“What We Have Here is *Failure* to Communicate”

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PEG PROTECTION ENGINEERS GROUP

Electrical Protection of Communications Networks

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atis

“What We Have Here is *Failure* to Communicate”

Standards, both nationally and internationally, are developed and published by a number of standards originations including…

- American National Standards Institute (ANSI)
- The Alliance for Telecommunications Industry Solutions (ATIS)
- International Electrotechnical Commission (IEC)
- Institute of Electrical and Electronics Engineers (IEEE)
- National Fire Protection Association (NFPA)
- USDA Rural Utility Service (RUS)
- Telecommunications Industry Association (TIA)
- Independent test laboratories such as Underwriters laboratory and Erikson/Telcordia also publish standards.
- Service providers develop and publish standards such as MOP’s, M&P’s, Job Aids, Technical Publications etc. which are based on these standards.

When these standards are not shared with those installing and maintaining communications facilities and equipment, safety and network reliability are put at risk.

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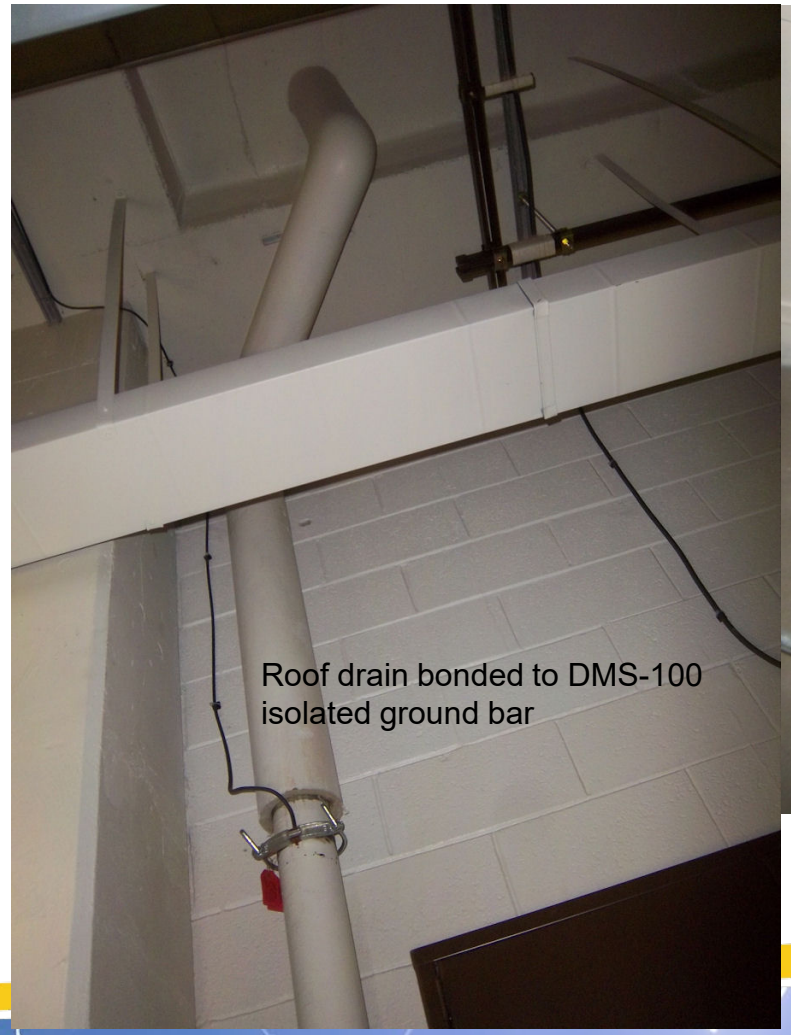
This presentation will attempt to give examples of installations in Central Offices and outside plant locations that did not meet national/ company standard.



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Real World Examples of Failures to Communicate Grounding and Bonding Standards.

NEC Chapter 250

- **250.70 Methods of Grounding and Bonding Conductor Connections to Electrodes.**

The grounding or bonding conductor shall be connected to the grounding electrode by exothermic welding, listed lugs, listed pressure connectors, listed clamps, or other listed means. Connections depending on solder shall not be used. Ground clamps shall be listed for the materials of the grounding electrode and the grounding electrode conductor and, where used on pipe, rod, or other buried electrodes, shall also be listed for direct soil burial or concrete encasement. Not more than one conductor shall be connected to the grounding electrode by a single clamp or fitting unless the clamp or fitting is listed for multiple conductors.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

Split bolt used to connect remote cabinet to ground ring.

Lashing wire clamp used to connect wave guide ground bar to tower ground ring.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

NEC Chapter 250

250.53 Grounding Electrode System Installation.

(A) (3) Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart.

Informational Note: The paralleling efficiency of rods is increased by spacing them twice the length of the longest rod.

(F) Ground Ring. The ground ring shall be installed not less than 750 mm (30 in.) below the surface of the earth.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

Same ground ring:

ground ring conductor
on top of the ground

ground ring conductor
10 inches deep

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Real World Examples of Failures to Communicate Grounding and Bonding Standards.

