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Lightning Protection for Missouri Farms and Homes

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The National Board of Fire Underwriters reports that lightning is the chief cause of farm fires. Thirty-seven percent of fires resulting from known causes are started by lightning. Each year lightning kills 400 people, injures 1,000 and damages two million dollars worth of property in the United States. In the five largest Missouri cities, we can expect an average of 61 thunderstorm days per year, according to the U. S. Department of Commerce weather data. Therefore, we can expect lightning to occur somewhere in Missouri on about one out of every six days.

Lightning can damage electrical equipment by striking power lines and surging through a building's wiring system. Building damage, fires, personal injury and livestock loss usually result from direct lightning strikes. A good lightning rod protection system is most apt to provide protection from these kinds of hazards. This guide will help explain the nature of lightning and how to provide protection for your family, livestock and property.

What is lightning?

Lightning is an uncontrolled giant electric spark with tremendous voltage and amperage. It always tries to follow the shortest, easiest path to earth. But because it has thousands of amperes and millions of volts, it often follows several paths to earth simultaneously.

Lightning is sometimes described as a visible discharge of static charges occurring with a cloud, between clouds or between a cloud and earth. Such charges always develop in pairs, one negative and one positive. When one develops in one area, another develops in a nearby area. The potential power depends upon the size of the charge that builds up between these opposite charges which are separated by an insulating air gap. If and when the electrical potential between the positive and negative charges becomes great enough to puncture the air gap insulator, the negative charges rush toward the positive charges and vice versa. This action produces a sudden release of energy, heating the air to incandescence to form the intense white spark we call lightning.

Generally speaking, the negative charges accumulate near the base of thunderclouds with opposite charges developing in the upper portion of the cloud and/or near the earth's surface with its projecting objects like trees, building steeples, chimneys, poles or wires. Because the potential build-up is greatest on these projecting objects, lightning is more apt to strike there than on larger, flatter surfaces projecting to the same or to a lower level.

When and what to protect?

Consider several factors before purchasing a protection system. Whether you invest in such a system will depend upon the frequency and severity of thunderstorms in your area, the value and nature of each building and its contents, the relative building exposure (whether located on a hill or in a valley), and the hazards to people and/or livestock. Other important considerations are the indirect losses that might result from building destruction, fire or loss of livestock. (Example: you can't replace a top-performing herd that years of personal effort have developed.) By evaluating your needs, the insurability factors and an gathering accurate cost estimates, you can decide the relative importance of such an investment.

What constitutes a good system?

The fundamental principle in protection against lightning is to provide a means by which a discharge may enter or leave the earth without passing through a non-metallic or non-conducting part of a structure or other object. An adequate protection system for buildings must include:

- Properly sized, placed and installed air terminals to receive the lightning stroke
- Down conductors designed to carry the discharge from the air terminal to the ground
- Ground rods of adequate size, properly located and driven into moist earth to serve as a ground terminal
- Interconnecting conductors of proper size and type to securely fasten together all system components.

Materials used in protection systems must be resistant to corrosion. Copper, copper alloys, copper-clad steel and aluminum are approved materials, with copper and aluminum the most common. Combinations of materials subject to electrolytic action should be avoided. There is one exception. Because aluminum conductors corrode when in contact with earth, such conductors should terminate at least one foot above ground level and connect with corrosion-resistant, copper conductors that carry the discharge under the earth surface to the grounding electrode. Always use a special bi-metal connector to bond the aluminum and copper conductors.

Installation

The installation of a lightning protection system is as important as the materials used. A few considerations will help you decide whether you have a complete system:

A sufficient number of air terminals or points must be spaced properly. Turns should not exceed 90 degrees, and no bend should have less than an 8-inch radius.

Entrance conduits, gutters, drain pipes, pipe vents, metal water pipe, radio and television antennas, metal roofing, fences and other metal objects should be bonded to main down conductors and ground rods. The bonding conductor must be at least number 6 A.W.G. copper or equivalent.

Lightning system ground rods (electrodes) must be driven to a minimum depth of 10 feet where soil conditions permit. When rocky terrain prohibits

this, alternate grounding procedures, as discussed below, must be used. Use no less than two rods for major buildings, one at opposite corners of each building. Locate ground rods two feet from the building foundation and drive rod well under the surface of the ground.

Buildings with a perimeter of over 250 feet need one additional down conductor for each additional 100 feet.

Water towers, silos, metallic spires, flag poles, tall trees, etc. should have their individual protection systems.

If driven grounds used for the electrical and/or the telephone systems are within 6 feet of a lightning protection system ground, all must be bonded together to prevent side flashes.

Protect down conductors from mechanical damage by enclosing in a conduit or metal tubing. Extend conduit from a point at least 5 feet above ground level to 1 foot below the ground surface.

Master label systems and their significance

Careful consideration must be given to both materials and workmanship when planning and installing lightning protection systems. Many conditions must be met to obtain a Master Label system approved by the Underwriters' Laboratories' Inc. A special application form must be signed by the owner, installer and the equipment manufacturer. If all materials and workmanship meet minimum requirements set by U. L., the Underwriters Laboratories will then issue a Master Label Identification plate directly to the owner.

Additional information can be obtained from the Underwriters' Laboratories, Inc., 207 E. Ohio Street, Chicago, Ill. 60611.

Livestock protection

Livestock loss during thunderstorms is largely due to herds congregating under isolated trees or along ungrounded wire fences. While it is not possible to eliminate all hazards, losses can be reduced by properly grounding your wire fences.

As the ordinary metal fence post does not always make an adequate ground, the best procedure is to drive a 1/2-inch copper rod or a 3/4-inch galvanized iron pipe to a depth of 10 feet at intervals of 150 feet along the fence line, bonding all wires to these artificial but effective electrodes. The fence line should be broken (no interconnections) with a separate ground every 1,000 feet. If terrain will not allow you to drive a 10 foot ground, a "trench ground" can be made by laying a 12-foot-long conductor 3 feet below earth surfaces.

Studies show that a certain relationship exists between the height of an air terminal and the area of protection that this grounded terminal will provide. The protected horizontal distance is about two times the height of the object on which the terminal is mounted.

Personal protection

The lightning hazard to people is greatest for those who are outdoors at work or play. Consequently, the best protection can be obtained by following a few simple safety rules:

- Do not go or stay outdoors in thunderstorms.
- Seek shelter in buildings with lightning protection systems, enclosed automobiles, trains, etc.
- Avoid tents, open-top autos, unprotected buildings.
- Avoid open fields, athletic fields, golf courses, wire fences, isolated trees, swimming pools and open bodies of water such as lakes. (Do not ride in open vehicles in above areas.)
- If possible, seek dense woods, depressed areas, and/or buildings in low areas.

You should always remember that partial protection is no better than no protection. But a properly installed system can save life and property. If you decide to install a lightning protection system, make sure you get the best. Investigate before — not after — signing a contract.

References

- Foss, E.W. *Lightning Protection*, Cornell Extension Bulletin 1150.
- New York State College of Agriculture. *Lightning Protection Code*, 1965 NFPA number 78.
- National Fire Protection Association
60 Batterymarch Street
Boston, Massachusetts 02110

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