PolyPhaser

White Paper

Halo Grounds

an INFINITE company

Halo Grounds

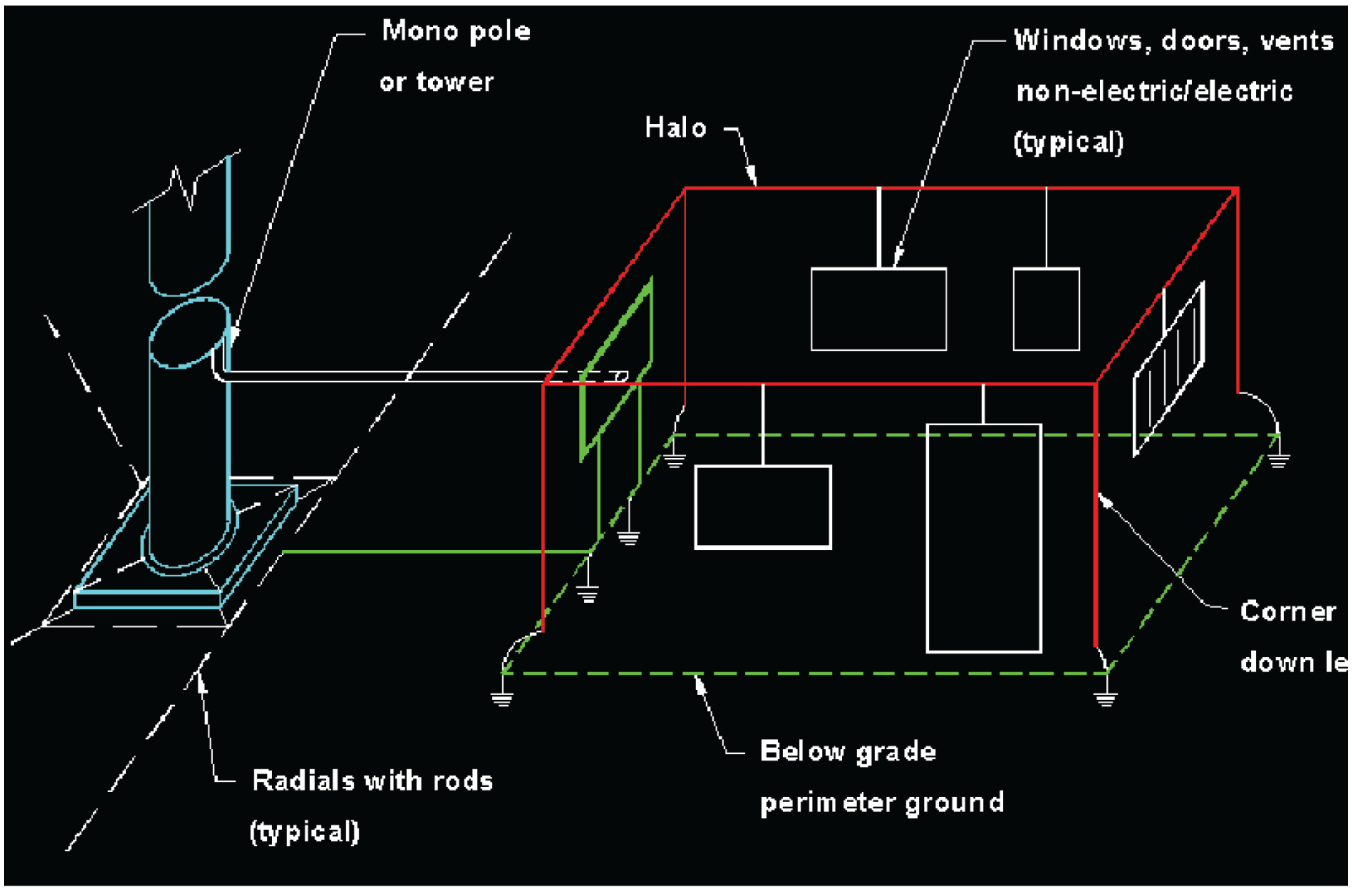
There are many opinions about how to ground equipment inside the equipment room. Two options are presented here.