Radio tower ground ring:

Solid #2 AWG copper ground ring conductor 12 inches below grade.

Grounding electrodes (10 foot rods) spaced at 10 and 18 inch separation.

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Real World Examples of Failures to Communicate Grounding and Bonding Standards.

And just to add to the heart burn…

Insulated ground ring conductors !

Corrosion Control?

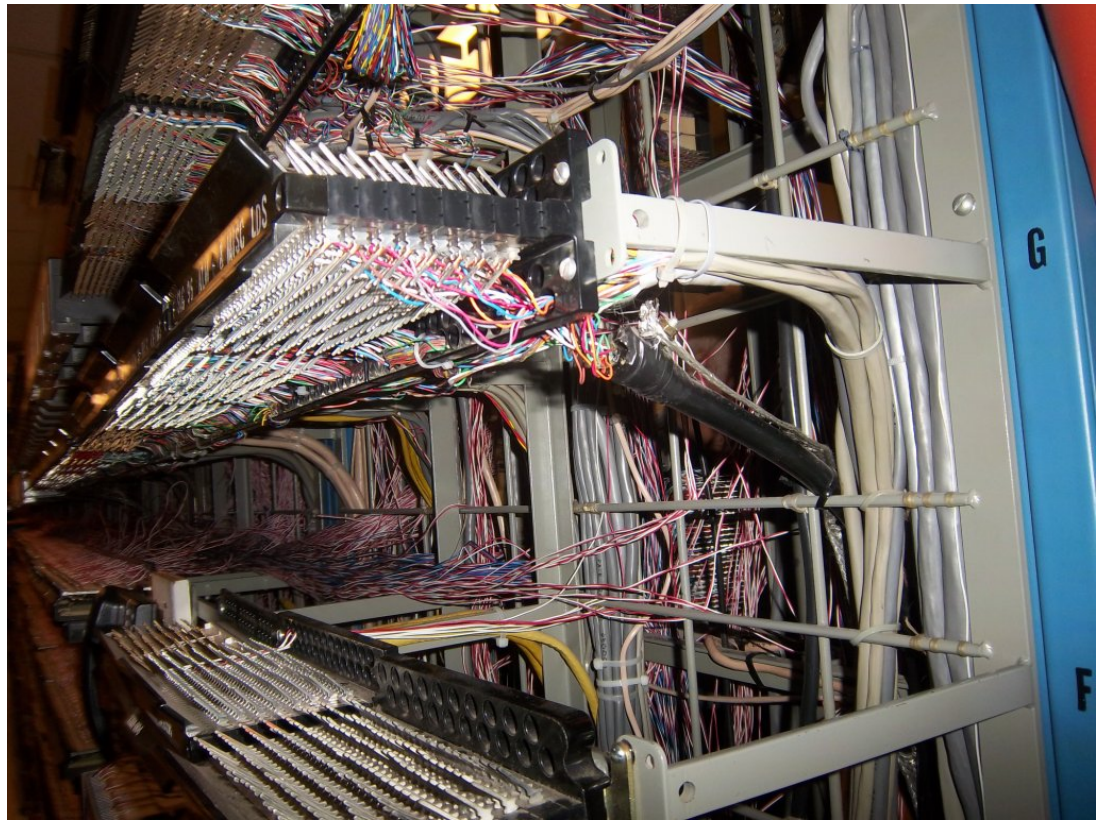
Real World Examples of Failures to Communicate Grounding and Bonding Standards.

NEC- Chapter 8

- **800.48 Un listed Cables Entering Buildings.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.



- Unlisted OSP copper cable extended over 75 feet into Central Office and bonded to main distribution frame (MDF).
- There are NO primary protectors associated with the terminated copper cable pairs.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

- Unlisted OSP optical fiber cable with over 80 feet of slack coiled. Shield bonded to main fiber distribution frame.

