

LIGHTNING SAFETY for Golf Courses



A Club Responsibility

Every year many golfers are caught on America's links as thunder rumbles in the distance then grows louder and sharper as storm clouds darken the sky and lightning flashes within the clouds and to earth.

A Lightning Protection Institute study of lightning deaths and injuries found that golf ranked second only to fishing as a leisure time activity during which lightning deaths and injuries occurred. Further, the only reason fishing was shown as the deadlier pastime was that more people were engaged in that activity than in golf.

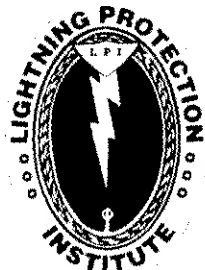
Recent events indicate that time has not dimmed the bravado or improved the prudence of dedicated golfers. The "It won't happen to me," attitude that many people, including

golfers, have about lightning held veteran pro Lee Trevino on the course longer than was safe at least twice during thunderstorms.

Trevino, Jerry Hurd, and Bobby Nichols suffered the debilitating effects of lightning caused ground voltage as they stood holding their clubs to the turf during a storm at the U.S. Open during 1975 in Chicago. Sixteen years later Trevino took time after thunderstorm sirens began to wail during the 1991 U.S. Open at Chaska, Minnesota to chip from the fringe and sink a putt before leaving the course.

Asked why he continued to play after hearing the warning, Trevino replied, "We're just as dumb as the spectators. We don't think lightning will hit us." In reality it can and does.

PRESENTED BY:



LIGHTNING PROTECTION INSTITUTE

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LIGHTNING'S DANGERS

Golfers and others engaged in outdoor activities face five potentially dangerous effects from lightning storms:

1. The most common danger that anyone engaged in an outdoor activity faces is also the worst. It is a **direct strike**. Alone or if accompanied on the course, perhaps with club upraised, a golfer is a potential target for a direct strike. Often fatal due to brain injury or cardiac arrest, direct strikes killed 136 persons engaged in recreational activity out of 313 fatalities reported in an LPI survey.

2. **Sideflashes** to the head from struck trees or other adjacent objects are also often fatal. If to the shoulder or other lower body parts, sideflash current often causes permanent injuries to muscles, nerves, and skin.

3. **Conducted current** ranges from a painful zap to the eardrum from a surge over a telephone line to a massive current from a struck metal pole, wire fence, or other object touched by a victim.

4. **Step voltage** consists of ground currents radiating outward through the earth from a struck tree, pole or other object. Its magnitude depends on several factors, the most important of which are the amount of current in the lightning bolt and the conductivity of the soil. Step voltage injuries are usually limited to a person's legs and lower torso where it can sometimes cause violent muscular reactions. Horses, cattle, and other four legged animals, however, are often killed as step voltage flows through their heart and lung regions.

5. **Streamer currents** are low level currents that shoot upward from people and other objects under the influence of storm clouds. Generally these currents are short lived, but when passing through the body many cause headaches or a feeling of lassitude. They may prove fatal, however, to persons in poor health. There is also the danger that a given streamer may unite with a downward streamer from the storm cloud and form the path for the main lightning bolt.

In addition to the above dangers, secondary effects of lightning strikes include fires ignited by "hot bolts," which are long duration strikes.

Fires started by lightning cause more deaths than any other weather caused effect.

THE QUANDARY

It is important to keep in mind Lee Trevino's admonition, "...we don't think lightning will strike us." Golf is an absorbing, usually competitive game. Golfers share the reluctance to quit that sometimes also keeps baseball, softball, or football players on the field longer than is safe during thunderstorms.

Today the proliferation of liability lawsuits relating to public safety has now reached out to include golf course owners and management as well. Even balanced against the attitudes and behaviors described earlier and in spite of the historical belief that lightning is considered an "Act of God", the fact that protection against its harm is possible and available now places a new responsibility on golf courses.

For example, the widow of a golfer who was killed along with two other golfers who were injured by a lightning strike at Quail Chase Golf Course in Jefferson County, Kentucky filed a suit against the course owners charging negligence due to "failure to install and operate adequate warning systems." In another case a golf course was found negligent by a jury and held liable for the lightning deaths in an unprotected shelter building. The couple's minor children were awarded damages sufficient to pay for their care and education.

FIVE LIGHTNING SAFETY STEPS

To address and resolve these liability considerations and to address the "Duty to Warn" precedent that appears to be developing, there are five steps a golf course's management can take to provide safety for the players and at the same time protect the course itself from liability in the face of possible lightning casualties.