When a large conductor such as a tower has high peak current flow through it (such as a lightning strike), an intense magnetic field is created around the tower. This field radiates out orthogonally from the tower. Since the building or cabinet is usually close to the tower, equipment in the building is subject to intense moving magnetic fields.

Just as a generator produces voltage and current flow from moving a coil within a magnetic field, so is voltage and current flow produced when a moving magnetic field cuts across a conductor. Wiring and circuit board traces in the equipment can have induced voltages present many times greater than the component's rated specifications. Even if this does not cause an immediate failure, components repeatedly stressed beyond specifications can have a shortened life. This can show up as "blue sky failures" (latent damage: equipment fails for no apparent reason).

When connected to grounded metal door frames, window frames, vents, air conditioners, or any non active metallic vertically aligned conductors, the "halo" will attenuate the magnetic field in the building. The vertical conductors intercept the magnetic field, convert it to voltage, and direct it through corner (or more) downconductors to the below grade perimeter ground loop. The remaining magnetic field is attenuated compared to its initial intensity.

“Halo” as intended for magnetic field attenuation



(1) The halo should not be interconnected with or used as a ground connection for any active electronic equipment. Do not attach the halo to the single point ground, equipment racks or the entrance panel / bulkhead / hatchplate / coax line ground bar.

The PolyPhaser entrance panel also functions as a large surface area grounding point for the coaxial cable shields and electronic equipment (single point ground). Any outside / inside ground bar with a connection to the coax cable shields will rise in potential far above local ground during the fast rise time lightning strike. The combined network of inductances formed by the tower, horizontal coax run, and entrance panel straps / ground bar conductors, could cause an Ldi/dt voltage drop of several kilovolts between the coax shield ground (high) and local earth ground (low). If the equipment is between these two potentials, it could be a path for damaging energy (Always insulate the rack from conductive flooring).

When the halo is connected to the entrance panel / ground bar, or the top of equipment racks, there are additional paths to earth ground through the halo’s vertical conductors and corner downleads. There will be current flow through all attached conductors. When this occurs, the halo and anything attached that is carrying current, radiates an additional magnetic field component inside the building. This field is additive to the tower’s radiated magnetic field. The halo, instead of attenuating magnetic fields in the building, becomes an antenna, radiating an additional magnetic field, increasing the probability of immediate or latent damage.

Keep the halo separate from coax and single point grounds!

(2) There are some compromises to the single point ground that can be implemented to increase safety (at some sacrifice of magnetic field attenuation effectiveness).

- Install an overhead, insulated from the wall, cable / buss bar connected only to the single point ground and extending out and around the inside walls of the equipment room (a buss bar “halo”). Do not connect any additional ground conductors downward to the outside below grade perimeter ground.

- Connect all metallic objects within the technician’s reach (while touching the equipment rack) to the cable / buss bar. If any of the connected metallic objects are grounded there will be an L di/dt peak voltage drop through them. Even after considering propagation caused peak differentials, the voltage on the halo should nearly equal the rack potential.

- Place high voltage insulating rubber mats on the conductive floor where technicians would stand.

There will be additional magnetic field in the building as a consequence of current flow through the buss bar and connected object to ground, and probable multiple current flow paths through interconnected I/O ports between equipment. If the outside low inductance conductors (multiple copper straps) are installed at the bulkhead or MGB, the peak voltage drop will be minimal, reducing current flow in the building. Properly rated protectors for all I/Os’ must be installed and grounded to the entrance port (single point ground) for equipment to survive in this configuration.

The only satisfactory approach to lightning protection and safety is an integrated set of grounding techniques, protectors, and safety procedures all working together (You can’t design in common sense).

Please contact us for questions or further information on this topic.

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