



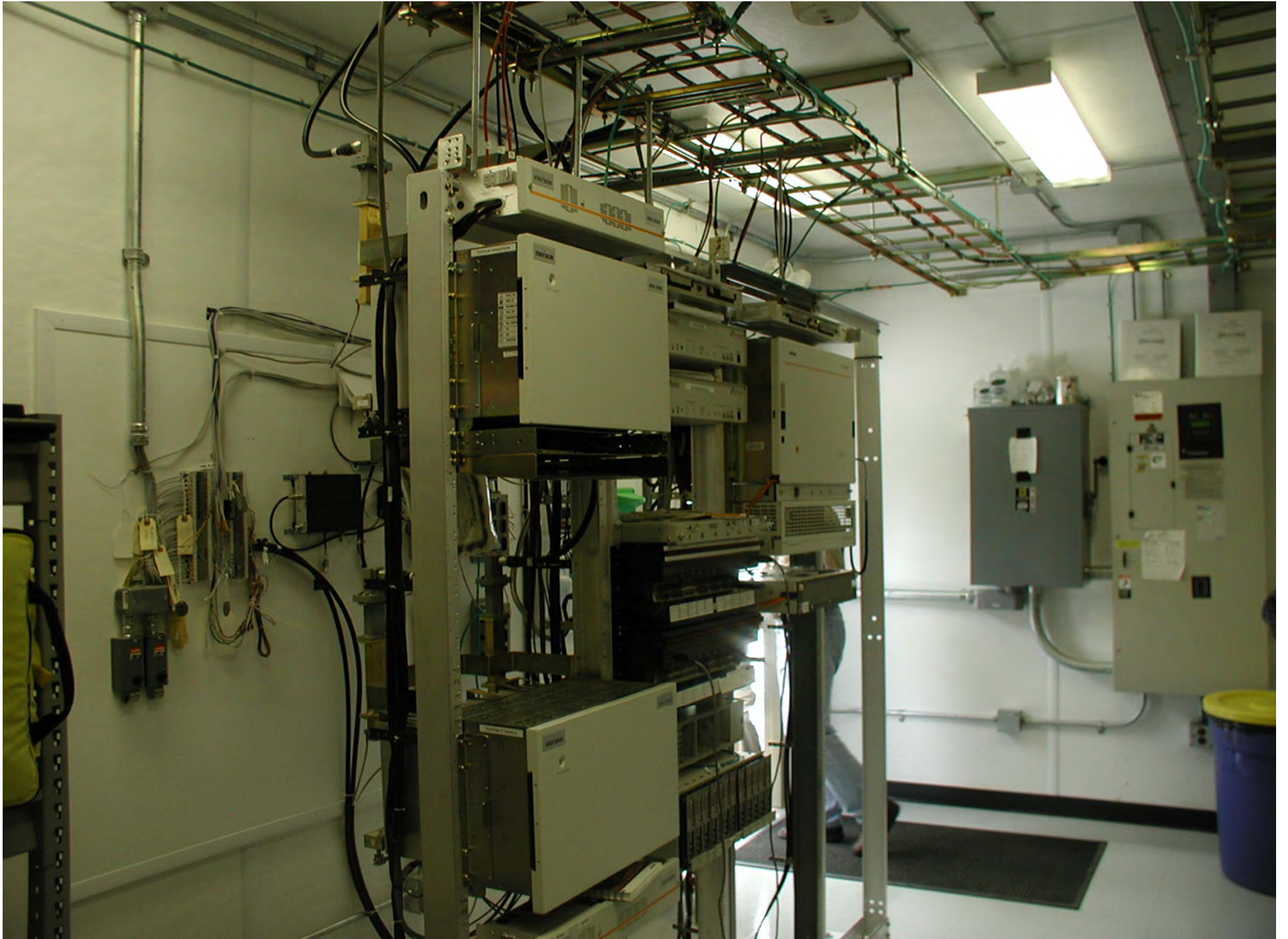
Bonding, Grounding and Power Issues at Municipal Radio Sites

How ugly can it get?

Dan McMenamin
Dan McMenamin and Associates, Inc.