Step 1 — Any golf course in an area of potential lightning strikes should offer golfers a lightning safe clubhouse. For a small course it may be the only publicly occupied structure; the one reachable safe haven.

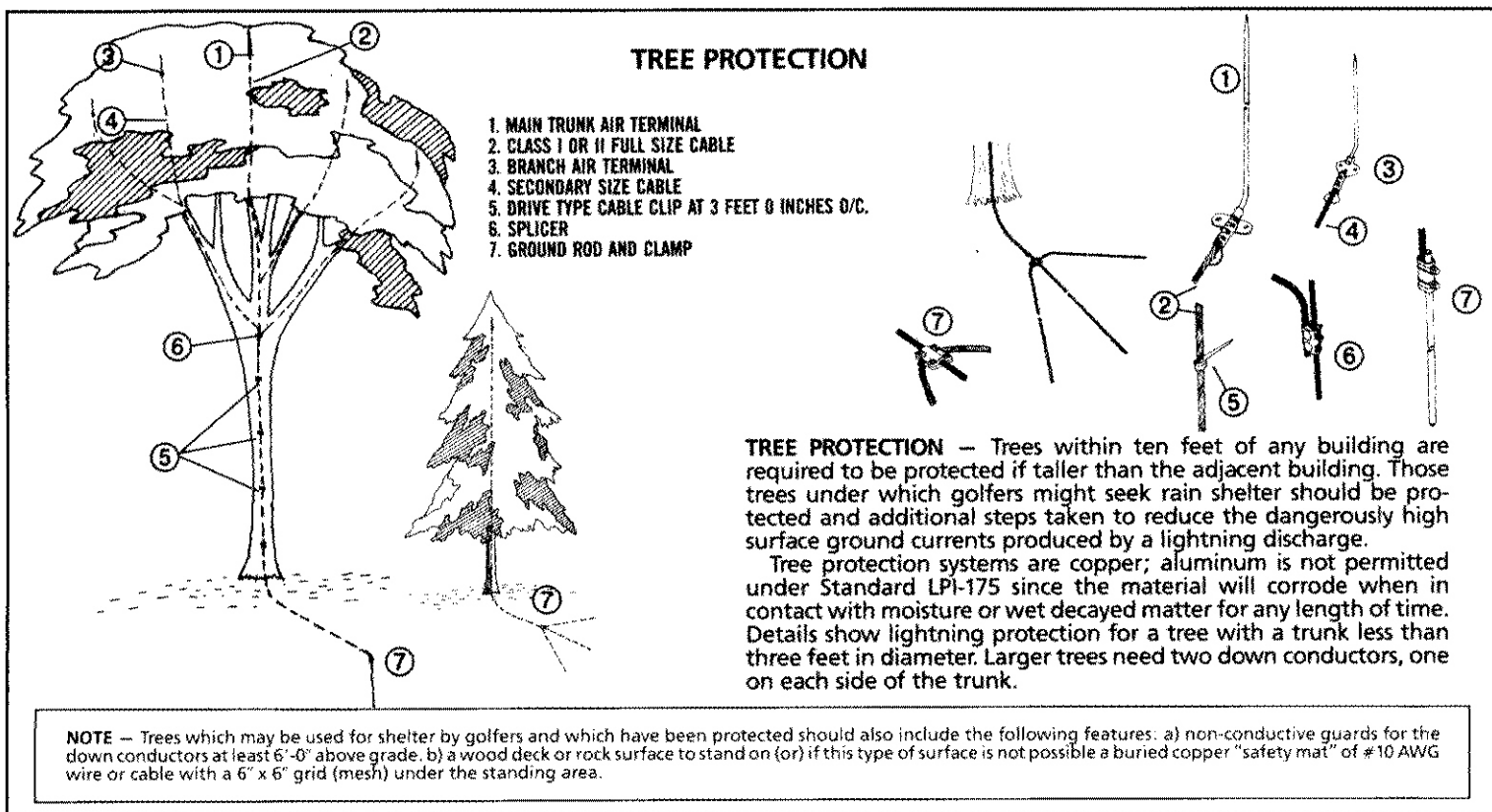
Step 2 — A thunderstorm warning system should be installed. In some parts of the U.S. lightning warning services are available on a subscription basis. A more preferable step would be to install a reliable warning system on the course itself. In general terms these devices measure the intensity of the atmospheric electric field. In clear weather this field is constant between the clouds and the earth. As a storm builds this constant level (gradient) begins to increase. When these voltage gradients reach a level where a lightning strike is imminent a preset sensor is triggered and an alarm is sounded. This warning can then be relayed by sirens etc. to players on the course.

