

University of Houston Master Specification

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SECTION 26 4113 - LIGHTNING PROTECTION FOR STRUCTURES

Maintain Section format, including the UH master spec designation and version date in the center columns of the header and footer. Complete the header and footer with Project information.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the terms "Architect" and "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

VERIFY IF LPI STANDARDS ARE TO BE USED, OTHERWISE USE UL STANDARDS

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.

1.2 SECTION INCLUDES

- A. Work Included: Provide lightning protection system work as shown, scheduled, indicated, and as specified.

1.3 STANDARDS

- A. Products and installation shall comply with applicable sections of the latest edition of the following standards:

NFPA 780 for Hazardous Occupancies, Gas Stations, Armories, etc. If selected, a ground loop is required on built-ins over 60-feet high.

- 1. **[NFPA 780 Lightning Protection Code.]**
- 2. LPI-175 Lightning Protection Installation Code.
- 3. UL 96 Lightning Protection Systems Standards for Components
- 4. UL 96A Lightning Protection Systems Standards for Installation.

- B. A complete Lightning Protection System shall be provided for the entire building **[and garage]**.

1.4 QUALITY ASSURANCE

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- A. Manufacturers: Only firms regularly engaged in the manufacture of lightning protection system components whose products have been in satisfactory use in similar service for not less than 5 years shall be used.
- B. Installer: System installer shall be a licensed electrical contractor, LPI certified Master Installer or an installer with a minimum of 5 years' experience as a UL Master Label Installer.

[VERIFY CLASS]

- C. LPI Compliance: The entire installation shall be in accordance with the LPI "Lightning Protection Installation Code", LPI-175 (latest edition), for Class [I] [II] installations.

[CLASS II INSTALLATIONS: BUILDINGS OVER 75-FEET IN HEIGHT OR ANY BUILDING IN WHICH THE STEEL FRAME IS USED AS A DOWN CONDUCTOR]

[CLASS I INSTALLATIONS: BUILDINGS UNDER 75-FEET IN HEIGHT, OR ANY BUILDING IN WHICH THE STEEL FRAME IS USED AS A DOWN CONDUCTOR]

- D. Underwriters' Laboratories, Inc. (UL) Labels: All conductors shall bear UL Label at 10-foot intervals along the length of the conductor. All air terminals shall bear UL Label. The completed installation shall be awarded the Master Label Certificate per UL 96A (latest edition).

1.5 SHOP DRAWING SUBMITTALS

- A. Shop Drawing submittals shall include, but not be limited to, the following:
 - 1. Manufacturer's data and cut sheets on all system components including, but not limited to air terminals, braces, and mounting base, main conductors, branch (secondary) conductors, ground electrode (rod, wing plate, or ground plate), bimetal splicers, clamps, fittings, and connectors, and method of roof flashing.
 - 2. Dimensioned drawings in plan view (and riser) showing accurately scaled air terminal layouts, main and branch conductor routing, down conductor location, ground electrode and inspection pit locations, counterpoise routing and all bodies of conductance and inductance connected to the system.
 - 3. Additional information as required in Section 26 0001 "Electrical General Provisions."

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Store lightning protection system materials in a clean, dry space.
- B. Handle carefully to avoid damage or bending of air terminals and components.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. General: All components of the system shall individually meet the factory inspection requirements of UL 96 for lightning protection materials. All materials shall comply in weight, size, and composition with the requirements of the Underwriters' Laboratories, Inc. and the National Fire Protection Association Code relating to this type of structure. Materials shall be designed for their intended use, and shall meet the factory inspection requirements of Underwriters' Laboratories, Inc. Provide products as specified in the following paragraphs:

[VERIFY TABLE AND CLASS AND USE OF ALUMINUM]

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1. Air Terminals: Chrome-tipped, solid copper **[or aluminum]**, 98 percent conductivity, sized per Section 4 Table **[4-1.1.1.1] [4.1.1.1.2]**, Class **[I] [II]** of NFPA 780 (latest edition).
2. Air Terminal Base Plate: Compatible copper[,] **[or]** copper alloy **[or aluminum]** suitable for intended mounting.
3. Main and Secondary Conductors, Class **[I] [II]**: Copper **[or aluminum]** conductors, sized per Section 4, Table **[4.1.1.1.1] [4.1.1.1.2]**, Class **[I] [II]** of NFPA 780 (latest edition).
4. Ground Electrode: Copper rod, wing plate, or ground plate as required by soil conditions and as required for optimum performance of entire system. Aluminum will not be acceptable.
5. Miscellaneous Hardware: Copper **[or aluminum]**, electrically compatible with other major components of the system.
6. Fasteners: UL-approved type of noncorrosive metal having ample strength to support the conductor.
7. Connectors: Provide connectors as follows:
 - a. Cable Connectors: UL-approved copper, copper-bronze, or cast bronze for use with copper conductors. Provide screw-pressure type using stainless steel bolts and nuts. ~~A~~ UL-approved fusion weld similar to "Cadweld" may be used for underground copper connections.
 - b. Connections to Building Steel or Reinforcing Steel: UL-approved fusion weld similar to "Cadweld".
 - c. Dissimilar Metals: UL-approved bimetallic connector.
 - d. Connections to Ground Rods: A UL-approved clamp, or a UL-approved exothermic weld similar to "Cadweld".