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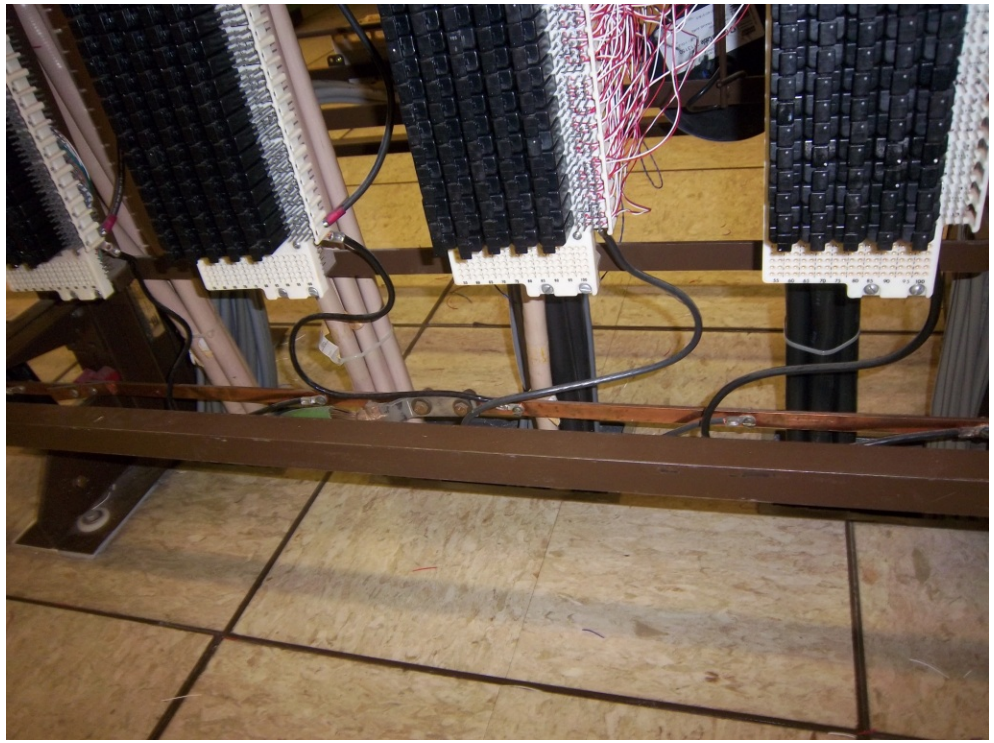
Real World Examples of Failures to Communicate Grounding and Bonding Standards.

NEC- Chapter 8

- **Part IV. Grounding Methods**
- **800.100 Cable and Primary Protector Bonding and Grounding.**
- **(5) Run in Straight Line.** The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

“Inductor” coils in primary protector grounding conductors



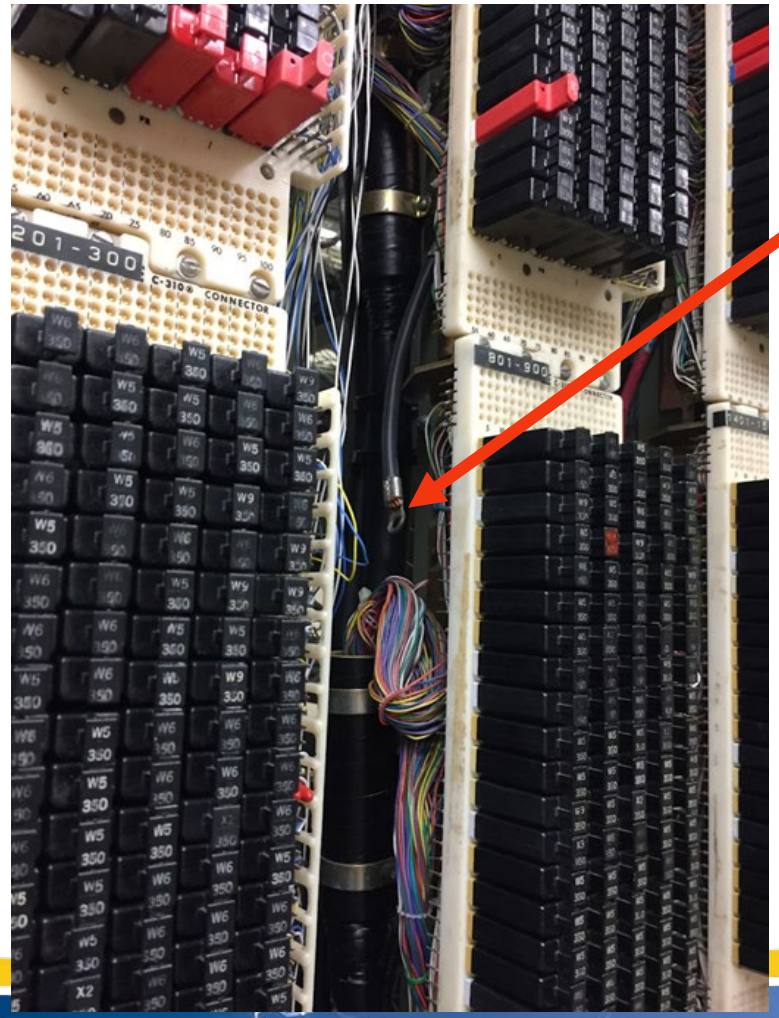
“S” Bends in grounding conductors

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

ATIS-0600313 *Electrical Protection for Telecommunications Central Offices and Similar Facilities*

