SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

SPEC WRITER NOTES: Use this section only for NCA projects. Delete between //----// if not applicable to project. Also delete any other item or paragraph not applicable to the section and renumber the paragraphs.

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing and installation of a complete master labeled lightning protection system, complying with NFPA 780, UL 96 and UL 96A.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL: penetrations through the roof.
B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

SPEC WRITER NOTES: Bonding buried steel to buried copper conductors and ground rods sets up a galvanic cell which will corrode the steel.

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
B. Shop Drawings:
   1. Isometric and plan views showing layout and connections to the required metal surfaces.
   2. Show the methods of mounting the system to the adjacent construction.
C. Qualifications: Submit proof that the installer of the lightning protection system is a certified Lighting Protection Institute (LPI) installer, and has had suitable and adequate experience installing other lightning protection systems, and is capable of installing the system as recommended by the manufacturer of the equipment.
D. Certification: Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer/COTR:
   1. Certification that the lightning protection system has been properly installed and tested.
   2. 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):
   70-08 .................. National Electrical Code (NEC)
   780-00 ................ Standard for the Installation of Lightning Protection Systems

C. Underwriters Laboratories, Inc. (UL):
   96-94 .................. Lightning Protection Components
   96A-02 ............... Installation Requirements for Lightning Protection Systems
   UL 467-07 ............ Standard for Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 MATERIALS

A. Attach master labels to each item by its manufacturer as evidence that the materials have been manufactured in conformance with the UL Standards for master label lightning protection materials.

B. In addition to conformance to UL 96, the component material requirements are as follows:
   1. Conductors: Electrical grade copper. Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.
   2. Air terminals: Solid copper, 457 mm (18 inches) long, not less than 9mm (3/8 inch) diameter, with sharp nickel-plated points.
   3. Ground rods: //Copper clad steel// //steel// //stainless steel// //solid copper//, not less than 13 mm (1/2 inch) diameter by 2400 mm (8 feet) long. Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to IEEE C135.30. Ground rods of copper-clad steel, steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the project.

SPEC WRITER NOTES: Designer will determine type and number of ground rods to be used; based on local conditions, earth resistivity data, and on the size and type of the electrical installation.
Copper clad steel rods will typically be specified for normal conditions. Galvanized coated steel or stainless steel rods will be typically used where low soil resistivities are encountered and galvanic corrosion may occur between adjacent underground metallic masses and the copper-clad rods. Stainless steel rods have a longer life than the zinc coated steel, but use must be justified based on the higher cost. In high resistivity soils, 3.048 m (10 foot) sectional rods may be used to obtain the required resistance to ground; however where rock is encountered, additional rods, a counterpoise, or ground grid may be necessary. Coordinate and standardize rod selection for individual facilities with other specification sections.

4. Ground plates: Solid copper, not less than 2 mm (1/16 inch) thick.

5. Tubing: Stiff copper or brass.

C. Anchors and fasteners: Bolt type which are most suitable for the specific anchor and fastener installations. Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation. Clamp-type connectors shall only be used for the connection of the roof conductor to the air terminal and to the guttering. All other connections, bonds, and splices shall be done by exothermic welds or by high compression fittings. The exothermic welds and high compression fittings shall be listed for the purpose. The high compression fittings shall be the type which require a hydraulically operated mechanism to apply a minimum of 10,000 psi.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be coordinated with the roofing manufacturer and installer.

B. Install the conductors as inconspicuously as practical and with the proper bends.

C. Install the vertical conductors within the concealed cavity of exterior walls. Run the conductors to the exterior at elevations below the finished grade and make the ground connections to the earth outside of the building.

D. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
E. Use the exothermic welding type connections that form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.

F. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between 300mm (1 foot) below and 2100mm (7 feet) above the finished grade. The conductor shall be bonded to the top and bottom of the tubing.

G. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 2mm (1/16 inch) thickness of lead to prevent staining of the exterior finish surfaces.

H. For the earth connections, install ground rods and ground plates, and the conductor connections to them and the main water pipes in the presence of the Resident Engineer/COTR. For the conductors located outside of the building, install the conductors not less than 600mm (2 feet) below the finished grade.

I. For structural steel buildings, connect the steel framework of the buildings to the main water pipe near the water system entrance to the building.

SPEC WRITER NOTES: A/E shall determine which equipment is required to be bonded, and which equipment requires an air terminal(s), depending on metal thickness.

J. Connect lightning protection cables to all metallic projections, equipment, and components above the roof as indicated on the drawings.

K. Connect exterior metal surfaces, located within 900mm (3 feet) of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.

L. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least a 203 mm (8-inch) radius and do not exceed 90 degrees.

M. Conductors shall be rigidly fastened every 900mm (3 feet) along the roof and down to the building to ground.

N. 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. Install air terminal bases, cable holders and other roof-system supporting means without piercing roof metal.

//O. Use clamp supports to secure supporting means to roof standing seams only.//
P. Use through-roof connectors for down-conductor attachment to roof system. Provide flashing in accordance with Section 07 60 00, FLASHING AND SHEET METAL.

Q. Down-conductors coursing on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 30m (100 feet).

R. A counterpoise, where shown, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600mm (2 feet) deep at a distance not less than 900mm (3 feet) nor more than 2.5m (8 feet) from the nearest point of the structure.

T. Grounding: 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.

U. Where shown, use the structural steel framework or reinforcing steel as the main conductor:
   1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
   2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
   3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18m (60 foot) intervals.
   4. Install ground connections to earth at not more than 18m (60 foot) intervals around the perimeter of the building.
   5. Weld or braze bonding plates, not less than 200mm (8 inches) square, to cleaned sections of the steel and connect the conductors to the plates.
   6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL Publication No. 96A.

V. When the lightning protection systems have been installed, have the systems inspected by a UL representative. 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 Resident Engineer/COTR.
SPEC WRITER NOTES: Insert the following paragraph for connection to existing lightning system, without master label.

//W. Where the drawings show the new lightning protection system connected to an existing lightning protection system without a UL master label, the new portion of the lightning system still requires inspection and labels as specified above for new work.//

X. Metal fences that are electrically continuous with metal posts extending at least 600mm (2 feet) into the ground require no additional grounding. Other fences shall be grounded on each side of every gate. Fences shall be grounded by means of ground rods every 300 to 450m (1000 to 1500 feet) of length when fences are located in isolated places, and every 150 to 225m (500 to 750 feet) when in proximity (30m [100 feet] or less) to public roads, highways, and buildings.

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