



**Section 33 79 00 (Formerly 16711) WIRELESS COMMUNICATION SITES LIGHTNING PROTECTION AND GROUNDING SYSTEM SPECIFICATION**

**Part 1 – GENERAL**

1.01 Summary:

- a. Provide a complete lightning protection and grounding system for the tower and the building(s) or structures included on the contract drawings that do not fall within a zone of protection generated by the taller tower. The system shall provide safety for the objects mounted on the tower, the building, the buildings contents and occupants by preventing damage caused by lightning. The design of this system is to be in strict accordance with this section of the specifications and all contract drawings that apply.
- b. The lightning protection system on the building(s) shall be installed by a firm actively engaged in the installation of Lightning Protection System. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association’s Lightning Protection Standard, NFPA 780.
- c. The work covered under this section of the specification consists of furnishing an adequate number of skilled trained personnel, materials and services required for the completion of a functional and unobtrusive lightning protection system on the shelter and a complete grounding system for the site.

1.02 References:

- a. Lightning Protection for the Shelter
  - I. NFPA 780, Standard for the Installation of Lightning Protection Systems.
  - II. UL 96A, Installation Requirements for Lightning Protection Systems.
  - III. Harger Lightning Protection System Specification Section 16670
- b. Grounding
  - I. NFPA 70, National Electric Code
  - II. IEEE Std.1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment.

1.03 Submittals:

- a. Shop drawings shall be submitted to the architect and engineer for approval prior to commencement of the installation. Shop drawings are to show the extent of the system layout designed specifically for the building(s) or structures included in the contract drawings along with details of the products to be used in the installation.

**Part 2 – TOWER**

2.01 Air Terminals:

- a. Air terminal(s), (lightning rod) shall extend a minimum of two feet above the tallest object on the tower (verify all objects on the tower fall within a zone of protection, the zone of protection shall



be determined by utilizing the 150 foot radius rolling sphere concept). If required the air terminals may be mounted at an angle on the side of the tower to insure the object falls within the zone of protection.

- b. The air terminals shall be constructed of 304 stainless steel or copper clad steel for strength. Two inches of thread shall be provided on the bottom of the air terminal for mounting purposes. The air terminal shall be fastened to the tower with pressure type connections utilizing stainless steel nuts and lock washers.

#### 2.02 Down Conductors:

- a. The tower legs shall be utilized as the down conductor for the lightning protection system as they provide an acceptable path of conductance; in addition utilizing the tower legs will eliminate the need to fasten the down conductor the entire height of the tower.

#### 2.03 Grounding

##### a. Coax Cables:

- I. The coax cables shall be grounded to the tower at the top and bottom, and right before entering the equipment shelter, using coaxial grounding kits. Ground bars may be mounted on the tower to provide grounding points for the coaxial grounding kits. If the tower is taller than 150', the cables shall be grounded every 75' or less. The coax cables shall be run down the center of the tower whenever possible.

##### b. Ground Rods:

- I. Ground radials utilizing 5/8" x 10' copper clad steel ground rods and #2 AWG solid tin coated copper ground conductor shall be used as the grounding electrodes. The ground conductor shall be connected to the tower or to a tower leg grounding strap with Ultraweld exothermic connections. In new construction, the rebar in the tower footing shall also be connected to the grounding system with Ultraweld exothermic connections.
- II. The ground rods shall be spaced 16' apart along the radial. The #2 AWG ground conductors shall be connected to the ground rod using Ultraweld exothermic connections. The length and number of ground radials required will vary due to ground resistance which is affected by the soil conditions. The length of the radials should not be more than 75'. The ground resistance shall be measured periodically, (during different climatic conditions), and shall always measure 5 Ohms or less.

##### c. Ground Loop Conductor:

- I. A ground loop conductor utilizing #2 AWG solid tinned copper conductor shall encompass the base of the tower and shall be connected to the shelter grounding system and shall interconnect all ground electrodes.

##### d. Guy Wires:

- I. Guy wires and guy anchors shall also be grounded. Tinned coated bronze or stainless steel pressure connectors shall connect the guy wires to the #2 AWG solid tinned copper conductors. The ground conductor should be connected to the guy anchor with Ultraweld exothermic



connections if permitted by the manufacturer. The conductors shall be connected to two 5/8" x 10' copper clad ground rods spaced 16' apart with Ultraweld exothermic connections.

### Part 3 – SHELTER

3.01 A shelter that is not located within a zone of protection generated by the tower shall be protected by a lightning protection system.

#### 3.02 Air Terminals:

- a. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Air terminals shall be located within two feet of roof edges and outside corners of protected areas.
- b. Air terminals shall be installed on mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.
- c. Air terminal bases shall be securely fastened to the structure in accordance the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.
- d. Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees nor have a radius of bend less than 8 inches.
- e. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. Where down conductors are installed exposed on the exterior of a structure and are subject to physical damage or displacement, guards shall be used to protect the conductor a minimum of 6 feet above grade. Metallic guards shall be bonded at each end.

#### 3.03 Roof Penetrations

- a. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning



conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

### 3.04 Grounding

#### a. Ground Loop Conductor

- I. A ground loop conductor utilizing #2 AWG solid tinned copper conductor shall encompass the shelter and be connected to the tower grounding system and shall interconnect all ground electrodes.