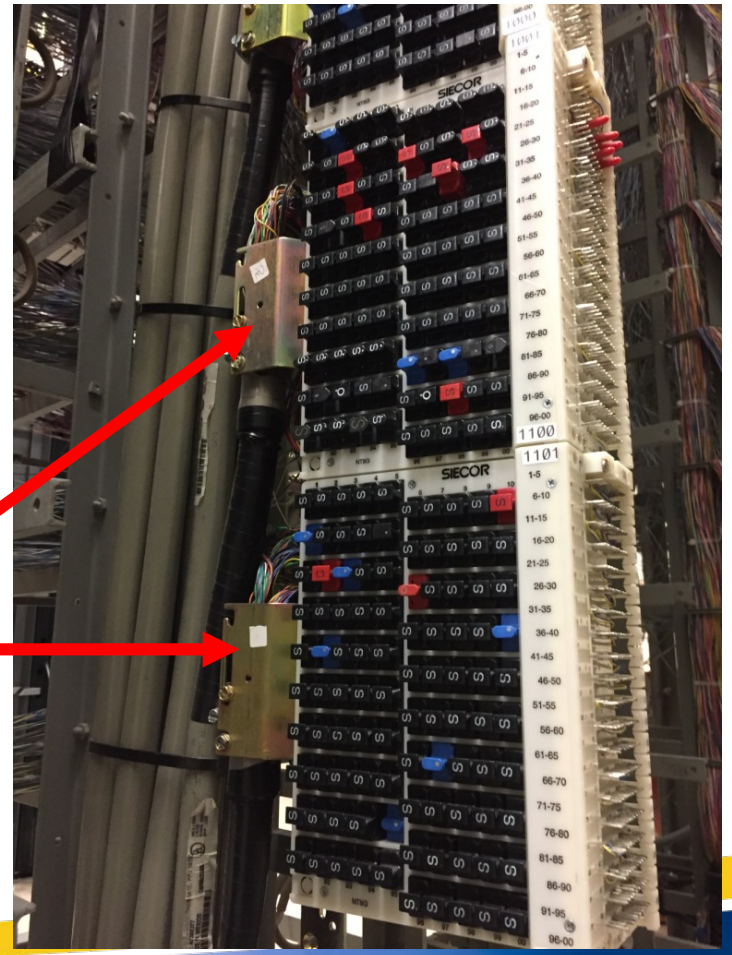
- 6.4 Protector Units (covers requirements for entrance cable protection including carbon block, gas tube or solid state)
- 7.2 Grounding (Earthing) System (covers grounding requirements including protector units)

Real World Examples of Failures to Communicate Grounding and Bonding Standards.



Grounding conductor disconnected

Grounding conductors never installed



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Real World Examples of Failures to Communicate Grounding and Bonding Standards.

GR-1089-CORE (Erickson)

- **9.3 Equipment Grounding Systems**
- **9.5.1 Network Telecommunications Facilities**

Each frame, cabinet, or similar metallic communication equipment enclosure or supporting assembly shall provide a means for attaching a connector to be used for making the connection to the CO GRD system or interior equipment grounding system. The location for the attaching means shall be readily accessible to the installer. The connector shall be installed in accordance with the requirements described in Section 9.9.2, “Connections,” and Section 9.9.3, “Connectors.”

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

Equipment installed in a communications facility
with no chassis bonding and grounding conductors

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

GR-1089-CORE (Erickson)

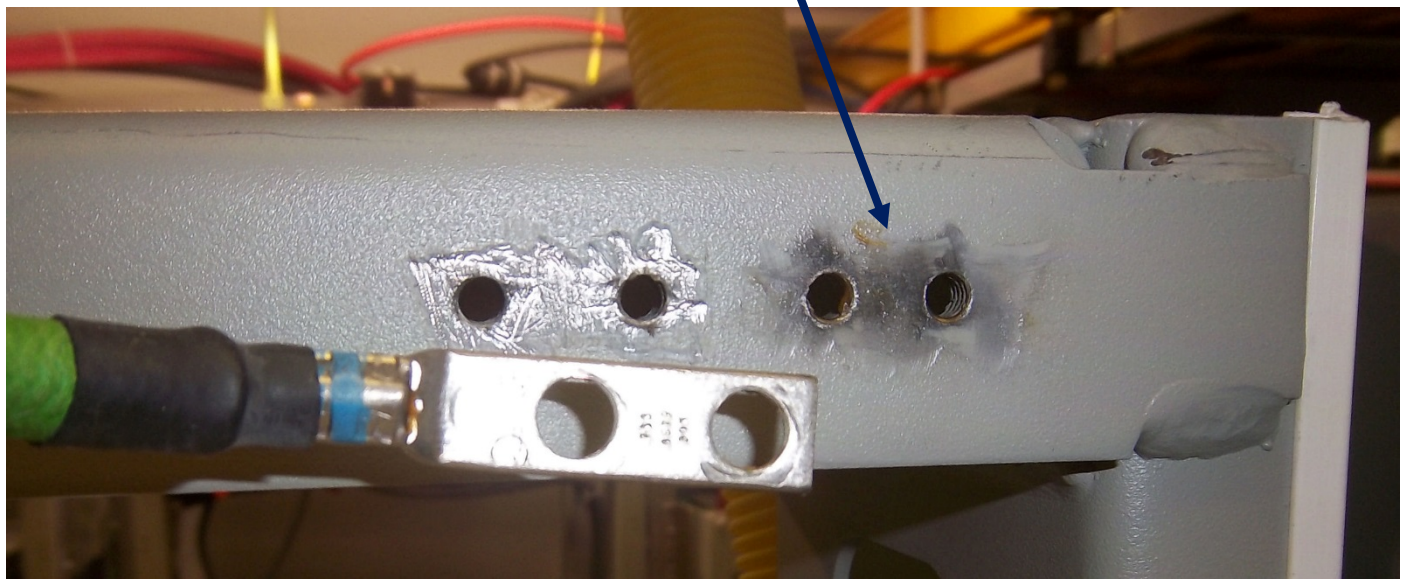
- **9.9 Bonding and Grounding Conductor and Connection Requirements**
- **9.9.2 Connections**

R9-20 [84] Bare conductors shall be coated with an appropriate antioxidant compound before crimp connections are made. All un-plated connectors, braided strap, and bus bars shall be brought to a bright finish and then coated with an antioxidant before they are connected. Tinned, solder-plated, or silver-plated connectors and other plated connection surfaces do not have to be prepared in this manner, but they shall be clean and free of contaminants. All raceway fittings shall be tightened to provide a permanent low-impedance path.

