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Diocese of Cleveland Facilities Services Corporation

Lightning & Surge Protection and Its Maintenance

With feedback from our survey of readers we are discussing lightning, lightning protection systems, surge protection, and maintenance of these two protection systems starting with our question, “What is lightning?”.

The simplest definition of lightning is that it’s a flash of light that is caused by the discharge of electricity in the atmosphere. One must be diligent of the sky and the potential for a lightning strike to occur in the neighboring vicinity. The National Weather Service (National Oceanic and Atmospheric Administration) advises people and their animals to be in a building as your safest option during a thunderstorm, but it does not guarantee you will be 100% safe from lightning. There are still some lightning safety guidelines you must follow while inside a place of shelter to keep yourself safe.

- Don't use corded phones: Using a corded phone during a thunderstorm is one of the leading causes of indoor lightning injuries. However, it is safe to use cordless or cell phones as long as they are not being charged.

- Stay away from windows and doors: Sitting on an open porch to watch a thunderstorm is also dangerous. It is best to be in an interior room during a thunderstorm.

- Don't touch electrical equipment or cords: Any device that uses electricity (e.g. computers, televisions, household appliances, etc.) is susceptible to a lightning strike. Electrical surges caused by lightning can damage electronics even at some distance from the actual strike, and a typical surge protector will do little to protect the device or the person using it if lightning should strike. So, consider unplugging certain appliances or electronics, but for your own safety do this BEFORE the storm arrives.

- Avoid plumbing: Metal plumbing and the water inside are both very good conductors of electricity. Therefore, do not wash your hands or dishes, take a shower or bath, do laundry, etc. during a thunderstorm.

- Refrain from touching concrete surfaces: Lightning can travel through the metal wires or bars in concrete walls and flooring, such as in the basement or garage.

- If inside a vehicle: Roll the windows up and avoid contact with any conducting paths leading to the outside of the vehicle (e.g. metal surfaces, ignition, portable electronic devices plugged in for charging, etc.).

For lightning myths and facts log on to https://www.weather.gov/iln/lightningsafetyweek

Commercial and institutional buildings are more apt to have a lightning protection system of some kind built into the structure, but this is not the case with most homeowners. One of the best ways for homeowners, in particular, to protect their homes from lightning is to install a home lightning protection system. NBC affiliate KXAS-TV in Dallas-Fort Worth, Texas (July 22, 2015) cited research from Underwater Laboratories, which stated a properly installed system is approximately 99 percent effective in preventing lightning damage. So, our next question is, “What makes up a lightning protection system?”

According the Lightning Protection Institute (LPI), a lightning protection system is a combination of highly conductive copper and aluminum materials used to provide a low resistance path to safely ground lightning's dangerous

electricity. This system is made up of a network of terminals installed in distributed locations exposed to the air/ environment, bonding conductors, and ground electrodes designed to provide a low impedance path to ground for potential strikes. This protection system is used to prevent or lessen lightning strike damage to structure and must be installed that complies with Safety Standards of National Fire Protection Association) NFPA 780 and Underwriters Laboratories (UL) 96A.

There are four main parts of a properly installed lightning protection system: copper air terminals (Figure 1) copper cable, copper clad ground rods, and surge suppressors. The air terminals and cable are typically copper, but sometimes they can (or must) be aluminum.

There are five types of lightning protection systems with the most common the air terminal device depending on the application with copper cabling extending down to a grounding rod.

Some people will confuse a lightning protection system with a surge protector device which is engineered to shields computer and other electronic devices e.g., TV, washing machines, etc. from surges in electrical power, or *transient voltage*, that flow from the power supply. Standard American voltage for home and office buildings is 120 volts. Anything over this 120 volt service is considered transient and can damage electronic devices that are plugged into an outlet. The surge protector is designed to channel the extra voltage into the outlet's grounding wire, preventing it from flowing through the electronic devices while at the same time allowing the normal voltage to continue along its path.

It is important to note that even the most effective surge protectors cannot protect equipment from the sudden increase in electrical pressure of millions of volts that lightning can supply. The best way to prevent damage during a lightning storm is to unplug devices that could be irreparably damaged.

Inspection and maintenance of lightning protection system should be completed, at a minimum, one visual inspection per year as part of the facility management process to assure the system will continue to provide the engineered safety for the structure. In addition to damage of the system e.g., air terminals from extreme weather, other concerns may be from when re-roofing and high volumes of construction traffic on the roof. It has also been suggested by lightning protection professionals that a quality assurance certification or report be provided every three to five years.

In addition to routine maintenance inspections, lightning protection systems should be inspected whenever any alterations, repairs, re-roofing or modifications are made to a protected structure. A certified LPI lightning protection specialist can take care of needed repairs or modifications and order a follow-up inspection to ensure continuity of the system and continued compliance with industry safety standards.

When providing a visual inspection, the following should be checked and corrections made:

1. Damaged air terminals e.g., bent
2. Terminals, cable connectors, and spliced fittings are secured e.g., nuts are tight
3. Confirm cable holders and anchors remain firmly attached with proper spacing and runs secured.

As part of the maintenance process 2-tests that should be performed are:

- Continuity tests and measurement of system resistance and grounding electrodes
- Surge protection test of devices within the system

For more information on lightning protection you can find a very good PowerPoint on the Internet web page; https://www.necanet.org/docs/default-source/NECA2015SF/e22_30_lightning-protection-system_harger-amp-johnston_0800am_0900am_100515.pdf?sfvrsn=2

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