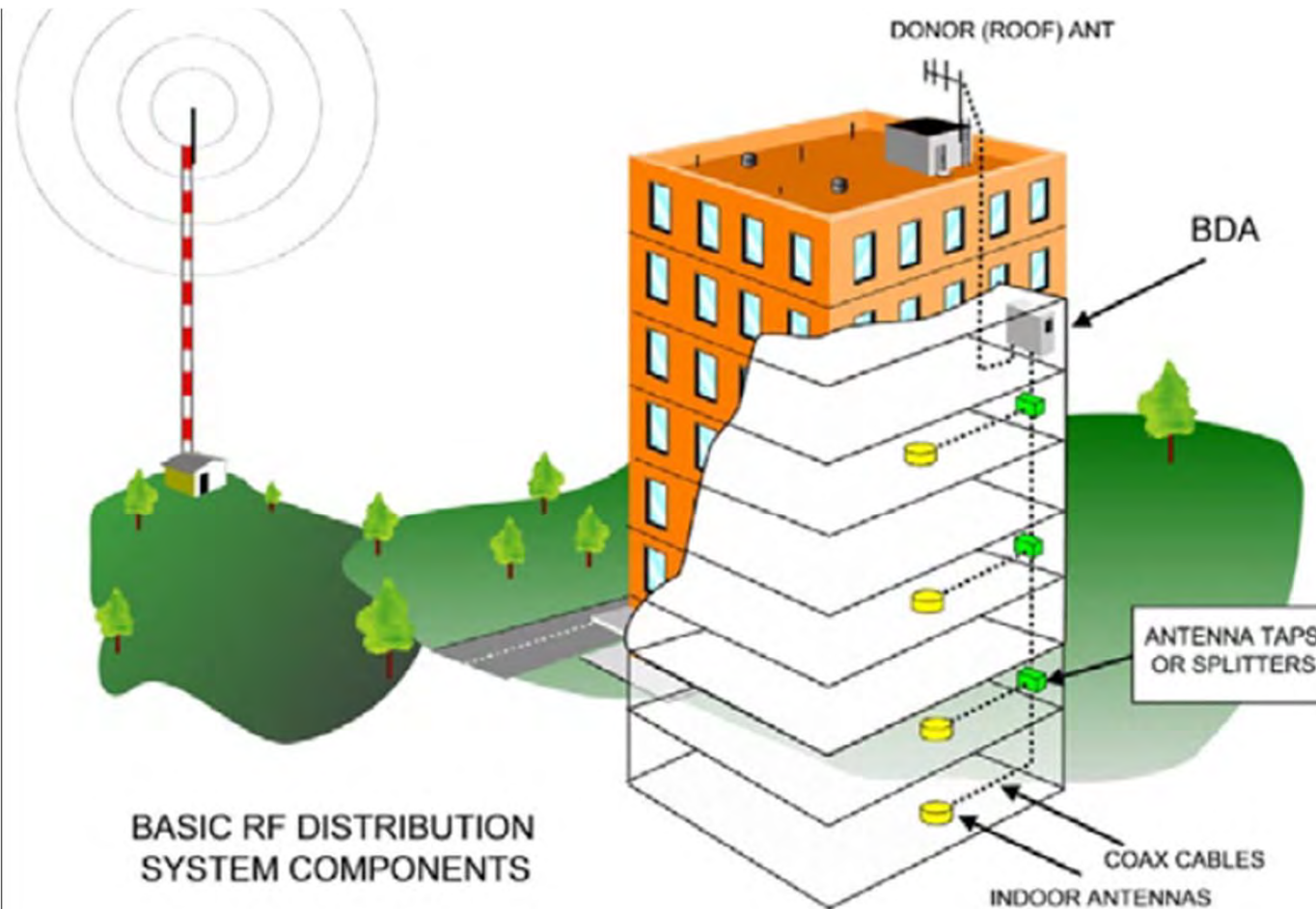




Antenna Positioning

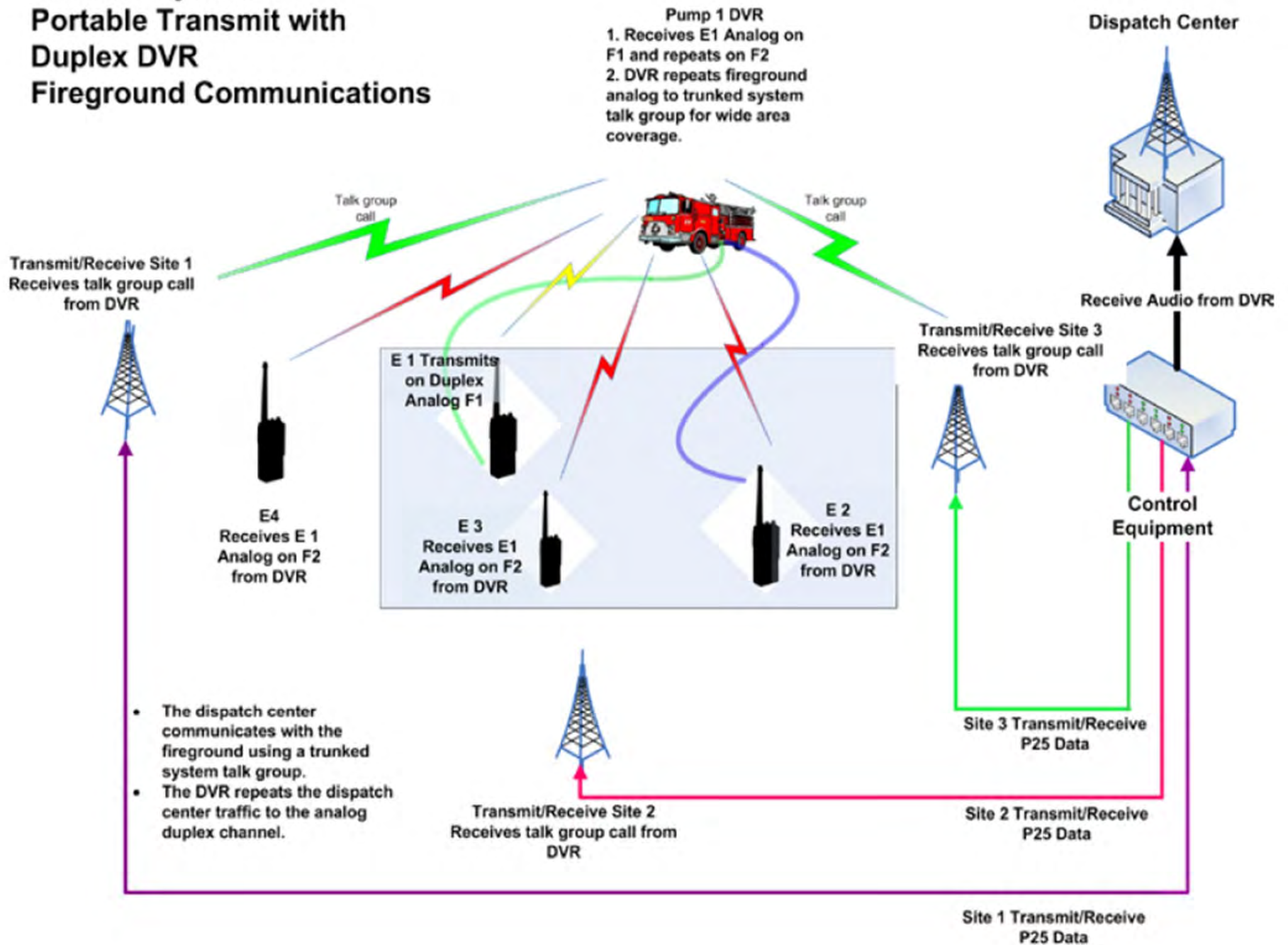


In-Building Repeaters

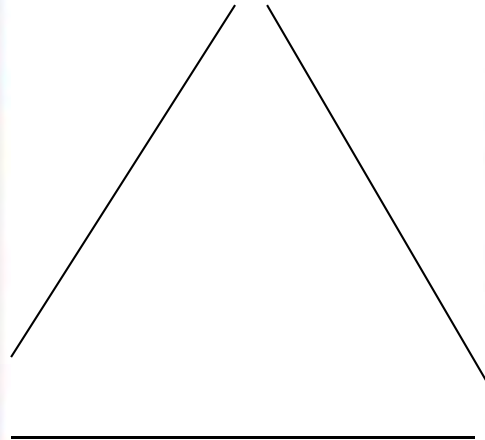


NPSTC (National Public Safety Telecommunications Committee) In-Building Best Practices for In-Building Communications

Trunked System Portable Transmit with Duplex DVR Fireground Communications



- The dispatch center communicates with the fireground using a trunked system talk group.
- The DVR repeats the dispatch center traffic to the analog duplex channel.

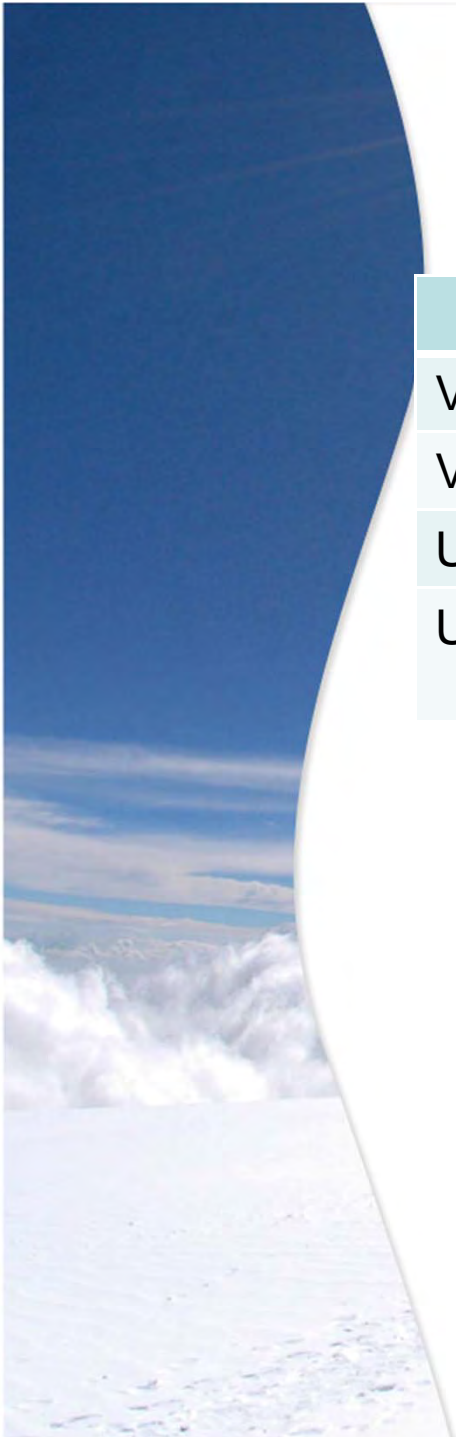


Frequencies & Harmonics

- T1: 1.544 MHz
 - Leaky coax
 - Poor grounds
 - Missing covers
 - Open doors
- ^{100th} Harmonic Fire Radio: 154.430 MHz
 - RFI
 - RFI
 - RFI
 - RFI

Fire Service Radio

Band	Frequencies	Coverage
VHF Low	30 – 50 MHz	About ¾ Mile range
VHF High	150 – 160 MHz	About ¾ Mile range
UHF	450 – 470 MHz	Poor in-bldg signal penetration
UHF	800 MHz	Poor in-bldg signal penetration