R9-24 [88] Non-conductive coatings (such as paint, lacquer, and enamel) on equipment to be bonded or grounded shall be removed from threads and other contact surfaces to assure electrical continuity.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

Evidence of arcing where paint was not removed

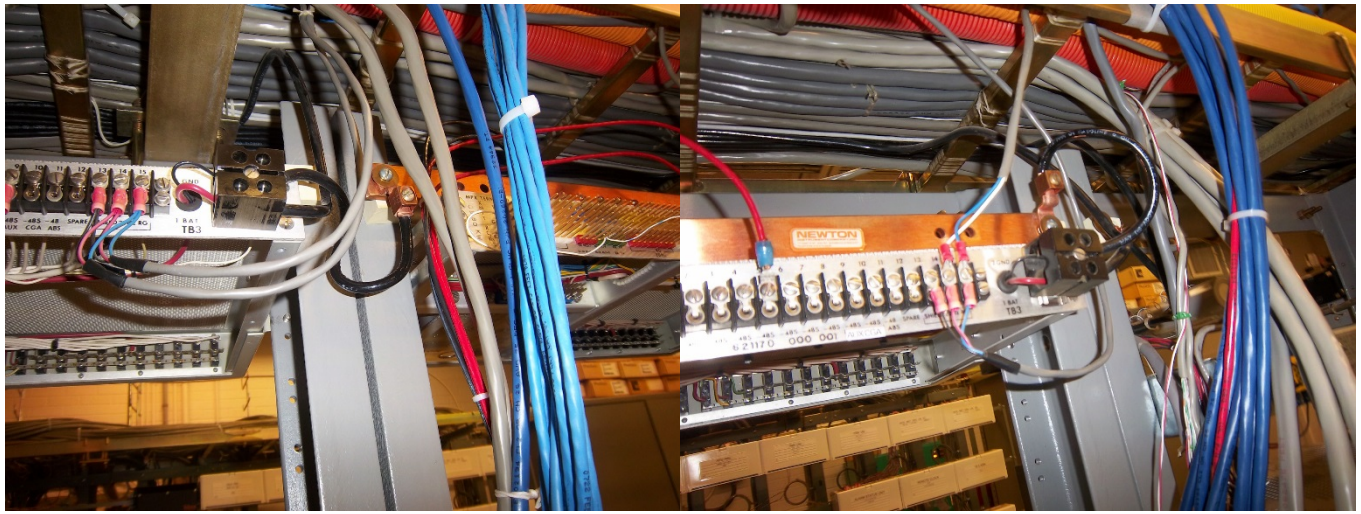


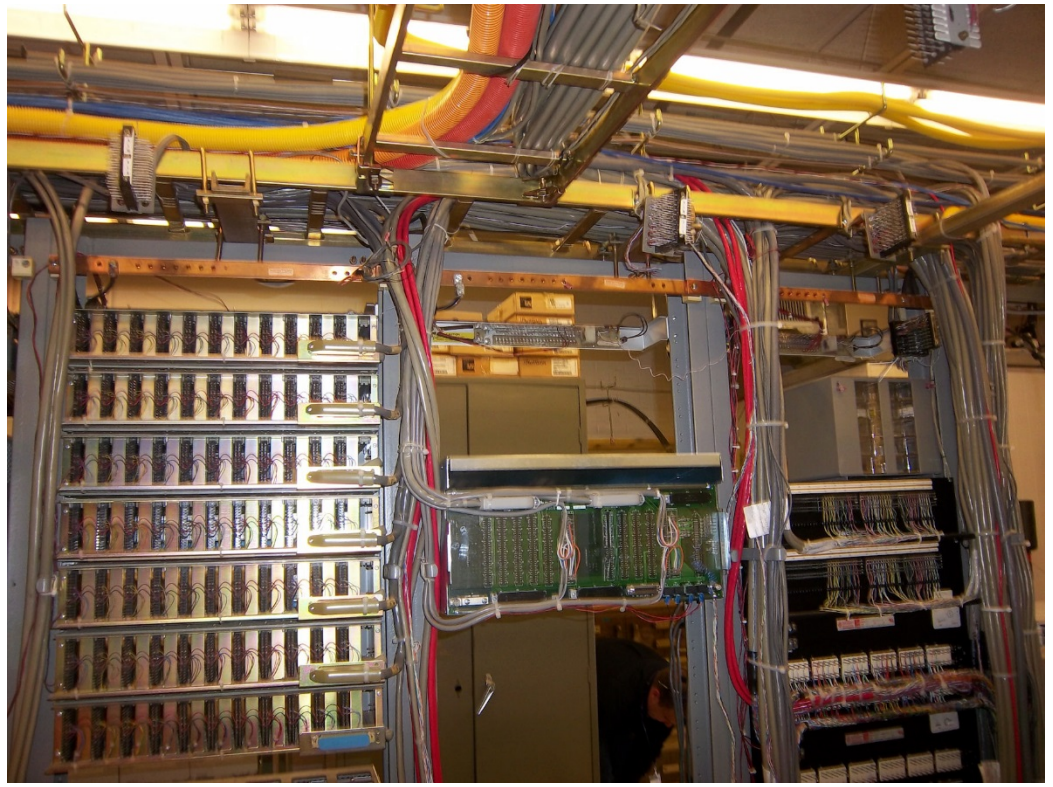
Paint was not removed and or anti oxidant compound was not applied to services before crimped connectors attached to frame ground.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