Step 3 — Any shelter building on a golf course can become a "lightning trap" because it concentrates potential victims at a time of prime vulnerability during a storm and because its small size places occupants within sideflash distance of a lightning strike to the structure. Typically built of wood or concrete block, such structures are poor conductors compared to the human body and should be protected in order to safeguard the occupants.

Step 4 — Lone trees and prominent trees in groves are handy shelters from the discomfort of rain. A golf course should be evaluated to determine which trees need to be equipped with special tree lightning protection systems.

Step 5 — Printed instructions for golfers on where and how to take shelter during thunderstorms may avert casualties and their consequences when handed out prior to teeing off. In addition, prominently posted signs describing lightning safety measures are also recommended.

Golf courses vary in the amount of lightning danger according to geographical location. Other factors such as terrain also play a role. The extent of such danger can be evaluated according to several factors, including the number of thunderstorms occurring annually in the area, the terrain, and the size of the course. Further information relative to the varying levels of risk can be obtained by referring to a "Risk Evaluation Guide" available from the Lightning Protection Institute.



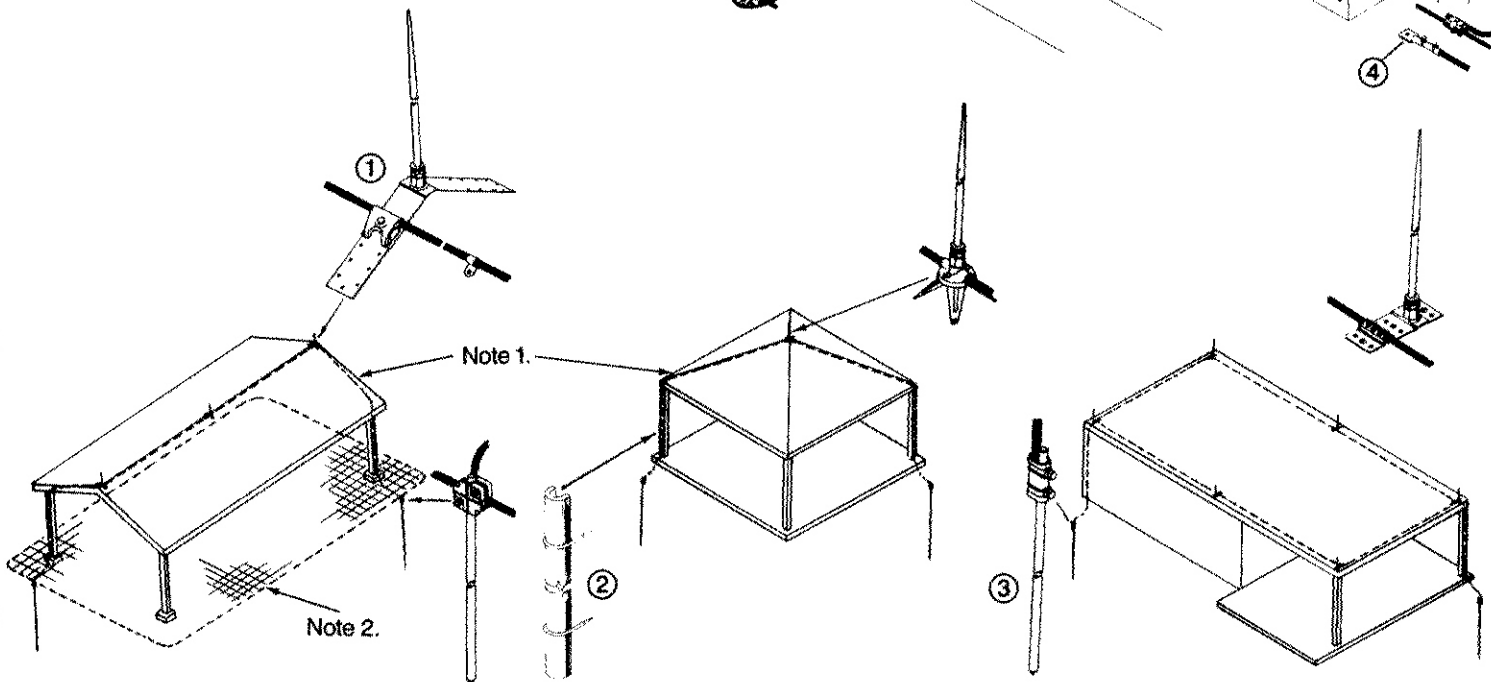
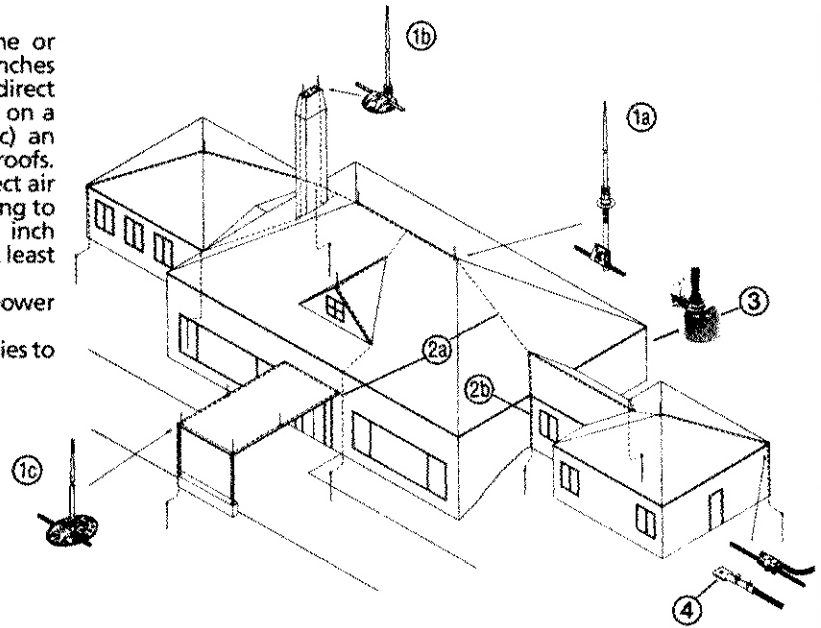
BUILDING PROTECTION