Differences

Fire Service	Law Enforcement
Majority of incidents in buildings	Majority of incidents on street
Contaminated breathing atmosphere requiring SCBA	Safe breathing atmosphere
Often operate in a prone position	Upright position
High temperatures	Normal temperatures
Poor voice quality to radio	Good voice quality to radio
High background noise on incident scenes	Normal to high background noise
Poor to zero visibility	Good visibility
Poor to no manual dexterity	Good manual dexterity
Local Command structure coordination Localized communications	Dispatch center coordination Wide area communications

9-1-1

- *6,050 PSAPs in US
- *240M calls to 9-1-1 per year
- 1/3 to 1/2 of those are wireless
- *VoIP is growing rapidly
 - 9-1-1 equipment for VoIP is becoming available
- **29.7% of all U.S. households currently rely on wireless as their primary service as of June 2011

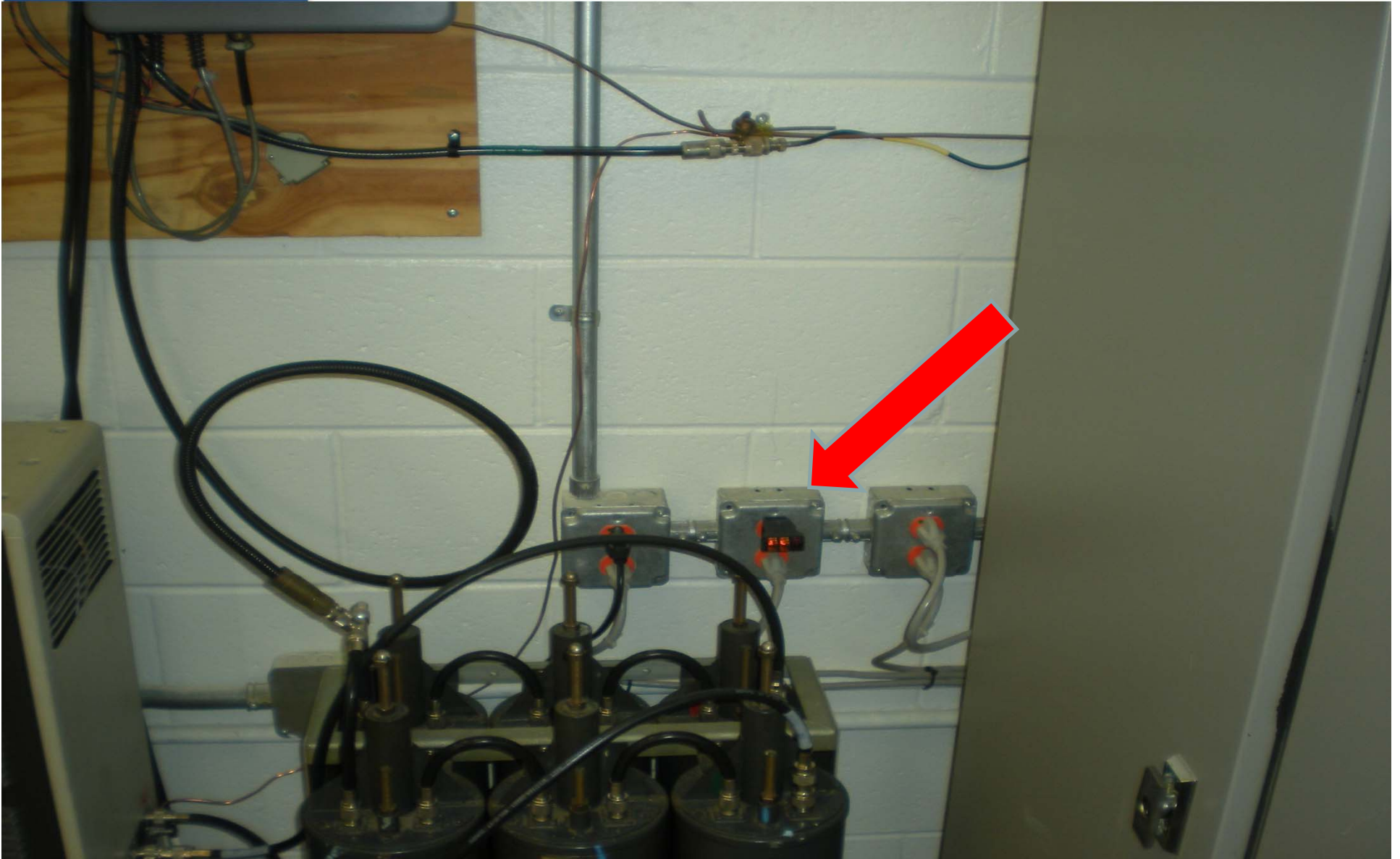
* National Emergency Number Association (NENA)

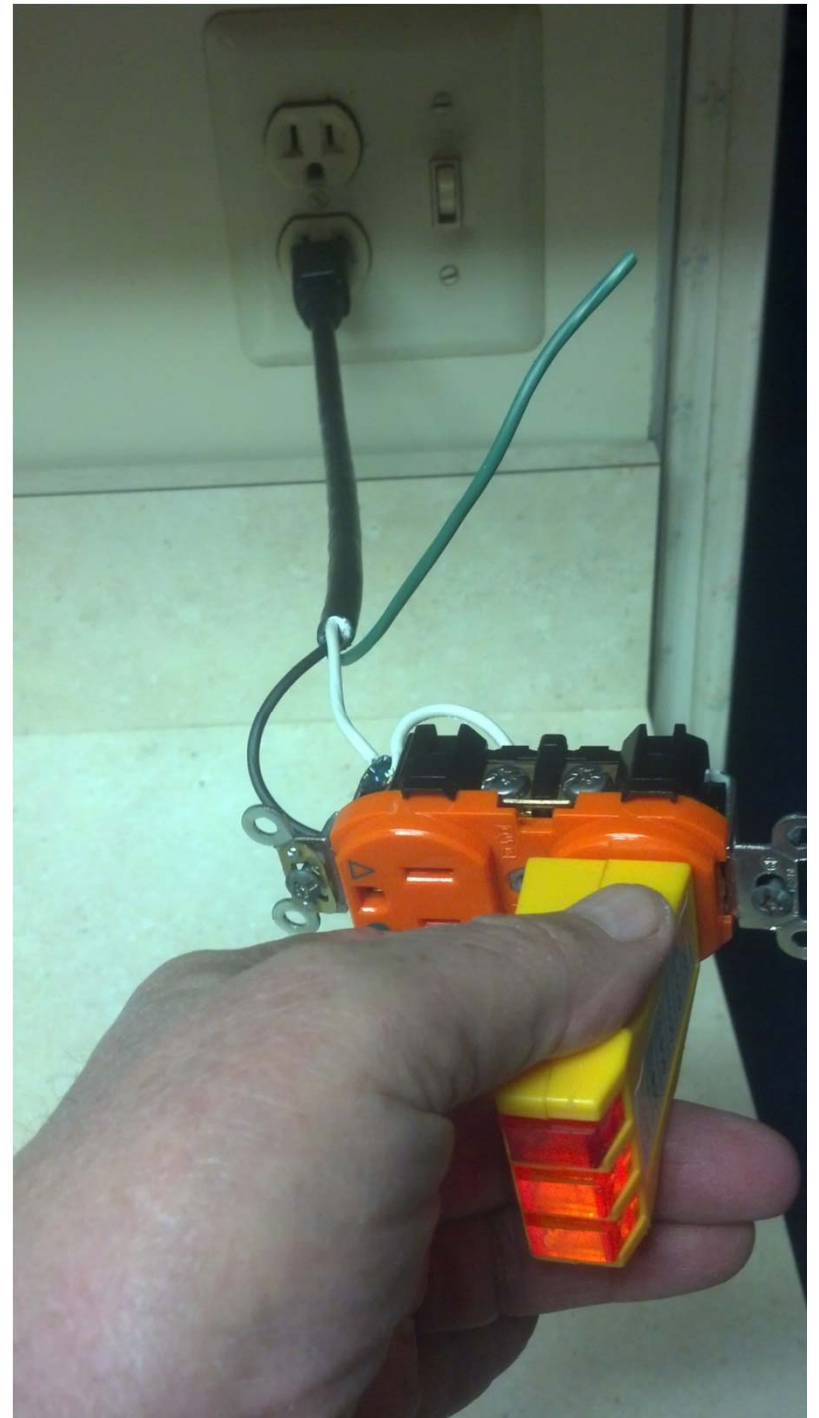
** Cellular Telecommunications Industry Association (CTIA)