- **Telcordia GR 1089**
- **R9-15 [151]**If the equipment has a DC power port, the equipment documentation and installation instructions shall specify the treatment of the Battery Return (BR) input terminals as one of the following
- Isolated DC return (DC-I),
- Common DC return (DC-C)

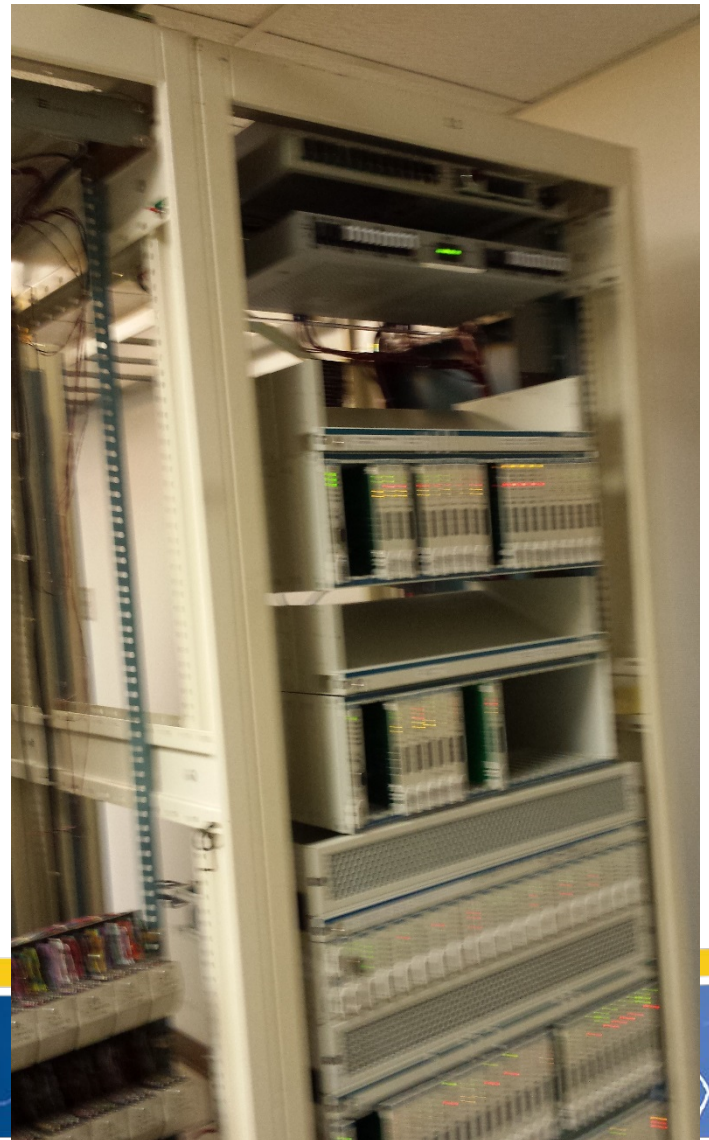
Real World Examples of Failures to Communicate Grounding and Bonding Standards.





DC-C return mixed with DC-I equipment. DC-C return for 4 bays was bonded to an isolated return bar. All DC return was through DC_C equipment to frame ground.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.



- DC-I equipment powered by DC-C fuse panel. DC-I fuse panel installed in same rack but equipment was not wired to DC-I fuse panel.
- This location also lacked a + DC ground reference.
- This bay failed during an AC/ DC power event. All system memory defaulted to factory settings.

