



Technical Bulletin

Bulkhead Grounding for Telecommunication Facilities

Most telecommunication facilities in the Land Mobile Services, Broadcast, Amateur and Personal Services are woefully under-grounded. Each year insurance companies pay out thousands of claims for lightning damage to installations that are "fully lightning protected". When inspecting these facilities it's easy to see why lightning damage is so easily caused, or why the station suffers from high noise levels and lots of interference.

Proper grounding is almost always the culprit, and it is so often the result of the ground system being installed as a quick, cheap afterthought to radio equipment placement. A really good engineer knows that the first item designed, constructed, and installed in a telecommunication facility is the ground system. And of the many ways that a grounding system can be employed, one type stands out as most often the best performer. Better yet, it costs less to build, involves fewer materials, and takes less time to implement.

Bulkhead ground systems are very easy to understand. They consist only of a plate and a single metallic fixture. The bulkhead is most often a metal plate made from aluminum but almost any metal will do just fine. A bulkhead could also be a piece of heavy wire several feet long to which station cables and protective devices are attached. It's not what you have; it's what you do with what you have. Most installations consist of an outside antenna with a coaxial line download connected to bonded equipment frames, and then a wire running from that point to ground. This has the unfortunate effect of placing the equipment chassis (and hence the operator if he is there) in series with an incoming lightning surge, nearly always causing equipment damage and often injuring the operator. A bulkhead grounding system overcomes this deficiency by intercepting the incoming surges and shunting them to ground BEFORE they reach the equipment.

A bulkhead plate is defined as a high integrity, zero or low inductance earth terminal connection. For that reason a bulkhead plate should always be placed very close to or on the ground with its lead connections to earth entry point very short - preferably less than a foot long. All incoming lines to the facility (coaxial cable, rotator lines, control lines, AC power lines, telephone lines, etc.) pass across the plate where they are connected to various lightning protective devices. The radio equipment should be located close by to take advantage of

short distance grounding to the bulkhead plate, thus reducing or preventing harmful local interference in transmission and reception. No other grounds should be employed or lightning current division may occur if the facility is struck. Division is what causes induced currents to flow across equipment chassis, resulting in circuitry damage.

What makes a good bulkhead? A commercial relay rack panel of 1/8" thick aluminum is quite nice and easy to obtain through electronic distributors. Copper plate is ideal if available, but even a steel plate is acceptable. Mount antenna switches, transmitting and receiving filters, and lightning protective devices all on the same plate, and be sure to use an anti-oxidant between metal surfaces to ensure good long term metal-to-metal electrical bonding. Examples of good anti-oxidants are Morgan Manufacturing's M-601 or M-602, Penetrox or Noalox. Mounting the bulkhead outdoors in a weatherproof enclosure is suggested. Keep all leads short and connections tight. And try to obtain a plate that is bigger than what you expect to need so that some room is left for facility expansion. Once you find out how nice the bulkhead system works, you'll probably want to build a bigger station!

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