

## Cone of Protection from Lightning - Faraday's Cage



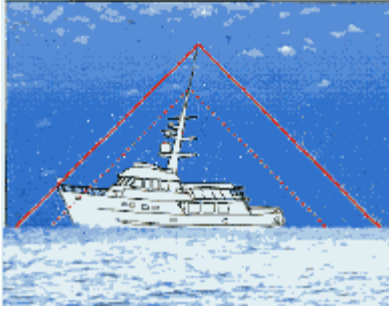
This spring seems to have brought the most extreme weather in history. With heavy thunderstorms you will often find lightning. Lightning on the water can bring life-threatening circumstances. For your safety and the safety of others boating with you we have updated and are republishing this article on Lightning Protection.  
Capt. Matt

Even though the odds are in your favor that your boat may never be hit by lightning, if it happens it can have devastating effects. Don't take a chance, **protect yourself**. If you are in a small boat and close to shore when a thunderstorm approaches, get in and off the water immediately. Better yet, don't go out if thunderstorms are predicted. But what if you are miles offshore and a storm pops up? Hopefully, you have prepared in advance.

The voltages involved in lightning are so high that even materials that would normally be considered non-conductive become conductors, including the human body. The voltages are so massive that if they start to travel through a boat's structure - say through its mast - then meet with high resistance (for instance, the hull skin) the current discharge, in its attempt to reach ground, may simply blow a hole in the non-conductive barrier. The safety conscious Captain should make sure that his vessel is properly protected. Reference should be made in detail to the standards for lightning protection as set forth by the American Boat and Yacht Council (ABYC) and the job should be performed by a licensed marine electrician.

In theory, a lightning protection system is used to create what is known as a "Faraday's cage," so called after the late nineteenth-century scientist Michael Faraday. The principle of a Faraday's cage is to provide a surrounding, well-grounded, metal structure, in which all of parts are bonded together and carry the same electrical potential. Such a "cage" attracts and carries any lightning strike to ground much like lightning rods on buildings. In other words, you need to provide an unobstructed way for the lightning to dissipate its energy to ground (the water surrounding you). Faraday himself risked his own life to prove this theory. The additional benefit of a lightning protection system is that it tends to bleed off any charge build-up in the general vicinity, possibly averting a lightning strike in the first place.

So how does a lightning protection system work? In a boat, the "cage" is formed by bonding together, with heavy conductors, the vessel's mast and all other major metal masses. A marine electrician must tie in the engines, stoves, air conditioning compressors, railings, arches etc. with a low resistance wire which would ultimately provide a conductive path to ground (the water) usually via the engine and propeller shaft, keel bolts, or better yet, a separate external



ground plate at least 1 square foot in dimension. It is important that you ensure that your crew fall within the protection of the "cage," something not always feasible when the vessel is not built of steel or aluminum. On fiberglass or wooden boats it is advantageous to have a mast or other conductive metal protrusion extending well above the vessel, creating what is known as a "cone" or zone of protection.

It is generally accepted that this cone of protection extends 45 degrees, all around, from the tip of the metal protrusion. This means that if the aluminum mast of the average sailing vessel is properly bonded to the vessel's other major metal masses and is given a direct, low-resistance conductive path to ground, the entire boat should fall within the protected zone. If the vessel has a wooden or composite mast, a marine electrician can achieve the same effect by installing a 6 to 12 inch metal spike at the top and running a heavy conductor down the mast and as directly as possible to ground, usually through the engine and propeller shaft.

Again, refer to the ABYC standards and have a professional marine electrician install your lightning protection. **This is not a do-it-yourself project.**