

SECTION 16670

LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this section of the specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of Article IV of the CONTRACT AND GENERAL CONDITIONS.
- C. Refer to Division 1, Sections 01010 - 01770 for additional information.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02070 – Selective Demolition
- B. Section 07510 – Thermoplastic Roofing and Flashing

1.3 SCOPE OF WORK

In general, the Contractor shall supply all labor, materials, equipment, temporary protection, tools and appliances necessary for the proper completion of the work in this Section, as required in the Specifications and in accordance with good construction practice. The work under this Section generally includes the following:

- A. Remove and resecure the existing lightning protection cable as required to remove and replace the roof system. Refer to the Contract Documents for additional information.
- B. Replace defective lightning protection cable and missing terminals as Unit Prices.
- C. Cut and splice the existing lightning cables for the installation of new through deck weatherheads – refer to Section 07510 – Thermoplastic Roofing and Flashing for additional information.
- D. Replace all parapet mounting hardware with low-slope roofing hardware, substitute aerial terminals into new low-slope hardware.

1.4 JOB CONDITIONS

- A. Should the Sub-contractor not complete his/her work as originally outlined in the General Contractor's initial schedules, they will be responsible for all access beyond the completion date at no additional cost to the Owner.

- B. Provide site specific work/safety plan for the Owner's review and files. Plans shall include, but not be limited to, fall arrest, handling of materials, lead work plans for removal of the existing metals, etc.
- C. Schedule and execute all work without exposing the building interiors to inclement weather. Protect all new and existing roof work, the building and its contents from staining and damages. Segregate all work areas from the building occupants.
- D. The Contractor is cautioned to take all necessary precautions and make all investigations necessary to install the work. The Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.
- E. The lightning protection work shall be coordinated with the roof work in such a manner that traffic on the new roof system is reduced.
- F. The lightning protection work shall be performed by licensed electricians.

1.5 SUBMITTALS

- A. The Contractor shall submit project literature and samples for the items listed in this section in accordance with Section 01330 –Submittal Procedures:
 - 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.
- B. Qualifications: Submit proof that the installer of the lightning protection system 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.
- C. Certifications: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the installed lightning protection system has been inspected above the roof line by a UL representative and has been approved by UL without variation.
- D. Permits: Submit copies of the electrical permits prior to performing any electrical modifications. Submit copies of the electrical inspectors final approval and inspection of the electrical systems.

1.6 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The issue in effect listed below (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by designation only.

- A. National Fire Protection Association (NFPA):
- 70-99 National Electrical Code (NEC)
780-97 Standard for the Installation of Lightning Protection System
- B. Underwriters Laboratories, Inc. (UL):
- 96-94 Standard for Lightning Protection Components
96A-94 Installation Requirements for Lightning Protection Systems

PART 2 - MATERIALS

2.01 METAL COMPONENTS

In general, protection systems shall be made of materials that are resistant to corrosion or acceptably protected against corrosion. Combinations of materials that form electrolytic couples of such a nature that in the presence of moisture corrosion is accelerated shall not be used. One or more of the following materials shall be used:

- A. Where copper is used, it shall be of the grade ordinarily required for commercial electrical work, generally designated as being of 95-percent conductivity when annealed.
- B. Where alloys of copper are used, they shall be as substantially resistant to corrosion as copper under similar conditions.
- C. Where aluminum is used, care shall be taken not to use it where contact could be made with earth or anywhere it could rapidly deteriorate. Conductors shall be of electrical grade aluminum.
- D. Minimum material requirements for each Type of Conductor Class are listed below:

Main Roof & Penthouse Roofs 1 – 3
Minimum Class II Material Requirements

Type of Conductor		<u>Copper</u>		<u>Aluminum</u>	
		Standard	Metric	Standard	Metric
Air Terminal, Solid Main Conductor, Cable	Diameter	1/2 in.	12,7 mm	5/8 in.	15.9 mm
	Size ea. Strand	15 AWG		13 AWG	
	Wgt. Per Length	375 lb/ 1000 ft.	558 g/m	190 lb/ 1000 ft.	283 g/m
	Cross Sect. Area	115,000 CM	58 mm ²	192,000 CM	97 mm ²
Bonding Conductor, Cable (Solid or Stranded)	Size ea. Strand	17 AWG		14 AWG	
	Cross Sect. Area	26,240 CM		41,100 CM	
Bonding Conductor, Solid Strip	Thickness	0.051 in.	1.30 mm	0.064 in.	1.63 mm
	Width	1/2 in.	12.7 mm	1/2 in.	12.7 mm

