Lightning Protection - In Compliance With National Safety Standards

By Kim Loehr, Lightning Protection Institute

Lightning's forces can be powerful and unpredictable. A direct lightning strike can carry over 30 million volts of electricity, enough power to rip through roofs, explode walls of brick and concrete, and ignite deadly fires. An indirect or nearby lightning discharge can cause damaging electrical surges by induction through the air for an over-voltage incident. Lightning can also enter through the electrical system, damaging appliances, home computers, surveillance and security systems, telephones, sprinkler systems, and electric fences. Almost any structure is vulnerable to lightning, but there is good news, according to Bud VanSickle, executive director of the Lightning Protection Institute (LPI). He said, "Unlike threats posed by other forces of nature such as tornadoes, hurricanes or floods, lightning is a force of nature for which affordable and reliable protection is available."

Compliance with Safety Standards

Lightning protection is a specialized trade and architects and engineers may not have the most up-to-date information at their fingertips. A lightning protection system that meets all applicable safety standards from the onset will ensure system reliability for the future. The not-for-profit, nationally recognized authorities which are currently publishing the technical information necessary to ensure safe and effective lightning protection systems are: the Lightning Protection Institute (LPI) Standard of Practice, LPI-175, Underwriters Laboratories (UL) Installation Requirements for Lightning Protection Systems UL 96A and the National Fire Protection Association (NFPA) Standard for Installation of Lightning Protection Systems, NFPA 780.

System Components

A lightning protection system includes the following elements:

- A network of rooftop strike termination devices,
- A network of conductors interconnecting the air terminals and grounds, interconnections with metallic bodies, surge suppression devices on all incoming power and communication lines. The first two elements of the system intercept conduct and dissipate the lightning discharge, while the third and fourth address the secondary effects of a lightning strike by limiting the dangers caused by side flashing and current surges on services. Each of these elements is essential to proper system performance and failure to incorporate all can result in inadequate protection. Air terminals, also referred to as lightning rods or strike termination devices, must be installed in accordance with industry standards, which dictate size, materials and spacing requirements, as well as rooftop placement in accordance with roof pitch, overall roof area and roof type. Metal rooftop equipment, such as air conditioning units, railings, skylight frames, ventilators and ornamental fixtures must be taken into account when designing and installing the lightning protection system.

Grounding Requirements & Surge Protection

While the rooftop components are the most visible elements, proper grounding is crucial to the effectiveness of the lightning protection system. Grounding must comply with the requirements of the installation safety standards so that lightning's dangerous electric current is safely dissipated into the earth, leaving the structure unharmed. The National Fire Protection Association defines a ground terminal as: "the portion of a lightning protection system such as a ground rod, ground plate or ground conductor that is installed for the purpose of providing electrical contact with the earth. While ground rods are the most common technique for lightning protection grounding, some projects may call for an alternative grounding application. Soil conditions, environmental challenges and structural characteristics are factors that can dictate applications and grounding methods. When continuity is in question, the lightning protection contractor can perform a ground resistance test to ensure that effective grounding has been achieved.

Lighting can wreak havoc on a facility's sensitive electronic equipment and damage appliances and computers. Surge suppression beyond that required by standards for structural lightning protection is often necessary. A qualified lighting protection specialist can assist in designing and recommending surge protection to accommodate the needs of a structure.

Design and Function

Lightning protection systems have seen many changes since Benjamin Franklin first invented the lightning rod in 1752. While Franklin's basic principle has remained the same, today's systems must address aesthetic requirements, while also protecting a sophisticated building environment—appliances, computers and electrical systems. In addition to evaluating risk, requiring compliance with national safety standards and using UL-listed lightning protection components for installation, it is imperative that the system be installed by an experienced contractor. "Above all, it's important to remember that lightning protection is a specialty discipline and expertise is required for design and installation," stated LPI's VanSickle.

The LPI is a nationwide not-for-profit organization founded in 1955 to promote lightning protection education, awareness and safety.

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