SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

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

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

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY

Retain one of two paragraphs below. See Table 2 in the Evaluations for a list of the standards and the miscellaneous structures and special occupancies that are covered by the referenced standards.

* + - * 1. Section includes lightning protection system for ordinary structures.
				2. Section includes lightning protection system for the following:

Ordinary structures.

<**Insert one or more miscellaneous structures or special occupancies**>.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.
				5. Shop Drawings:

Include layouts of the lightning protection system, with details of the components to be used in the installation.

Include raceway locations needed for the installation of conductors.

Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.

Retain first subparagraph below to ensure coordination with roof installation, so as not to void roof warranty.

Include roof attachment details, coordinated with roof installation.

The calculations referred to by the subparagraph below determine the sideflash distance. Calculate according to NFPA 780; for UL 96A, use the 6-foot rule. Metal bodies inside this distance need to be bonded, whereas the metal bodies outside the distance do not.

Calculations required by NFPA 780 for bonding of metal bodies.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Lightning protection cabling attachments to roofing systems and accessories.

Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.

Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

Coordinate "Qualification Data" paragraph below and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For Installer.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.
				2. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Maintenance Data: For lightning protection system to include in maintenance manuals.

Include the following:

Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations.

A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

* + - * 1. Completion Certificate:

Retain one of four options in subparagraph below. Coordinate subparagraph below with "Special Inspections" paragraph in Part 3 "Field Quality Control" Article.

[**UL Master Label Certificate**] [**UL Letter of Findings Limited Scope Inspection Report**] [**LPI Master Certificate**] [**LPI Limited Scope Certification**].

* + - 1. QUALITY ASSURANCE

Retain one of or both installer options in "Installer Qualifications" paragraph below. Either installer is qualified to install UL- or LPI-certified lightning protection systems.

* + - * 1. Installer Qualifications: [**UL-listed installer, category OWAY**] [**or**] [**LPI Master Installer**].
				2. Equipment Qualifications For Products Other Than Those Specified:

At the time of submission provide written notice to the Director of the intent to propose an “or equal” for products other than those specified. Make the “or equal” submission in a timely manner to allow the Director sufficient time to review the proposed product, perform inspections and witness test demonstrations.

If products other than those specified are proposed for use furnish the name, address, and telephone numbers of at least 5 comparable installations that can prove the proposed products have performed satisfactorily for 3 years. Certify in writing that the Director’s Representative of the 5 comparable installations will allow inspection of their installation by the Director's Representative and the Company Field Advisor.

Make arrangements with the Director’s Representative of 2 installations (selected by the Director) for inspection of the installations by the Director's Representative. Also obtain the services of the Company Field Advisor for the proposed products to be present. Notify the Director a minimum of 3 weeks prior to the availability of the installations for the inspection, and provide at least one alternative date for each inspection.

Only references from the actual Director or Director’s Representative (Security Supervisor, Maintenance Supervisor, etc.) will be accepted. References from dealers, system installers or others, who are not the actual Director’s Representative of the proposed products, are not acceptable.

Verify the accuracy of all references submitted prior to submission and certify in writing that the accuracy of the information has been confirmed.

The product manufacturer shall have test facilities available that can demonstrate that the proposed products meet the contract requirements.

Make arrangements with the test facility for the Director's Representative to witness test demonstrations. Also obtain the services of the Company Field Advisor for the proposed product to be present at the test facility. Notify the Director a minimum of 3 weeks prior to the availability of the test facility, and provide at least one alternative date for the testing.

Provide written certification from the manufacturer that the proposed products are compatible for use with all other equipment proposed for use for this system and meet all contract requirements.

* + - * 1. Installers’ Qualifications: The system shall be installed by a firm actively engaged in the installation of Underwriters Laboratories Inc. Master Labeled Lightning Protection Systems. The persons performing the Work of this section and their supervisor shall be personally experienced in lightning protection systems and shall have been regularly employed by a Company engaged in the installation of this type system for a minimum of 3 years.

Furnish to the Director the names and addresses of 5 similar projects which they have worked on during the past 3 years.

