

# KL7KC QUICK GUIDE TO LIGHTNING SAFETY AND PROTECTION

## SAFETY FIRST

- Watch for environmental clues, such as increasing wind, flashes of lightning, sounds of thunder, darkening skies, and AM radio static.
- Avoid being the tallest object.
- Do not stand under or near an isolated tree or small group of trees.
- When outdoors, get inside a sturdy structure before the storm approaches.
- Unplug all *unnecessary* appliances **BEFORE** the storm approaches.
- **DO NOT** use the telephone during the storm, unless it's an emergency!
- Don't stand by open windows, doors, or patios during a thunderstorm.
- Get out of boats and away from water.
- If lightning is occurring and a sturdy shelter is not available, get inside a hard topped automobile and keep the windows up. The rubber tires **DO NOT** protect you, it's the roof.
- Do not take a bath or shower during a storm.
- If you feel your skin tingle or your hair stands on end, squat low to the ground on the balls of your feet. Place your hands on your knees with your head between them. Make yourself the smallest target possible, and be sure to minimize your contact with the ground!

Lightning can strike as far as 10 miles away from the rain area in a thunderstorm. That's about the distance you can hear thunder. When a storm is 10 miles away, it may even be difficult to tell a storm is coming. **IF YOU CAN HEAR THUNDER, YOU ARE WITHIN STRIKING DISTANCE. SEEK SAFE SHELTER IMMEDIATELY!** Use the "30-30 rule" where visibility is good and there is nothing obstructing your view of the thunderstorm. When you see lightning, count the time until you hear thunder. If that time is 30 seconds or less, the thunderstorm is within 6 miles of you and is dangerous. Seek shelter immediately. The threat of lightning continues for much longer period than most people realize. Wait at least 30 minutes after the last clap of thunder before leaving shelter. Don't be fooled by sunshine or blue sky!

## EQUIPMENT PROTECTION

A lightning protection system is made up of several components:

1. *Air Terminals:* (a.k.a. lightning rods): Inconspicuous slender rods installed on the roof at regular intervals as defined by industry standards.
2. *Conductors:* Aluminum or copper cables that interconnect the air terminals and the other system components.
3. *Ground Terminations:* Metal rods driven into the earth to guide the lightning current harmlessly to ground.
4. *Surge Arrestors and Suppressors:* Devices that are installed in conjunction with a lightning protection system to protect electrical wiring and electronic systems and equipment.

**All equipment elements must be connected to a single, low impedance ground system.**

This includes the antenna, the antenna support (pole, tower, etc.), and all of your station's input and output protectors. (I/O's: antenna, power, telephone, rotor, etc.). The sooner the ground system is able to spread out the energy, the better the chances of preventing it from traveling to your equipment. Almost 90% of strikes will be electrons that, due to like charge, repel and spread out. The antenna ground system provides the interface to the earth body. Also fundamental to a good protection scheme is the creation of a single point ground within the ham shack. This single point ground is used to mount all of the protectors and to provide a ground for all of the equipment chassis. This interior single point ground is connected to an external ground system (composed of radials with ground rods) with a low impedance copper strap. The tower ground

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system and the single point ground system must be interconnected. This interconnection should be below grade and with a bare low inductance conductor. **The coax cable shield must not be the only interconnection between ground systems.**

**Do not use a non-conductive structure for an antenna support.** Only conductive towers or metal poles should be used for mounting antennas. Guyed towers are better if the guy anchors are grounded properly. At least some of the strike energy will traverse the inductive guy wire to the ground. The more the strike energy is divided, the less there is to go to your equipment.

Connecting Equipment and Cables to Ground: Dissimilar metals can be trouble. **Copper should never touch galvanized material directly without proper joint protection.** Water shedding from the copper contains ions that will wash away the galvanized (zinc) tower covering. Stainless steel can be used as a buffer material. Joint compound should also be used to cover the connection so water cannot bridge between the dissimilar metals.

Coax Grounding: **All of the coax lines should be grounded** (using a grounding kit) at the top of the tower close to the antenna and at the base of the tower before they come toward your equipment. The next step in a good protection scheme is to **provide a single point ground, a plate where all of your equipment I/O protectors can be located.** The panel is best located near the ground to keep the inductance of the ground conductor low.

Surge Protectors: The basic elements used as protective switches are: gas tubes, metal oxide varistors and silicon avalanche diodes (transorbs). Each has certain advantages and disadvantages.

Because they can withstand many kilovolts and hundreds of amperes, gas tubes have traditionally been used to suppress lightning surges on telecommunications lines. This is just what is needed to protect against a direct strike. **Because gas tubes have a relatively slow response time, this slowness lets enough energy to pass to destroy typical solid state circuits. Metal oxide varistors (MOVs) provide an improvement** over the response time problem of gas tubes. But, operational life is a drawback. MOVs protection characteristic decays and fails completely when subjected to prolonged over-voltages.

**Coax protectors should be units that have dc blocking on the center pin.** This serves as a high pass filtering that prevents the lightning's low frequency energy from continuing to your equipment. The strike energy is picked off and diverted into the ground system in a controlled way. The dc blocking ensures the operation of the protector regardless of the input circuitry of the equipment.

## WEB LINKS

Lightning Facts and Safety

<http://www.noaa.gov/lightning.html>  
<http://www.nssl.noaa.gov/edu/ltg/>  
<http://www.crh.noaa.gov/pub/ltg.php>  
<http://www.lightning.org/>

Lightning Protection for Home and Shack

<http://www.arrl.org/tis/info/lightning.html> (excellent general information)  
[http://www.polyphaser.com/kommerce\\_products.aspx](http://www.polyphaser.com/kommerce_products.aspx)  
<http://www.harger.com/>  
<http://www.alphadeltacom.com/>  
<http://www.lightningrod.com/>