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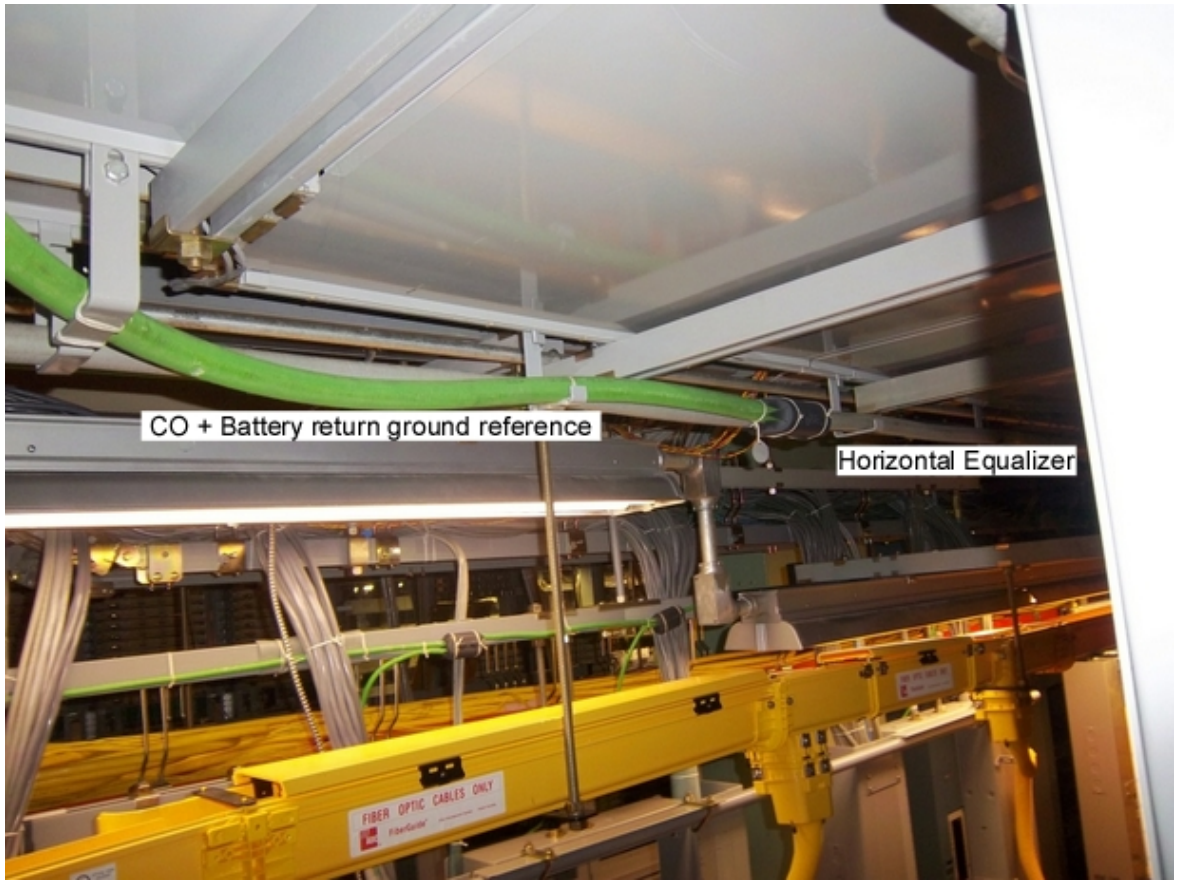
Real World Examples of Failures to Communicate Grounding and Bonding Standards.



CO battery ground reference bonded to horizontal equalizer.

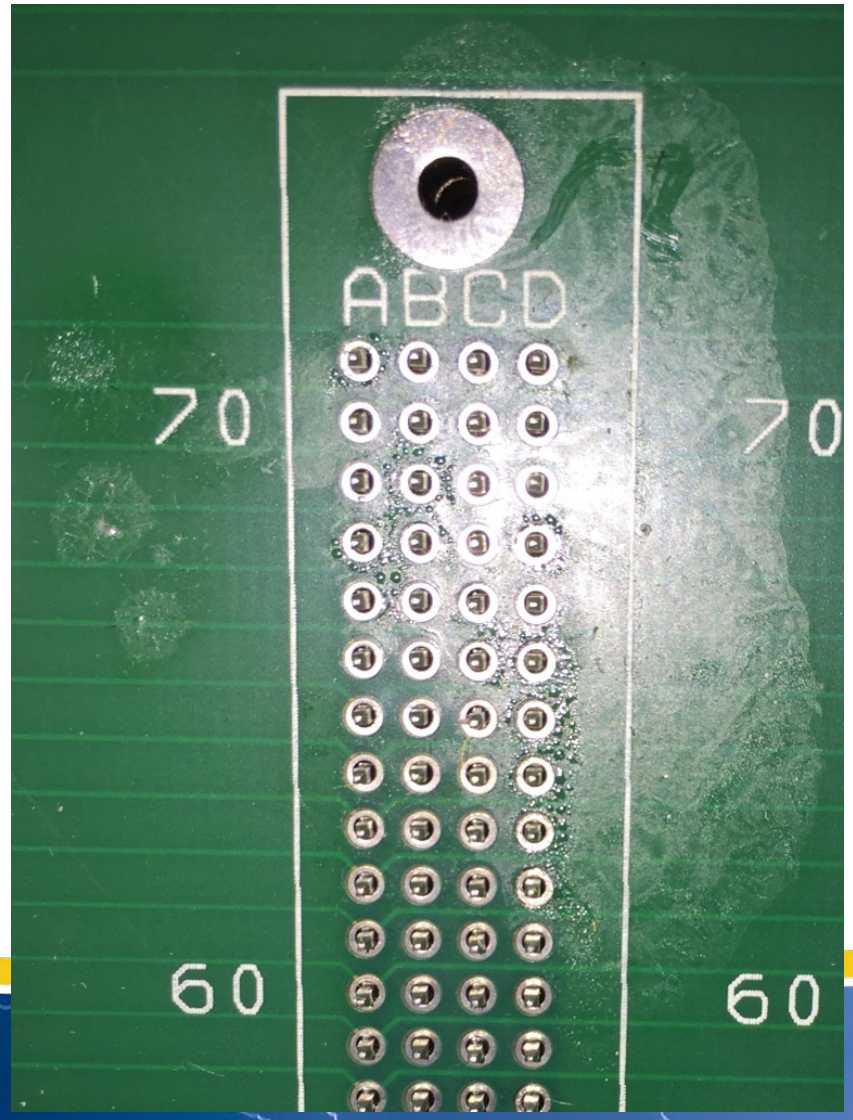
- CenturyLink Tech Pub 77355 and M&P for CO electrical protection specify the CO battery reference ground should terminate on the site principle ground point/ master ground bar.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.