* + - * 1. Underwriters Laboratories Inspection:

Send completed Master Label Application Form to Chicago Office of Underwriters Laboratories Inc.

After completion of UL inspection and acceptance, install Master Label at appropriate location.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. MANUFACTURERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2216) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Harger Lightning & Grounding](http://www.specagent.com/Lookup?uid=123457098109).

[Heary Bros. Lightning Protection Co. Inc](http://www.specagent.com/Lookup?uid=123457098110).

[Independent Protection Co](http://www.specagent.com/Lookup?uid=123457098111).

Or equal.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "NFPA Lightning Protection Standard" or "UL Lightning Protection Standard" paragraph below. See "Lightning Protection Standards" Article in the Evaluations for a discussion of whether or not to retain the requirement of complying with NFPA 780 or UL 96.

* + - * 1. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for [**Class I**] [**Class II**] buildings.
				2. UL Lightning Protection Standard: Comply with UL 96A requirements for [**Class I**] [**Class II**] buildings.

Retain "Lightning Protection Components, Devices, and Accessories" paragraph below to specify that components of lighting protection system comply with requirements of lighting protection standard chosen in retained paragraph above.

* + - * 1. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.
			1. MATERIALS

NFPA 780, LPI 175, and UL 96A stipulate minimum size requirements for components, depending on selected metal and class of building. To require components larger than minimum size, to specify component material composition, or for Projects with unique lighting protection requirements, add component requirements here.

The specified standards prohibit the use of aluminum conductors and materials embedded in concrete or masonry, or installed in a location subject to excessive moisture, and within 18 in of the point where the lightning protection system conductor comes into contact with the earth.

* + - * 1. Air Terminals:

[**Copper**] [**Stainless steel**] [**or**] [**Aluminum**] unless otherwise indicated.

 [**1/2-inch**] diameter by [**10 inches**] [**12 inches**] [**15 inches**] [**18 inches**] [**24 inches**] <**Insert length of air terminal**> long.

[**Pointed**] [**Rounded**] tip.

[**Integral base support**] [**Threaded base support**].

Retain "Air Terminal Bracing" paragraph below for terminals more than 24 inches in height that require bracing.

* + - * 1. Air Terminal Bracing:

[**Aluminum**] [**Copper**] [**Stainless steel**] [**Galvanized steel**].

[**1/4-inch**] <**Insert size**> diameter rod.

Retain "Class 1 Main Conductors" paragraph for structures less than 75 feet high, or retain "Class II Main Conductors" paragraph below for structures more than 75 feet high. Secondary conductor shall be of same material composition as main conductor.

* + - * 1. Class 1 Main Conductors:

[**Stranded Copper: 57,400 circular mils in diameter**].

[**Aluminum: 98,600 circular mils in diameter**].

* + - * 1. Class II Main Conductors:

[**Stranded Copper: 115,000 circular mils in diameter**].

[**Aluminum: 192,000 circular mils in diameter**].

* + - * 1. Secondary Conductors:

[**Stranded Copper: 26,240 circular mils in diameter**].

[**Aluminum: 41,400 circular mils in diameter**].

Retain "Ground Loop Conductor" paragraph below if soil conditions at the Project site dictate the use of tinned conductors. If a ground ring is present, a ground loop may not be required. See discussion of ground rings in "Grounding and Bonding" Article in the Evaluations.

* + - * 1. Ground Loop Conductor: [**Stranded copper**] [**Tinned copper**]**.**

Copper-clad, steel ground rods are the most common grounding electrodes. See "Corrosion" Article in the Evaluations for assistance in selecting ground rod materials. UL 96 and NFPA 780 allow the use of ground rods no less than 1/2 inch (12.7 mm) in diameter and 96 inches (2400 mm) long. The smallest ground rod size commonly available is 5/8 inches (16 mm) in diameter by 96 inches (2400 mm) long.

* + - * 1. Ground Rods:

Material: [**Solid copper**] [**Copper-clad steel**] [**Stainless steel**].