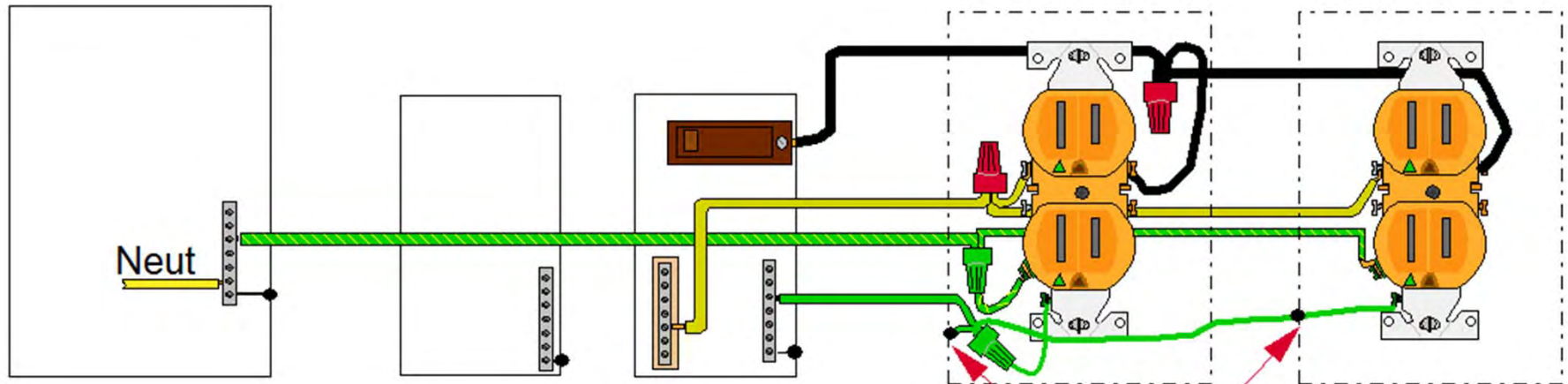


Sins of the fathers...

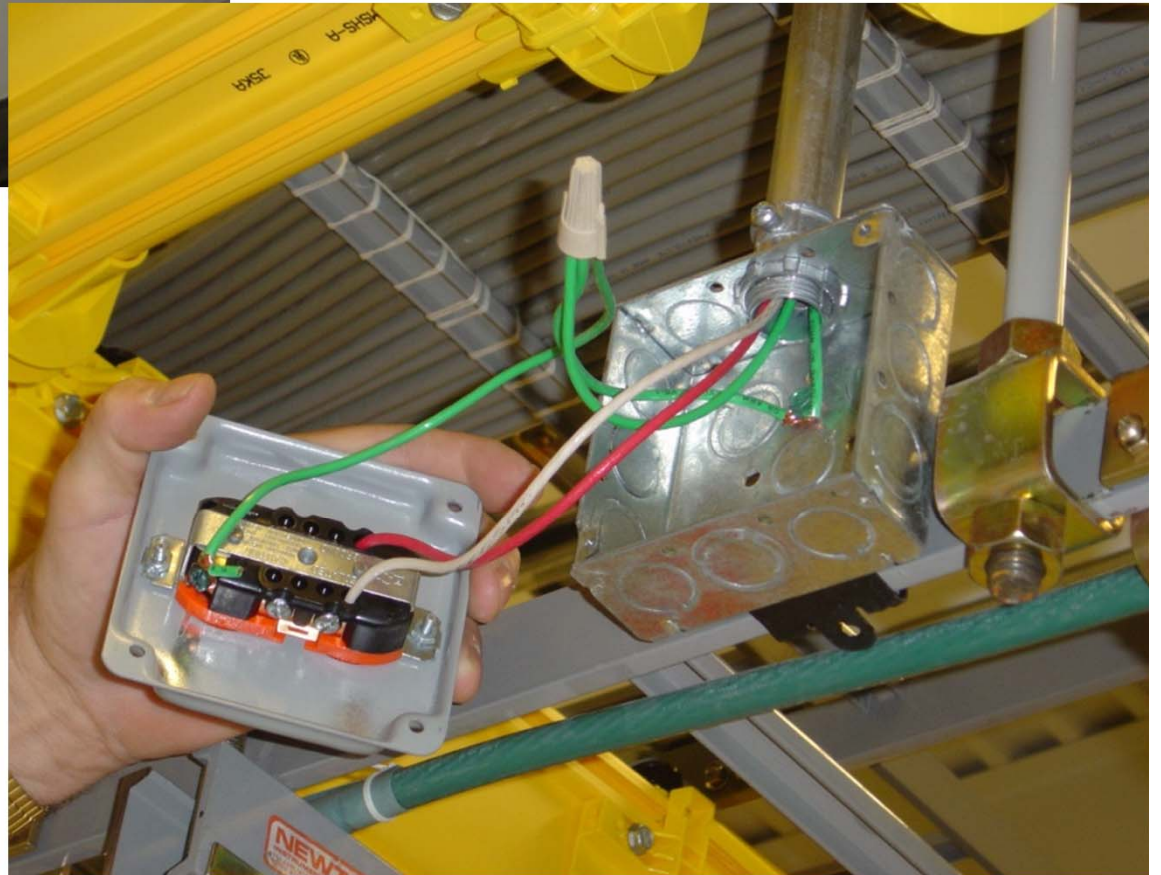




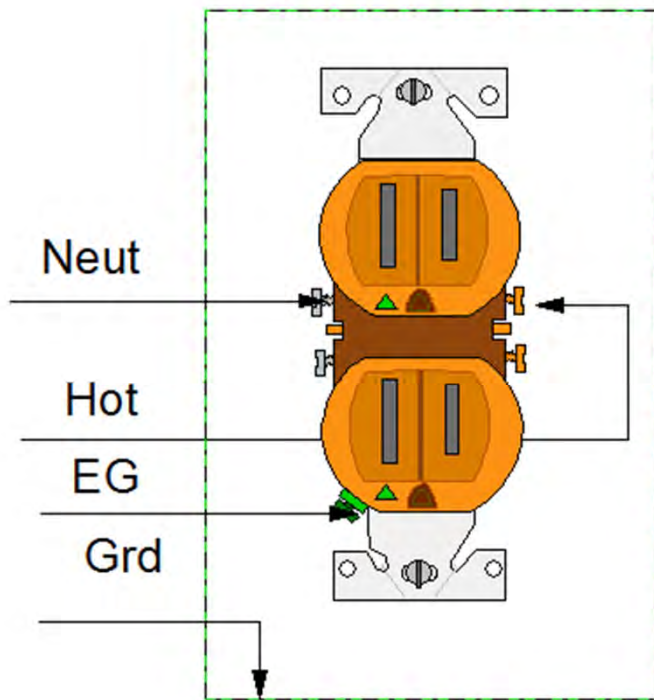
Per NEC (R) 250.146(D), where isolated-ground-type receptacles are used, the isolated EGC can terminate at an equipment grounding terminal of the applicable service or derived system in the same building as the receptacle. If the isolated EGC terminates at a separate building, a large voltage difference may exist between buildings during lightning transients and could cause damage to equipment connected to an isolated ground-type receptacle and present a shock hazard between the isolated equipment frame and other grounded surfaces.



