Specification – Lightning Protection Systems

General:

Summary –

A) This Section specifies the lightning protection and grounding system for the building(s) or structure(s). This system provides facility protection for the building and occupants by preventing damage to the structure caused by lightning and induced transient currents. The design of this system is to be in strict accordance with this section of the specification and all contract drawings that apply.

B) The work covered under this section of the specifications consists of furnishing labor, materials and engineering services required for the completion of a functional and unobtrusive lightning protection and facility grounding system approved by the architect and engineer.

System Description –

The entire lightning protection system shall be designed and installed in accordance with:

A) Lightning Protection Institute (LPI) Standard #175
B) National Fire Protection Assoc. (NFPA) Document #780
C) Underwriters' Laboratories, Inc. (U/L) Standard #96A
D) NEC

Submittals –

A complete shop drawing shall be submitted to the architect and engineer for approval prior to commencement of the installation. The shop drawing will show the extent of the system layout designed for the structure along with details of the products to be used in the installation.

Quality Assurance –

A) The contractor shall furnish an LPI-IP Certificate or a UL Certificate upon completion of the installation.

B) The System Design shall be completed and the shop drawing stamped by an LPI Certified Master Designer - Installer of Lightning Protection Systems.

C) The installing contractor shall be listed with the Lightning Protection Institute, and Underwriters' Laboratories, Inc. The installation contractor shall have personnel on staff Certified by the LPI as a Master Installer – Designer of lightning protection systems. LPI qualified staff, Journeyman

or higher, shall provide on-site supervision of the installation to the Standards.

Products:

Standards –

All materials shall comply in weight, size, and composition with the requirements of the UL 96 Materials Standards. All equipment shall be UL listed and properly labeled. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment and a member of LPI. Equipment shall be the manufacturer's latest approved design of construction to suit the application where it is to be used in accordance with accepted industry standards and with NFPA, LPI, & UL requirements.

Surge Suppression products for the electrical service entrance shall comply with both NFPA 780 Sec 4.18 and UL 1449 3rd Edition. Surge Suppression products for the communication service shall meet NFPA 780 Sec 4.18.

Acceptable Manufacturers –

ERICO, Inc. (www.erico.com)
Thomas & Betts / Furse (www.tnb.com)
Lyncole (www.lyncole.com)
VFC ZPen® (www.vfcinc.com)

Materials – XIT Grounding System

A) A Lyncole XIT$_{TM}$ Grounding System shall be installed at Electrical Service Entrance. Either a vertical or horizontal 10' unit shall be used. Lyncole part numbers K2-10CSD, or K2L-10CSD
B) A Main Ground bar shall be installed at the electrical service with minimum dimensions of ¼" x 4" x 24" with 2 hole lug spacing.

Materials – Lightning Protection

A) Class I materials shall be used for systems on structures not exceeding 75 feet in height and Class II materials shall be used for systems on structures exceeding 75 feet above grade.
B) Copper shall be of the grade ordinarily required for commercial electrical work, generally designated as being 95 percent conductive when annealed.
Aluminum conductors shall be of electrical grade aluminum.

C) Lightning protection materials shall be coordinated with building construction materials to assure compatibility. Aluminum lightning protection materials shall not be embedded in concrete or masonry, installed on or below copper surfaces, or used for the in-ground system. Copper lightning protection materials shall not be installed on aluminum surfaces or on exterior sheet metal surfaces. Copper system components within 2 feet of chimney exhausts shall be tin coated to protect against deterioration.

D) Strike termination devices shall be provided to place the entire structure under a zone of protection as defined by the Standards. Air terminals shall project a minimum of 10 inches above protected areas or objects. Air terminals shall be located within 2 feet of exposed corners and roof edges.

E) Metallic bodies having a thickness 3/16” or greater may serve as strike termination devices without the addition of air terminals. These bodies shall be made a part of the lightning protection system by connection(s) according to the Standards using main size conductors and bonding fittings with 3 square inches of surface contact area.