CLUBHOUSE PROTECTION — A clubhouse of ordinary frame or masonry construction needs a system of air terminals, 10-24 inches high, mounted on all roof areas and projections subject to a direct strike, such as (1-a) a through the roof concealed installation on a wood-framed roof; (1-b) a top-mounted masonry base; (1-c) an adhesive base for mounting on a built-up or membrane type roofs.

Roof conductors (2-a) and down conductors (2-b) interconnect air terminals and provide multiple paths to ground placed according to perimeter dimensions of the building. In deep clay soil 1/2 inch minimum diameter copper clad steel ground rods are driven at least 10 feet deep at each down conductor location.

A secondary lightning arrester (3) is installed on the electric power service entrance.

Branch conductors (4) bond rain gutters and other metal bodies to the conductor system to prevent flashover hazards.



GABLE ROOF SHELTER — Gable roofed shelters require at least two air terminals as illustrated. (1) Air terminals from ten to 24 inches high, within two feet of gable ends and spaced at twenty foot maximum intervals along the ridge. (2) A minimum of two down conductors shall be installed and guarded with non-conducting material to a minimum height of six feet and (3) ten foot ground rods should be driven at each downlead (typically at diagonally opposite corners) and separated by at least twenty feet. (See Note 2.)

PYRAMID ROOF SHELTER — Pyramid roof shelters generally require a single air terminal at the peak. Two down conductors and ground rods are required as illustrated for gable roof shelters. (See Note 1.)

FLAT ROOF SHELTER — Flat roof shelters shall have an air terminal within two feet of each corner and around the periphery of the roof spaced at not more than twenty foot intervals. A minimum of two down conductors and ground rods as illustrated for gable roofs are required.

NOTE 1 — Gable and pyramid roofs having a pitch of less than 1/8 require additional perimeter air terminals as illustrated for flat roofs.

NOTE 2 — Lightning strikes to the shelter lightning protection system or to nearby objects will produce very strong earth currents in the immediate vicinity which could be hazardous to anyone standing on the bare ground. For this reason it is essential that the shelter include flooring. A raised wooden floor is ideal, but other types including reinforced concrete or a four to six inch bed of crushed stone are satisfactory. If no floor is present, the ground rods should be interconnected with a ground mat buried at least three to four inches below grade to prevent injuries from ground currents. (See note at left for further details.)

FOR MAXIMUM LIGHTNING SAFETY —

SUGGESTED LONG FORM LIGHTNING PROTECTION SPECIFICATIONS

GENERAL — The contractor shall provide a complete system of lightning protection as shown on the drawings and as required for (designate building or other), as approved by the Architect and/or Engineer. The system shall be installed by a lightning protection contractor actively engaged in the installation of UL Master Label systems and so listed by the Laboratories. The contractor shall have a minimum of two years of experience in lightning protection installations and shall be a Certified Master Installer by the Lightning Protection Institute.