Metal raceways and boxes are required to be grounded by one of the EGC types specified in NEC^(R) 250.118

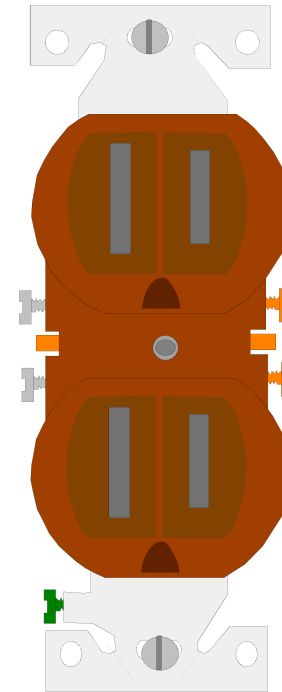


Isolated receptacles not preferred for communications



EG and metal yoke at
Different potentials

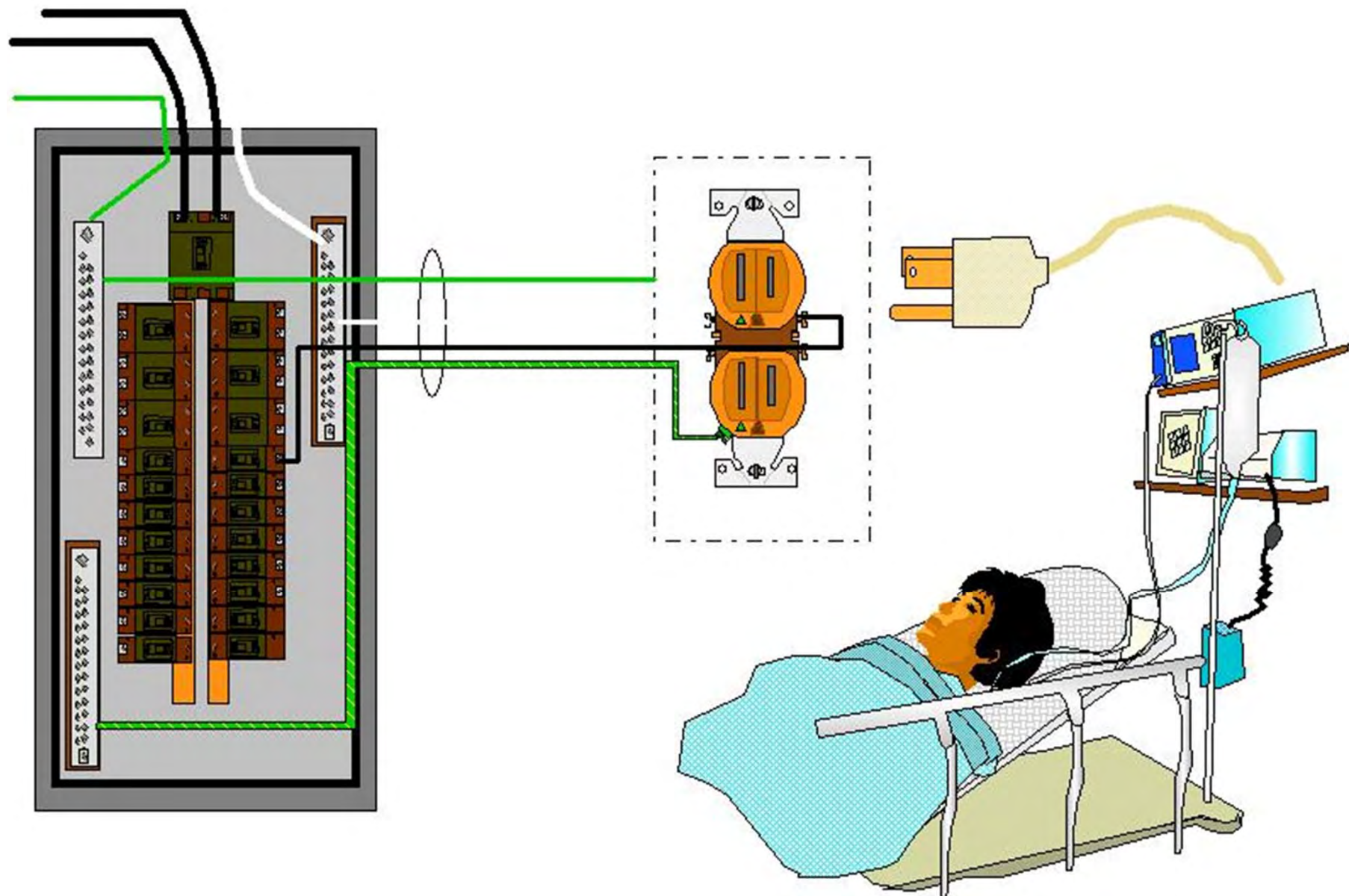
(Problematic).

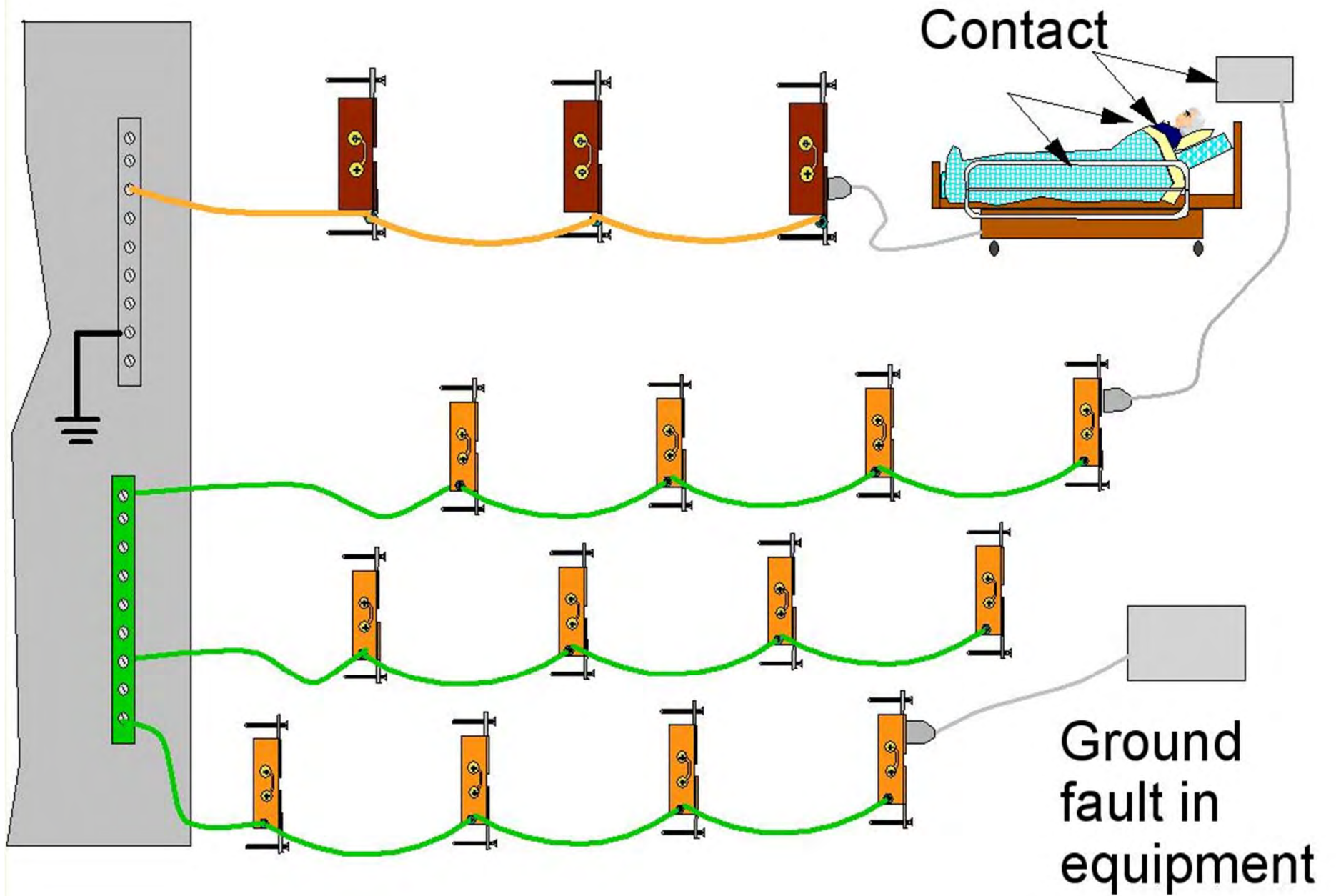


EG and metal yoke at
the same potential

(Preferred).