#### b. Ground Electrodes

- I. Ground electrodes shall be copper clad steel and a minimum 5/8" diameter and 10 feet long. A ground electrode shall be provided for each down conductor and shall be spaced on average 16' apart. The down conductor shall be connected to the ground electrode by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).

#### c. Bonding

- I. The structural steel and or rebar of the shelter shall be connected to the ground loop at each corner with Ultraweld exothermic connections.

#### d. Ground Mesh

- I. Equipotential ground mesh shall be provided and connected to the tower grounding system and the shelter ground loop with Ultraweld exothermic connections. The ground mesh can be strategically placed to help protect personnel against step and touch voltages and improve the grounding system. 5/8" x 10' copper clad ground rods shall be connected to each corner of the ground mesh with Ultraweld exothermic connections.

#### e. Ground Bars

- I. A 1/4" thick copper exterior ground bar shall be provided and installed on the exterior of the shelter near the point where the coax lines enter the shelter. The ground bar shall be connected to the grounding system with an Ultraweld exothermic connection and shall serve as the single point ground bus.
- II. A 1/4" thick copper interior ground bar shall be provided and installed on the inside of the shelter on the opposite side of the wall that the exterior ground bar is mounted. The interior ground bar shall be connected to the exterior bar using a min. 2" wide copper strap, #2 AWG solid tinned copper ground conductor or with a solid copper or brass horizontal riser bar. When using a copper flat strap or conductor the connections to the interior and exterior bars should be with an Ultraweld exothermic connection when possible. All interior equipment and grounded metal bodies shall be connected to the interior ground bar.



### 3.05 Equipotential Grounding

- a. Common interconnection of all grounded systems within the building shall be ensured by interconnecting to the lightning protection system using main size conductor and fittings.
- b. This interconnection shall include but is not limited to the electrical service, telephone and antenna system grounds as well as all underground metallic piping systems including water, gas and sewer. Interconnection to a gas or water line shall be made on the customer's side of the meter. Fences, generators and rebar in new construction shall also be bonded to the grounding system. Steps shall be taken to ensure a continuous bond for all grounded metal bodies. All underground and wherever possible above ground connections shall be with Ultraweld exothermic connections.

## Part 4 – Difficult Grounding Conditions

- 4.01 If the site soil resistivity is 15,000Ωcm or greater, standard approaches to achieving the required system ground resistance may be ineffective. In this situation, the ground electrode system may require the use of enhanced ground rod electrodes and or the utilization of Ultrafill ground enhancement backfill materials. Contact Harger Lightning & Grounding for solutions when difficult grounding conditions are encountered.

## Part 5 – Equipment Protection

### 5.01 RF Surge Protection

- a. All coax cables shall be grounded to the single point exterior ground bar before entering the building. In-line suppressors shall be installed immediately after the coax enters the building. These suppressors shall be grounded to the interior ground bar.

### 5.02 A/C Surge Suppression

- a. Surge suppression shall be provided at all service entrances.
- b. Surge protection shall be installed at the service entrance panel. The unit shall have one time withstand surge capacity of 100 KA or more. (One time withstand if an 8 x 20 micro second pulse stated in thousands of amperes). The surge protection unit shall be a UL 1449 listed device.
- c. Series type plug-in suppressors shall be installed at the plug-in receptacles where sensitive communications equipment is connected.

### 5.03 Telephone / Data Surge Suppression

- a. Surge suppression shall be provided at all service entrances and at entrances of conductive signal, data and communication services.
- b. In-line twisted pair protectors shall be installed for all telephone, data, fax, modem lines, etc. They shall also be bonded to the interior ground bar.



## Part 6 – Acceptable Sources / Manufacturers

### 6.01 Acceptable Manufacturers

#### a. Harger Lightning & Grounding

301 Ziegler Drive, Grayslake, IL 60030

(847) 548-8700 • 800-842-7437 • Fax (847) 548-8755

E-mail: [hargersales@harger.com](mailto:hargersales@harger.com) • Web-site: [www.harger.com](http://www.harger.com)

## Part 7 – List of Approved Materials

- 7.01 Air Terminals - #585CCAT, #586SS3AT, #586SS3AT, #585CCAT-2/0, #1224CUAT, #1212CUAT (Harger Lightning & Grounding) or other approved Harger air terminals
- 7.02 Air Terminals Bases - #CUBU12I, #CPRB1.5/2AT12, #158 (Harger Lightning & Grounding) or other approved Harger air terminal bases
- 7.03 Coax Ground Kits – CGKB Series (Harger Lightning & Grounding)
- 7.04 Pressure Connectors - #204T, #SSC25/875 (Harger Lightning & Grounding) or other approved Harger connectors
- 7.05 Ground Bars - #EPK Series, #GBIA14424M (Harger Lightning & Grounding) or other approved Harger ground bars
- 7.06 Ground Mesh - #GM121266, #GM121266SPR12 (Harger Lightning & Grounding)
- 7.07 Ground Rods - #5810 (Harger Lightning & Grounding)
- 7.08 Ground Conductor - #2T (Harger Lightning & Grounding)
- 7.09 Enhanced Ground Rods - #EGR Series (Harger Lightning & Grounding)
- 7.010 Ground Enhancement Material - #ULTRAFILL (Harger Lightning & Grounding)
- 7.011 Lightning Conductor - #28T (Harger Lightning & Grounding)
- 7.012 Exothermic Connections – Ultraweld (Harger Lightning & Grounding)

**END OF SECTION 33 79 00**