The lightning protection system shall conform to the Lightning Protection Institute's Installation Standard (LPI-175) which has a basic requirement for compliance with the latest issue of Underwriters' Laboratories, Inc., "Installation Requirements, MASTER LABELED LIGHTNING PROTECTION SYSTEMS", (UL 96A). Upon completion of the work for the lightning protection, contractor shall deliver to the Owner for attachment to the building the Master Label issued by Underwriters' Laboratories, Inc. The LPI System Certification including form LPI-1-R91 shall also be furnished to the Owner.

QUALITY OF MATERIALS — The Lightning Protection Contractor shall submit to the Architect all evidence to establish that materials are manufactured, furnished, and recommended for their intended use by a reputable lightning protection manufacturer who is a Manufacturer Member of the Lightning Protection Institute. All materials used in this installation shall bear the inspection label of Underwriters' Laboratories, Inc.

TYPE OF SYSTEM — Install conductors and complementary parts in a (concealed or semi concealed) system so completed work is unobtrusive and does not detract from appearance.

AIR TERMINALS — Locate required number of air terminals not less than ten inches high at no more than twenty foot intervals per the requirements of UL 96A and LPI-175.

GROUND — Connect each down conductor to a suitable, properly located ground as determined by soil conditions encountered. Assume in bidding that the earth is permanently moist to within three feet of finished grade. If actual conditions vary with this assumption, adjustment will be made by the Owner upon the Architect's approval for any greater expense involved in providing proper grounds.

CONDUCTORS — Interconnect conductors to provide at least two electric paths to ground. Avoid an upward direction for lateral conductors interconnecting air terminals. Turn conductors with a radius of at least eight inches at an included angle not more acute than a right angle. Space down conductors around building's periphery as evenly as permitted.

FASTENERS — Place fasteners amply strong for rigid, permanent support no more than three feet on center of all exposed vertical or down conductors and horizontal conductors.

CONDUCTOR GUARDS — Protect exposed down conductors to six feet above ground with an approved guard (preferably of non-conductive material).

GROUNDING METAL ELEMENTS — Bond into protection system all metal caps, breechings, metal ventilators, vent stacks, pipes, roofing or siding, spandrels, ridge rolls, valleys, crickets, eaves, troughs, downspouts, ducts, clothes chutes, cold water supply piping, and any other metallic object or surface of a size presenting a flashover hazard. Protect telephone lines, electric service, radio, television, or other masts or wires entering the building by establishing a common ground and use of a proper lightning arrester where advisable. Arresters should be installed by a qualified technician typically of the appropriate trade or by the service or utility responsible for the system.

ALUMINUM AND COPPER — Either metal may be used for lightning protection, but never together without special connectors. Aluminum materials shall not be used embedded in concrete or below eighteen inches above finished grade.

SPECIFY L.P.I.

Your safety □□□ What You Should Know and Practice!



SEEK SHELTER IN A PROTECTED BUILDING The safest place to be in a thunderstorm is in a house or other building properly protected against lightning. Proper, complete protection should include an L.P.I. System Certification and an Underwriters' Laboratories "Master Label".



IN AN UNPROTECTED BUILDING, BE CAREFUL! Avoid the fireplace, stove, sink, other plumbing fixtures, electric appliances, and other metal objects. Don't use the telephone if it can be avoided.



A CLOSED CAR IS SAFE; STAY IN IT If your car is handy when you are caught unaware, get in it. A closed automobile protects you; avoid touching the metal sides.



SHUN THOSE LIGHTNING TARGETS Keep away from trees, metal fences, poles, and similar upward-projecting objects. If in a grove of trees, take shelter under a small one. To help avoid step voltage injuries, try to stay a minimum 100' away from the most prominent, likely lightning targets.



IT'S A BAD TIME TO TEE OFF! If on a golf course put those irons back in the bag; seek shelter in a *protected* structure; avoid lone trees. If you must be in the open choose a low spot and keep low yourself.



TAKE A DIP ANOTHER DAY Stay away from beaches, swimming pools, lakes, rivers. Lightning has an affinity for water and it doesn't have to hit you in the water to kill you!

HOW CAN I HELP A VICTIM THAT HAS BEEN STRUCK?

Call for help (ambulance, Fire Department, 911) right away. People struck by lightning suffer severe electric shock and may be burned but they carry no electrical charge and can be handled.

If the victim appears stunned or otherwise unhurt, stay with that person until medical help arrives. Although a person sometimes feels okay after a strike it's still important that they be checked by a doctor.

If the victim is not breathing and has a pulse administer artificial respiration (mouth-to-mouth resuscitation). If there is no pulse begin cardiopulmonary resuscitation (CPR). Keep trying to restore breathing and blood circulation until victim's heart and lungs resume normal functioning or medical help arrives.