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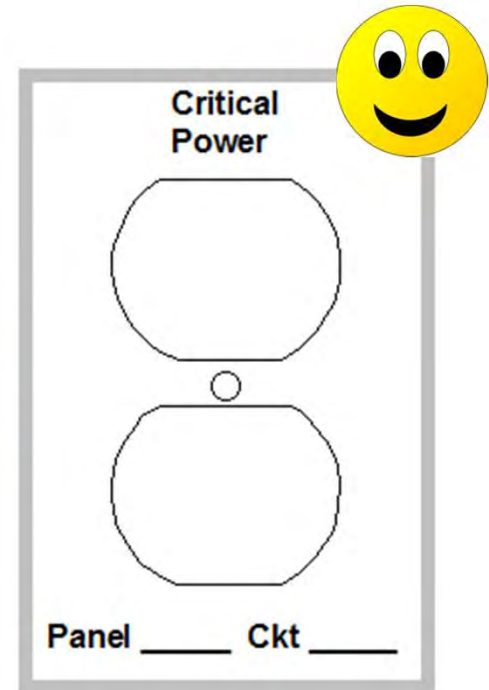
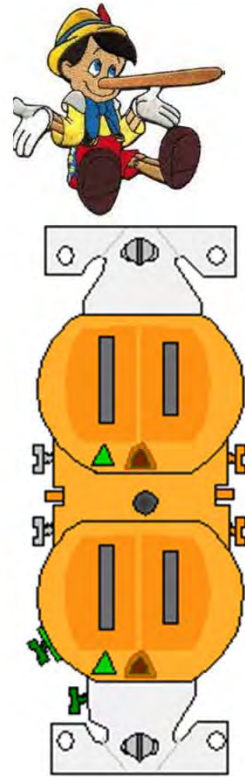
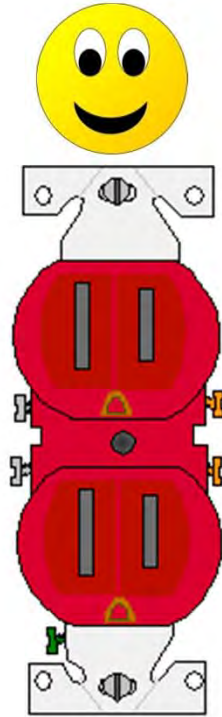




NEC 708.10 (2) Receptacle Identification.

- In a building in which COPS are present with other types of power systems described in other sections in this article, the cover plates for the receptacles or the receptacles themselves supplied from the COPS shall have a distinctive color or marking so as to be readily identifiable.