F) Cable conductors shall provide a two-way path from strike termination devices horizontally and downward to connections with the ground system.
Cable conductors shall be free of excessive splices and sharp bends. No bend of a conductor shall form a final included angle of less than 90 degrees nor have a radius of bend less than 8 inches. Structural elements and design features shall be used whenever possible to minimize the visual impact of exposed conductors.

G) Cable down conductors may be concealed within the building construction or enclosed within PVC conduit from roof to grade level. Down conductors shall be spaced at intervals averaging not more than 100 feet around the protected perimeter of the structure. In no case shall any structure have fewer than two down conductors. Where down conductors are exposed to environmental hazards at grade level, guards shall be used to protect the conductor to a point 6 feet above grade.

H) In the case of structural steel frame construction, cable down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the protected perimeter of the structure.

I) Exposed cable conductors shall be secured to the structure at intervals not exceeding 3 feet – 0 inches.

J) **All fasteners to be VFC** ZPen® **#ZP3412 with appropriate loop supports. No support penetrations shall be made in any sheet metal flashing or roof top equipment. Sheet metal screws shall not be used. Appropriate adhesive supports and construction mastic may be used on Membrane roof surfaces only. Adhesive supports and construction mastic shall not be used on any sheet metal surfaces.**

K) Connectors and splicers shall be of suitable configuration and type for the intended application and of the same material as the conductors or of

electrolytically compatible materials.

L) Ground terminations suitable for the soil conditions shall be provided for each downlead conductor. Where the structural steel framework is utilized as main conductors for the system, perimeter columns shall be connected to the grounding system at intervals averaging 60 feet or less on the protected perimeter. For any structure in excess of 60 ft. in vertical elevation above grade, a ground loop interconnecting all ground terminals and other building grounded systems shall be provided.

M) Common interconnection of all grounded systems within the building shall be accomplished using main size conductors and fittings. Grounded metal bodies located within the calculated bonding distance as determined by the formulas of the Standards shall be bonded to the system using properly sized bonding conductors.

Materials – Surge Suppression

A) Surge Suppression units shall be provided at every system entrance to the structure to prevent massive lightning overvoltage's from entering the Structure.

B) Surge Suppression units may be built directly into the switchgear by the switchgear manufacturer. The unit used by the switchgear manufacturer must meet the minimum requirements set out by NFPA 780 and UL 1449 3rd edition type 1 or type 2 units.

C) If the Surge Suppression unit is not built into the switchgear the unit must meet NFPA 780 and UL 1449 3rd edition type 1 or type 2. The unit must be installed as per the manufacturer's instructions and the NEC.

D) Surge Suppression products for the communication service shall meet NFPA 780 Sec 4.18 and shall be installed as per the manufacturer's requirements and NFPA 780 Paragraph 4.18.6 and 4.18.7.

Execution:

Standard –

The installation shall comply with the requirements of NFPA 780, UL 96A, LPI 175, and the NEC.

Acceptable Design and Installation Firms –

VFC Lightning Protection www.vfcinc.com. 800-825-1948
Or equal with the following requirements:

A) 5 Years Minimum experience as a Lightning Protection Installation firm.
B) LPI Certified Master Designer on staff at the Lightning Protection Installation firm.
C) LPI Master and Journeyman installers on site to complete actual installation.
D) Participate in UL's "Alternate Quality Management System Inspection Program"

Installation – XIT Grounding System

A) General
To achieve specific earth resistance, contact Lyncole for engineering design assistance. Preliminary step in grounding design requires a "Wenner four-point" soil resistivity test be performed on the earth at the job site.
Install ground rod system in compliance with manufacturer's instructions or recommendations.