PART 3 - EXECUTION

3.1 CERTIFICATION

- A. General: The entire installed lightning protection system shall be an LPI-certified lightning protection system complying with requirements of UL 96A (latest edition) for a Master Label C, which shall be furnished. The installation shall be in accordance with recognized industry practices to ensure that products serve the intended function. All parts of the Lightning Protection System shall be bonded together. The Lightning Protection System shall be installed by a bonded Lightning Protection System Contractor who specializes in lightning protection system engineering and installation.
- B. Equipment shall be located as inconspicuously as possible. Wiring run inside building shall be installed in conduit. Provide installation diagrams for approval by Architect and Engineer before proceeding.

3.2 INSTALLATION

VERIFY USE OF ALUMINUM

- A. Aluminum Materials:
 1. Aluminum conductors shall not be permitted for installation underground or in corrosive or salt laden atmospheres. If aluminum systems are employed, suitable bimetallic connectors shall be used ahead of the copper ground electrode and counterpoise.

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2. Aluminum materials may be employed at any location where aluminum materials are used on the structure, are contiguous to the lightning protection system elements, and are approved by the Engineer. All aluminum elements shall be sized for equal ampacity and conductivity as required for copper.
- B. Exothermic Welds: Exothermic welds will not be permitted on loose weave conductors, but may be used on conductors which are stranded tightly, for sizes 197 MCM and larger.
- C. Down Conductors: Down conductors shall be concealed at all points within the structure.
- D. Visual Access: All points of connection shall have visual access. Provide visual access via inspection pits and similar means.
- E. Cable Runs: Provide a perimeter cable run around the perimeter of the main roof and all penthouses. Provide other cable runs to meet specified requirements. Provide downloads as required to bond cable runs to ground electrodes. Where building structure is steel, the building steel may be used for downloads where permitted.
 1. Roof: Exposed and fastened 3 feet on center maximum. Cable bend shall be minimum 8 inch radius with maximum 90-degree bends.
 2. Underground: Copper cable direct buried.
 3. Down Conductors: Concealed and installed in a minimum one inch PVC conduit.
- F. Air Terminals: Provide 18 inch projection air terminals at a maximum spacing of 20 feet around perimeter cable runs, and 24 inch projection air terminals at a maximum spacing of 25 feet apart through the center of flat roofs.
- G. Metal Bodies of Conductance: Bond all metal bodies of conductance which are located on the roof to the lightning protection system. This includes, but is not limited to exhaust fans, vents, handrails and ladders, metal screens and panels, air conditioning units, pumps, hatches, flag poles, antennas, and any metal body which exceeds the height of air terminals.
- H. Metal Bodies of Inductance: Bond all metal bodies of inductance located within 6-feet of a cable run or bonded object to the Lightning Projection System. This includes, but is not limited to: flashings; metal coping caps; gravel guards; fascias; roof drains; downspouts; interior ducts, equipment and piping; or in general, any isolated body at or below the roof in the 6-foot zone mentioned above.
- I. Roof Penetrations: Use properly flashed fittings for non-leaking roof penetrations at downloads and other areas where roof penetrations are required.
- J. Ground Electrodes: Ground rods shall be driven so that the bottom of the rod is at least 10-feet below grade and not less than 2-feet from the building wall.

LOOP ONLY REQUIRED FOR UL 780

- K. **[Ground System Loop Interconnection: Lightning ground rods specified shall be interconnected with a bonding loop conductor below the building slab. The loop thus formed shall be bonded to the electric service ground and the transformer ground rods at the point of attachment to the ground rods. Ground connections shall interconnect with the main conductive grounding system of the structure.]**
 - L. **[Provisions: Install air terminal devices and down conductors such that the future vertical expansion of the building may incorporate these devices.]**
- 3.3 TESTING

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- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Overall system resistance shall not exceed 25 ohms total. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument.
- B. Submittals: Contractor shall furnish all instruments and personnel required for tests. Submit two copies of certified test results for Owner's record and submit four copies of certified test results to Architect and Engineer for review. Test reports shall include time and date of tests, relative humidity, temperature and weather conditions.

END OF SECTION 26 4113

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