COPS

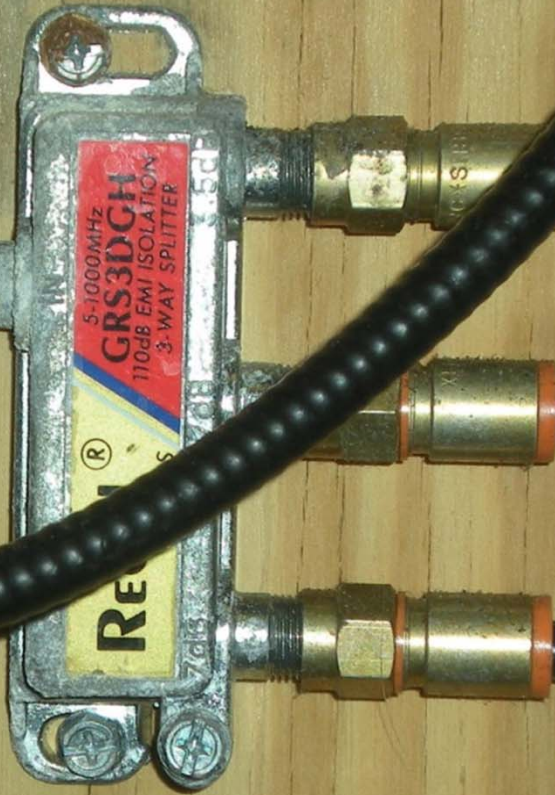




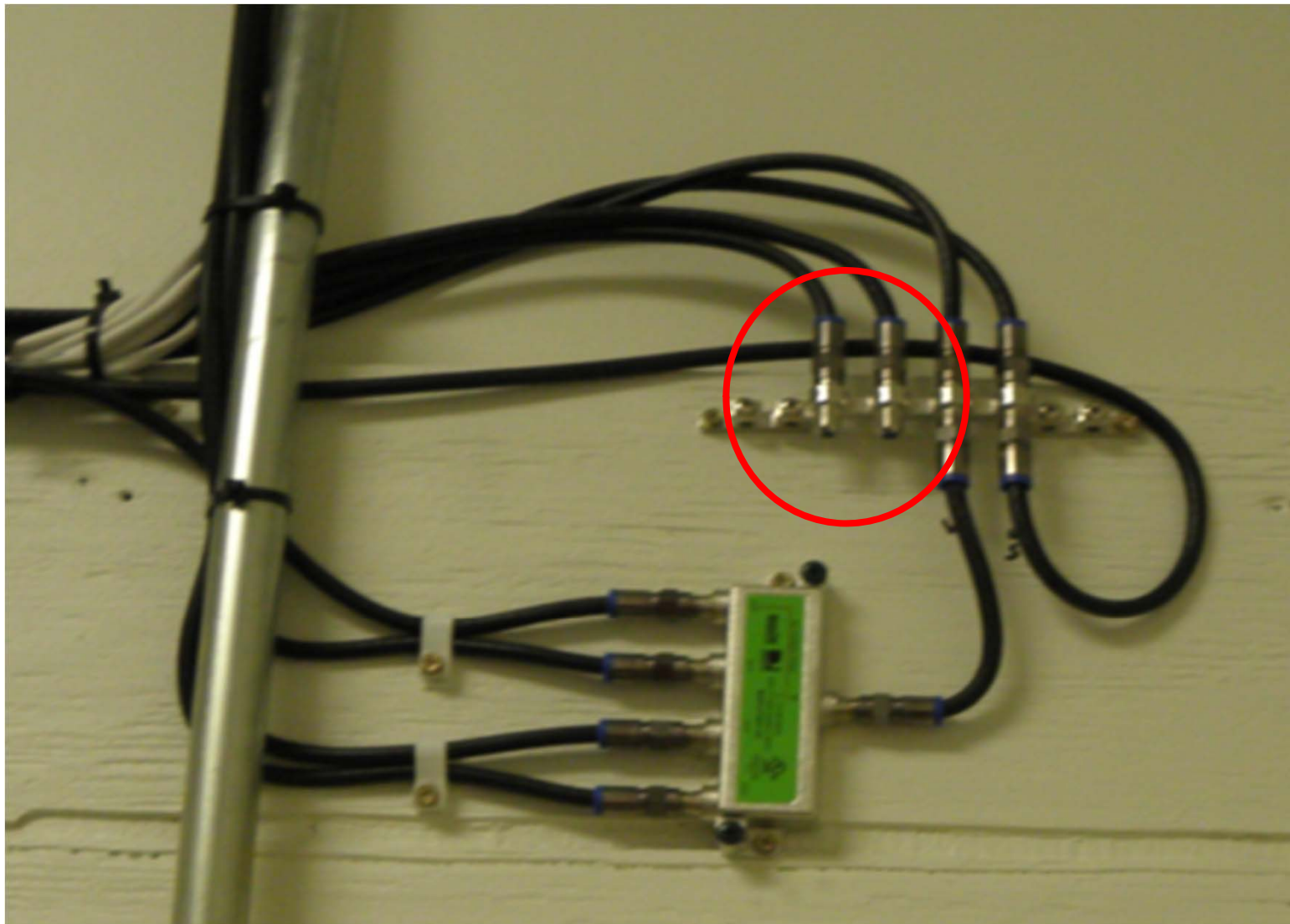


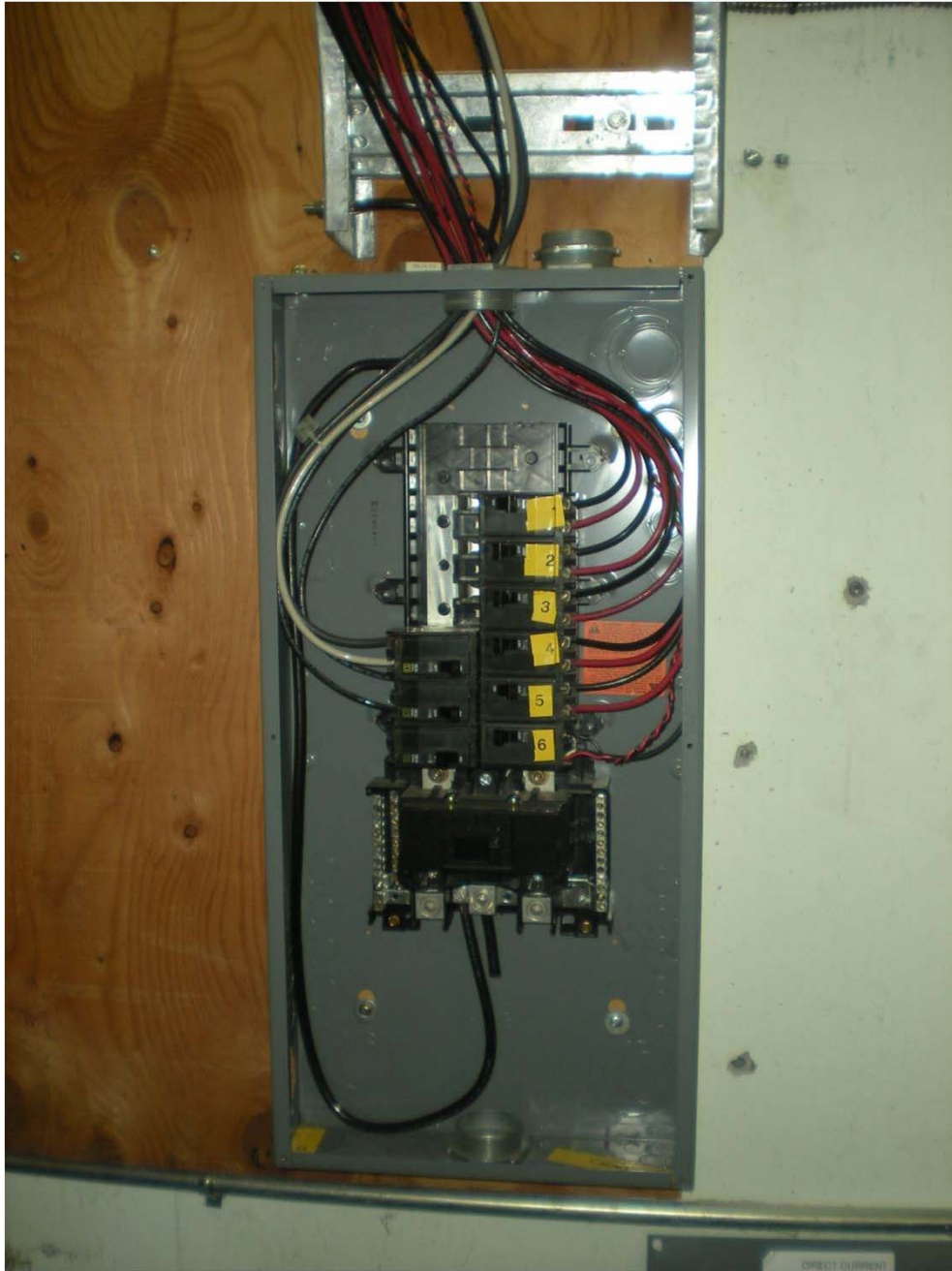
Mold

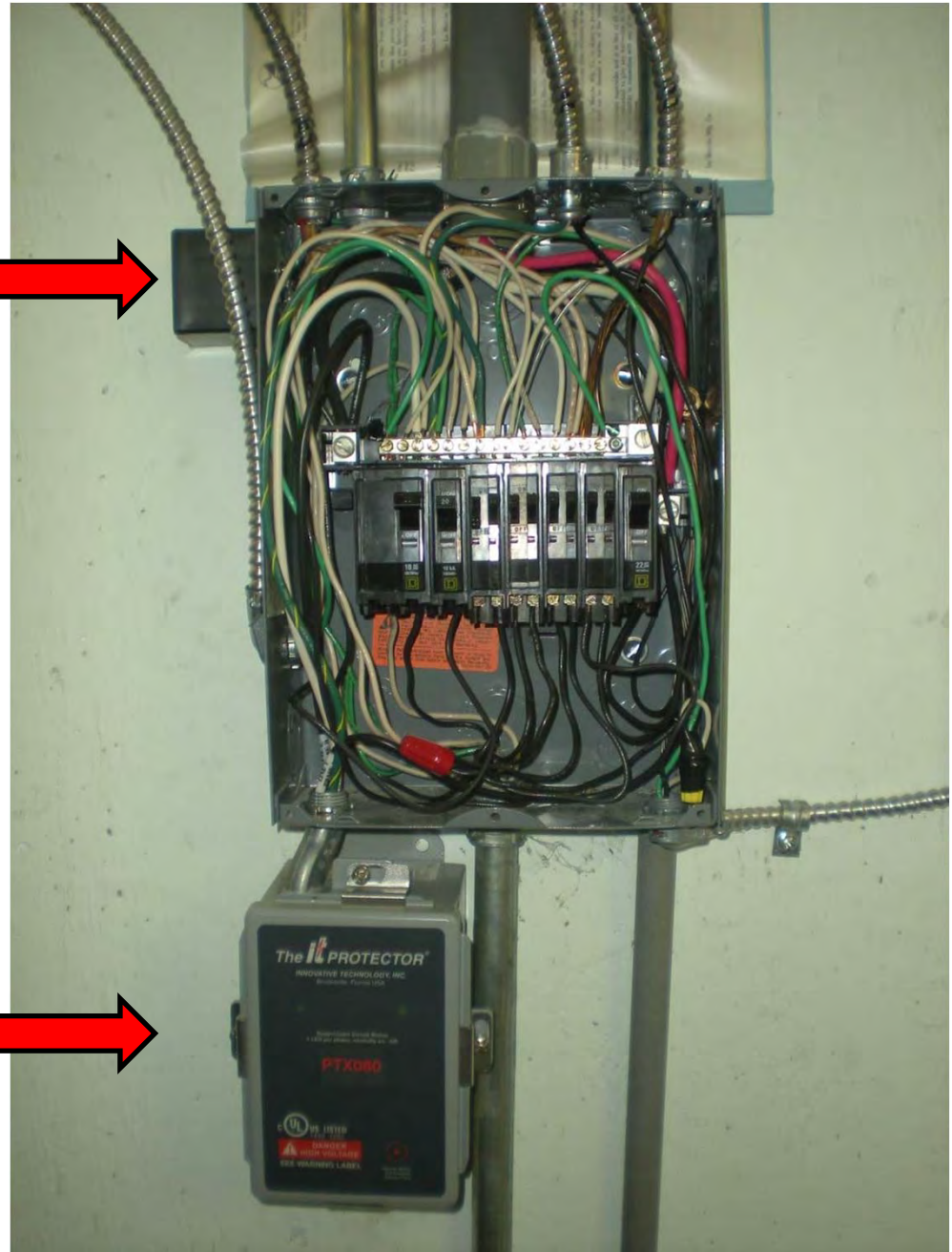
Corrosion



