT FERTILIZERS

- A. Soil Test: Evaluate existing soil conditions and requirements before fertilizer selection and application to minimize use of all fertilizers and chemical products. Obtain approval of Contracting Officer's Representative for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements. Fertilizers to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.
- B. Fertilizer for groundcover, wildflowers, and grasses is not acceptable. Provide fertilizer for trees, plants, and shrubs as recommended by plant supplier, except synthetic chemical fertilizers are not acceptable. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not acceptable.
- C. Granular Fertilizer: Organic, granular controlled release fertilizer containing minimum percentages, by weight, of plant food nutrients.
 - 1. Composition: Nitrogen, phosphorous, potassium, sulfur, and iron in amounts recommended in soil reports from qualified soil-testing laboratory.
- D. Fertilizer Tablets: Organic plant tablets composed of tightly compressed fertilizer chips, insoluble in water, to provide continuous release of nutrients for minimum 24 months and containing following minimum percentages, by weight, of plant food nutrients:

1. Nutrient Composition: 20 percent available nitrogen, 20 percent available phosphorous, and 5 percent available potassium.

2.12 WEED CONTROL FABRIC (NOT USED)

2.13 MULCH (NOT USED)

2.14 EDGING (NOT USED)

2.15 ANTIDESICCANT (NOT USED)

2.16 EROSION CONTROL

- A. Erosion Control Blankets: 100 percent agricultural straw or 70 percent agricultural straw and 30 percent coconut fiber matrix stitched with degradable nettings, designed to degrade within 12 months.
- B. Erosion Control Fabric: Knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm (3/4 to 1 inch) square with strips of biodegradable paper. Minimum filler paper strip life of six months.
- C. Erosion Control Net: Heavy, twisted jute mesh weighing approximately 605 grams per meter (1.22 pounds per linear yard) and 1200 mm (4 feet) wide with mesh openings approximately 25 mm (1 inch) square.
- D. Erosion Control Material Anchors: As recommended by erosion control material manufacturer.

2.17 ROOT CONTROL BARRIER (NOT USED)

2.18 BIOSTIMULANTS (NOT USED)

2.19 STAKING AND GUYING MATERIALS (NOT USED)

2.20 TREE WRAP (NOT USED)

2.21 TACKIFIERS AND ADHESIVES (NOT USED)

2.22 WATER

- A. Water: Source approved by Contracting Officer's Representative and suitable quality for irrigation, containing no elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

2.23 PESTICIDES (NOT USED)

2.24 FINISHES (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants as directed by Contracting Officer's Representative and provide new planting soil.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
 - 4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.
 - 5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Contracting Officer's Representative stating special conditions and proposed variance.
- B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect existing and proposed landscape features, elements, and site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on drawings.
- B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.

3.3 PLANT BED PREPARATION

- A. Verify location of underground utilities before excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside the project boundary. Where planting beds occur in existing turf areas, remove turf to depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Provide depth of plant pit excavation and relation of top of root ball and finish grade as indicated on drawings. Install plant

materials as specified in Article 3.8. Do not plant trees within 3 m (10 feet) of any utility lines or building walls.

- B. For newly graded subgrades, loosen subgrade to minimum 100 mm (4 inches) deep. Remove stones larger than 25 mm (1 inch) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
 - 1. Apply fertilizer and soil amendments directly to subgrade before loosening, at rates recommended by soils analysis.
 - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil 100 mm (4 inches) deep but minimum required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 thickness of planting soil over loosened subgrade. Mix thoroughly into top 50 mm (2 inches) of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Finish grade planting areas to smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 13 mm (1/2 inch) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in immediate future.

3.4 GROUND COVER AND PLANT INSTALLATION (NOT USED)

3.5 TREE, SHRUB, AND VINE PLANTING (NOT USED)

3.6 MECHANIZED TREE SPADE PLANTING (NOT USED)

3.7 TREE WRAP (NOT USED)

3.8 TREE AND SHRUB PRUNING (NOT USED)

3.9 STAKING AND GUYING (NOT USED)

3.10 ROOT CONTROL BARRIER INSTALLATION (NOT USED)

3.11 MULCH INSTALLATION (NOT USED)

3.12 EDGING INSTALLATION (NOT USED)

3.13 SODDING (NOT USED)

3.14 SPRIGGING (NOT USED)

3.15 PLUGGING (NOT USED)

3.16 SEEDING

- A. Broadcast and Drop Seeding: Uniformly broadcast seed at rate of 7-10 pounds per 1000 square feet. Use broadcast or drop seeders. Sow one-half seed in one direction and sow remainder at right angles to first sowing. Cover seed uniformly to maximum 6 mm (1/4 inch) deep in clay soils and 13 mm (1/2 inch) deep in sandy soils by means of spike-tooth harrow, cultipacker, raking, or other approved device.
- B. Rolling: Immediately after seeding, firm entire area, except for slopes in excess of 3 to 1, with roller not exceeding 130 kg/m (90 lb./ft.) of roller width.

3.17 HYDROSEEDING (NOT USED)

3.18 TURF RENOVATION (NOT USED)

3.19 PLANT MAINTENANCE (NOT USED)

3.20 SLOPE EROSION CONTROL MAINTENANCE

- A. Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped areas. Maintenance tasks include immediate repairs to weak spots in sloped areas and maintaining clean, clear culverts to intercept and direct water flow to prevent development of large gullies and slope erosion.
 - 1. Fill eroded areas with amended topsoil and replant with same plant species.

3.21 REMOVAL OF DYING OR DEAD PLANTS (NOT USED)

3.22 TURF MAINTENANCE (NOT USED)

3.23 CLEANING

- A. Remove and legally dispose of all excess soil and planting debris.

3.24 PROTECTION

- A. Protect plants from traffic and construction operations.
- B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

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