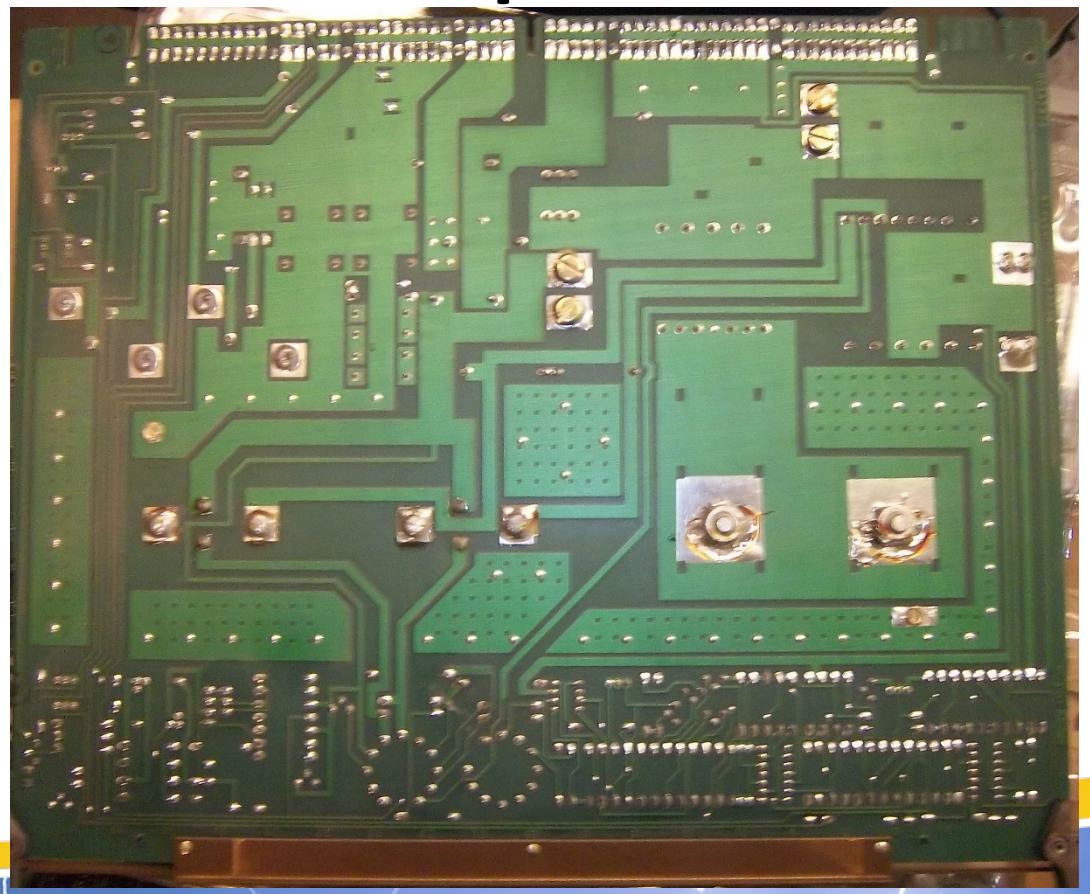
AC MGN ground reference placed at AC sub panel

- CenturyLink Tech Pub 77355 and M&P for CO electrical protection specify the AC MGN ground reference must be placed at the main AC service disconnect.

Real World Examples of Failures to Communicate Grounding and Bonding Standards.



Consequences:



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Real World Examples of Failures to Communicate Grounding and Bonding Standards.

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“What We Have Here is *Failure* to Communicate”

- Training and communicating proper designs for grounding and bonding in communications facilities is essential for installation and maintenance personnel. Properly built and maintained facilities will prevent a large range of service interruptions caused by lightning and AC power faults.

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QUESTIONS ?