B) Excavation - Bore minimum 6" diameter hole 6" deeper than the length of rod to be buried. This insures that the top of the copper XIT rod will not come in contact with the metal grate of the protective box or hand-hole cover. If the electrode is longer than 10', a minimum 8" diameter hole should be utilized. This is to insure that the system will be completely surrounded by the backfill material. Remove sealing tape from leaching holes. Place XIT unit in hole, so that the top of unit is about 6" below grade. Lynconite backfill is a specific clay included with the system. Mix each 50# backfill grout material with 14 gallons water to form a thick slurry and pour around XIT rod up to "bury to here sticker".
Place protective box so top is flush with grade level and finish.
Remove sealing tape from top breather holes to activate.

D) Connection
Connect grounding electrode conductor(s) to ground rod pigtail exothermically (Cadweld or Ultraweld).
Bury grounding conductor 30" below grade. Cover bare conductor with a small amount of backfill for protection against corrosion.

Installation – Lightning Protection

A) The installation of the lightning protection system components shall be done in a neat and workmanlike manner.
B) Roof penetrations required for down conductors or for connections to structural steel framework shall be made using through-roof assemblies with solid bars and appropriate roof flashings. The roofing contractor shall furnish the methods and materials required at roofing 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.

(Note: The roofing contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. The lightning protection roof penetrations and/or method of conductor attachment should be addressed in the roofing section of the specifications.)

C) **All fasteners to be VFC** ZPen® **#ZP3412 with appropriate loop supports. No support penetrations shall be made in any sheet metal flashing or roof top equipment. Sheet metal screws shall not be used. Appropriate adhesive supports and construction mastic may be used on Membrane roof surfaces only. Adhesive supports and construction mastic shall not be used on any sheet metal surfaces.**

D) If the protected structure is an addition to or is attached to an existing structure that does not have a lightning protection system, the contractor shall certify that the system installed complies with the requirements of the Standards, and advise the owner of the lightning protection work required on the existing structure to obtain full certification for the structure. If the existing structure does have a lightning protection system, the contractor shall advise the owner of any additional work required on the existing system to bring it into compliance with current Standards and thus qualify for LPI or U/L certification.

Installation – Surge Suppression

A) At locations indicated on drawing(s), install Surge Protection Devices in full accordance with manufacturer's written instructions and comply with all applicable codes.

B) At Distribution, MCC and Branch Panels, Surge Protection Devices with a UL 1449 Edition 3, Listing as a SPD Type 2 shall have a 30-Amp Circuit Breaker or other size as recommended by the manufacturer's installation manuals. This independent Circuit Breaker will serve as a means of a disconnect for servicing the Surge Protection Device with the protected panel remaining energized.

C) Surge Protection Devices with a UL 1449 Edition 3 Listing as a SPD Type 1, and an integrated disconnect can be connected directly to the buss without a designated circuit breaker.

D) The Surge Protection Device shall be installed with the shortest possible leads, or wire length maximum 18".

Final System Inspection and Quality Control.

A) The contractor shall furnish an LPI-IP Certificate or a UL Certificate upon completion of the installation.

B) LPI certification requires a signature by a representative of the owner at multiple stages of installation & by their third party field staff. UL certification

requires inspection by their third-party field staff after completion of the installation.

C) **The contractor shall furnish 10 Year Adhesion Warranty on the VFC** ZPen® **fastener system.**

D) As-Built Drawings shall be completed and stamped by an LPI Certified Master Designer - Installer of Lightning Protection Systems.

E) Final Inspection Report – A final test and inspection report shall be completed based on ANSI/TIA/EIA 607, NEC, NFPA 780, and UL96A industry standards as applicable. The scope of the inspection and report shall include;
   a. Test and evaluation the grounding system. Record final systems to ground resistance level.
   b. Evaluation and Testing of the internal bonding and grounding systems.
   c. Evaluation and Testing of equipment grounding.
   d. Evaluation of AC surge suppression installation.
   e. Evaluation of telco surge suppression installation.
   f. Copy of the LPI-IP Lightning Protection Certification.
   g. Final As-Built Review and submission.

F) Report shall include detailed reporting and test results with corresponding photos of each evaluation category.