PART 3 - EXECUTION

3.01 GENERAL

- A. In General, an ordinary structure shall be any structure that is used for ordinary purposes whether commercial, industrial, farm, institutional, or residential. Ordinary structures not exceeding 75 ft. (23 m) in height shall be protected with Class I materials as shown in Table 3-1.1(a). Ordinary structures greater than 75 ft. (23 m) in height shall be protected with Class II materials. If part of a structure is over 75 ft. (23 m) in height (e.g., steeple) and the remaining portion does not exceed 75 ft. (23 m) in height, the requirements for Class II air terminals and conductors shall apply only to that portion exceeding 75 ft. (23 m) in heights. Class II conductors from the higher portion shall be extended to ground and shall be interconnected with the balance of the system.
- B. All work in this Section shall be coordinated with roof replacement work.
- C. The Contractor is cautioned to investigate all existing conditions and materials of construction.
- D. Copper lightning protection materials shall not be installed on aluminum roofing, siding, or other aluminum surfaces.
- E. Aluminum lightning protection materials shall not be installed on copper surfaces.

3.02 AIR TERMINALS

- A. The tip of an air terminal shall be not less than 10 inches (254 mm) above the object or area it is to protect.
- B. Air terminals shall be secured against overturning by attachment to the object to be protected or by means of braces that shall be permanently and rigidly attached to the building. An air terminal exceeding 24 inch (600 mm) in height shall be supported at a point not less than one-half its height.

3.03 ZONE PROTECTION

At a minimum, the zone protection used at the site shall include the following strike termination locations:

- A. Strike termination devices shall be placed at or within 2 feet of edges and outside corners of the flat roofs.
- B. Strike termination devices shall be placed at intervals not exceeding 20 feet (6 m).
- C. Strike termination devices 24 inches (600 mm) or more above the object or area to be protected shall be permitted to be placed at intervals not exceeding 25 feet (7.6 m).

- D. Flat roofs that exceed 50 feet (15 m) in width or length shall have additional strike termination devices located at intervals not to exceed 50 feet (15 m) on the flat areas.

3.04 REINSTALLATION

- A. The contractor shall survey the existing air terminals and conductors and reuse where applicable. Reinstall the existing conductors as inconspicuously as practical and with the proper bends.
- B. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
- C. Use the exothermic welding type connections which form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.
- D. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between 300 mm (one foot) below and 2100 mm (seven feet) above the finished grade.
- E. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 2 mm (1/6 inch) thickness of lead to prevent staining of the exterior finish surfaces.
- F. Connect exterior metal surfaces, located within 900 mm (three feet) of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.
- G. Weld or bond the non-electrically-continuous sections together and make them electrically-continuous.
- H. Verify the electrical continuity by measuring the ground resistance to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
- I. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18000 mm (60 foot) intervals.
- J. Install ground connections to earth at not more than 18000 mm (60 foot) intervals.
- K. Weld or braze bonding plates, not less than 200 mm (eight inches) square, to cleaned sections of the steel and connect the conductors to the plates.
- L. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to the UL Publication No. 96A.

- M. When the lightning protection systems have been installed, have the systems inspected by a UL representative. Obtain and install a UL numbered master label "C" for each of the lightning protection systems at the location directed by the UL representative and the Resident Engineer.
- N. Where the new lightning protection system is 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.

3.05 CORROSION PROTECTION

Precautions shall be taken to provide the necessary protection against any potential deterioration of any lightning protection component due to local conditions. Copper components installed within 24 in. (600 mm) of the top of the chimney or vent emitting corrosive gases shall be protected by a hot-dipped lead coating or equivalent.

3.06 CLEAN-UP

All floor and adjacent areas, both interior and exterior, damaged or stained by the installation of the lightning protection work shall be repaired and cleaned of all dust, debris and any other materials to the Owner's satisfaction.

END OF SECTION

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