Retain one of first two subparagraphs below if minimum dimensioned rods do not comply with Project requirements. The heavier rod dimensions give additional strength that may be needed due to soil conditions, but do not improve ground resistance.

Diameter: [**3/4 inch**].

Rods shall be not less than 120 inches long.

[**Sectional type, with integral threads**].

Retain "Conductor Splices and Connectors" paragraph below to prevent use of finger-, crimp-, and saddle-type cable connectors.

* + - * 1. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.
				2. Attachments: Fasteners shall be of suitable configuration for the intended application and of the same material as the conductor. Nails, screws, or bolts employed to secure the fasteners shall be of the same material as the fasteners or of material which is as resistant to corrosion as that of the fasteners. (Galvanized or plated steel nails, screws, or bolts are not acceptable).
				3. Chimneys:

All materials for this installation shall be Class III, as defined by Underwriters Laboratories Inc. for use on heavy duty smoke stacks.

Copper shall be of the grade ordinarily required for commercial electrical Work, generally designated as being 98 percent conductivity when annealed.

Materials used within 25’-0” of the top of the stack shall have a continuous covering of lead at least 1/6 inch thick.

Air Terminals: Solid copper having a minimum diameter of 5/8 inch and length to extend above the top of the stack not less than 18 inches nor more than 30 inches.

Conductors:

Copper, weighting not less than 6 ounces per linear foot (375 pounds per thousand feet).

The size of any wire in the conductor not less than No. 15 AWG (.057 inch).

The thickness of any web or ribbon not less than No. 12 AWG (.080 inch).

Attachments: All attachments (brackets, splicers, fasteners, connectors, clamps, clips) shall be made of bronze.

Joints: Joints shall be of such construction as to show by laboratory tests, a strength in tension of at least 50 percent of that of the conductor.

Ground Electrodes: Solid copper or copper-clad ground rods; 3/4 inch minimum diameter, 10’-0” long.

1. EXECUTION
	* + 1. INSTALLATION

Revise first paragraph below to indicate which standards apply. Retain UL 96A if just compliance with UL Master Label or LPI certification is desired. Retain NFPA 780 if the most stringent or comprehensive requirements are needed.

* + - * 1. Install lightning protection components and systems according to [**UL 96A**] [**NFPA 780**].
				2. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.
				3. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for [**concealed installations in UL 96A**] [**concealed systems in NFPA 780**].

Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.

Install conduit where necessary to comply with conductor concealment requirements.

Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems." Retain "Air Terminals on Single-Ply Membrane Roofing" subparagraph below for single-ply membrane roofing.

Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

A ground ring installation based on requirements in Section 260526 "Grounding and Bonding for Electrical Systems" may be used as a ground loop for the lightning protection system, provided the counterpoise conductor complies with or exceeds minimum NFPA 780 requirements.

* + - * 1. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.
			1. CONNECTIONS

NFPA 780 allows for four different connection types (bolted, welded, high compression, and crimp). High-compression connectors and exothermic welds are the only type of connections suitable for both underground and concealed connections. Bolted- or crimp-type connections are suitable for aboveground, interior, and exterior exposed applications.

* + - * 1. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.
				2. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: [**bolted connectors**] [**exothermic weld**] [**high compression**] [**crimp**].
				3. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

* + - 1. CORROSION PROTECTION
				1. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
				2. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.
			2. FIELD QUALITY CONTROL

Retain first option in "Special Inspections" paragraph below if Director’s Representative engages special inspector. Consider retaining second option if authorities having jurisdiction allow Contractor to engage special inspector. If retaining second option, retain "Field quality-control reports" paragraph in "Informational Submittals" Article. See "Lightning Protection System Certificates" Article in the Evaluations.

* + - * 1. Special Inspections: [**Director’s Representative will engage**] [**Engage**] a qualified special inspector to perform the following special inspections:

Retain one of two subparagraphs below.

Perform inspections as required to obtain a UL Master Label for system.

Perform inspections to obtain an LPI certification.

* + - * 1. Prepare test and inspection reports and certificates.

END OF SECTION 264113