

Protecting Your Station From Lightning

Due to the type of equipment utilized (i.e., towers, electronic equipment and satellite dishes) lightning is a major concern of the broadcast industry. A broadcast tower, typically the tallest structure in a given area, is a prime target of lightning. Buildings housing administrative, studio and engineering operations are also susceptible to lightning strikes. If your tower or other facilities are a target of lightning strikes, your lightning protection system should be evaluated.

Lightning is a product of electrically charged storm clouds. The charged clouds induce an opposite charge (ground charge) on the surface of the earth beneath it as they travel through the atmosphere. When the ground charge reaches a structure, the cloud charge pulls it up onto the structure, concentrating the ground charge on and around it. If the ground charge builds to a level exceeding the dielectric (insulation resistance) of the intervening air, an arc or lightning strike will occur. The process begins with stepped leaders branching down from the clouds. When they come within close proximity to the ground, approximately 500 feet, and the electric field intensity at ground level becomes so strong that objects and structures begin to breakdown electronically, shooting streamers up toward the stepped leaders. When a streamer and stepped leader connect, a path is created for a lightning strike.

The theory of lightning protection is to provide a means by which a lightning discharge may enter or leave the earth without damaging protected property. The conventional approach utilizes lightning rods or air terminals with an associated bonding and grounding system. Such systems are designed to intercept a lightning discharge before striking a protected object, safely transmitting the strike to ground.

Presently, there is much debate among lightning protection experts regarding air terminal design. According to researchers, a sharp or pointed air terminal has built in defenses against lightning strikes. The strength of the electric field around the tip of a sharp air terminal is limited by a phenomenon called "point discharge." When the electric field around the air terminal reaches a certain strength, the current from a stepped leader is allowed to flow through the terminal from air to ground, before a lightning strike occurs. Overtime, the sharp point of a conventional air terminal or lightning rod erodes due to atmospheric conditions. This causes a rod to hold its charge and produce streamers, providing a path for a lightning strike. Therefore, a blunt lightning rod is more likely to intercept a lightning strike. While a sharp pointed lightning rod is more likely to prevent a strike. The effectiveness of sharply pointed versus blunt lightning rods is currently being studied.

Static dissipation lightning technology is becoming more common for protection of broadcast towers. It is based on the point discharge principle, utilizing air terminals with multiple point small radius electrodes. It is designed to prevent a lightning strike by dissipating ground charges into the surrounding atmosphere, retarding the formation of streamers.

Regardless of which type system is used, it should be effectively bonded and grounded. Also, surge suppression devices should be installed on all incoming and outgoing AC power, telephone, coax, waveguide and other data lines.

Inspection, testing and maintenance of lightning protection systems is very important as components tend to lose their effectiveness over time due to corrosion, weather related damage and strike damage. All systems should be visually inspected for problems or damage annually. They should also be inspected when alterations or modifications are made to the protected property (buildings or tower). If located in areas where severe climate changes occur, semi-annual visual inspections should be completed. In-depth inspection and testing should be completed every one to three years. Maintenance procedures should be established and become a part of the overall maintenance program. Whether conducted by in-house personnel or outside service contractors, all inspection, testing and maintenance activities should be documented and kept on file for future reference. Items that should be included in the inspection, testing and maintenance program are outlined below.

Visual Inspections - should be conducted to determine the following:

- The system is in good repair
- There are no loose connections that might result in high resistance joints
- No part of the system has been weakened by corrosion or vibration
- General liability coverage should be requested (minimum \$1 million general aggregate and the same amount for each occurrence sub-limit, if any) with your company named as an additional insured.
- All conductors and system components are securely fastened and protected against mechanical displacement
- There have been no facility additions or modifications that require additional protection
- There is no visual indication of damage to surge suppression devices

In-depth Inspection and Testing - should include the visual inspection items indicated above plus the following:

- Conduct ground resistance tests of the ground termination system and its individual electrodes. Results should compare with previous or original values, or current values are acceptable for the soil conditions involved. If values differ substantially, additional investigation should be made to determine the reason for the difference.
- Request a certificate of insurance before work begins.
- General liability coverage should be requested (minimum \$1 million general aggregate and the same amount for each occurrence sub-limit, if any) with your company named as an additional insured.
- Perform continuity testing to determine if suitable bonding has been established for any additions or modifications.
- A routine maintenance program should be established based on the results of the visual and in-depth inspection and testing.

Following these guidelines will help ensure the integrity of your lightning protection systems thereby reducing the possibility of equipment damage, high repair costs, a station outage and the subsequent loss of operating revenues that often results from a lightning strike.

[Lightning Eliminators & Consultants, Inc.](#), has partnered with Royal Insurance to provide free engineering assistance for National Association of Broadcasters (NAB) Members in the areas of lightning protection, grounding and surge protection for loss prevention. For more information go to www.lightningeliminators.com and click on the NAB Member button.

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* Based on claims experienced by Broadcasters Business Assurance program - participants during 1999.