Unterminated Coax







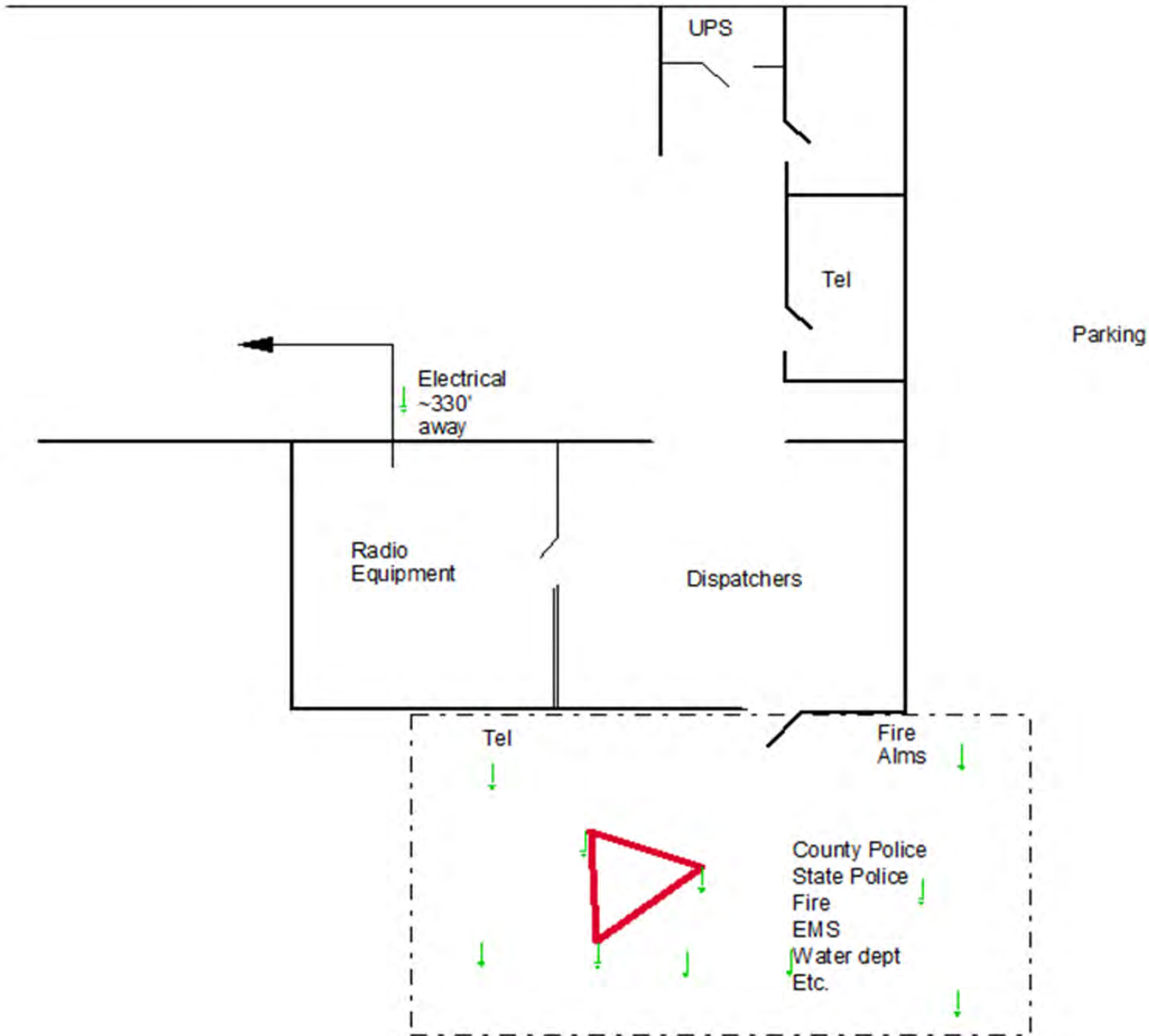
Are either of these SPDs “Discrete All Mode”?



HVAC Redundancy Ventilation

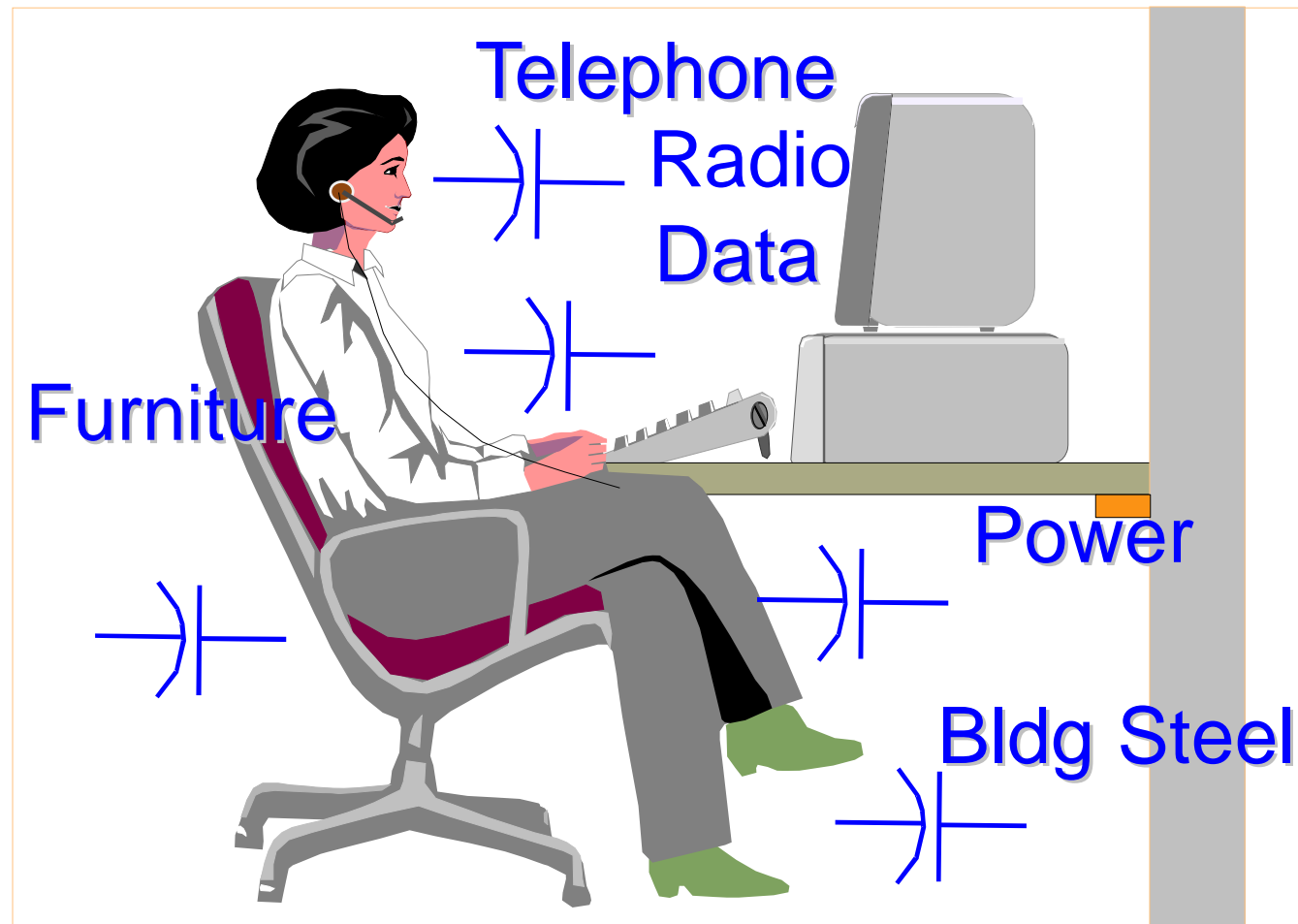




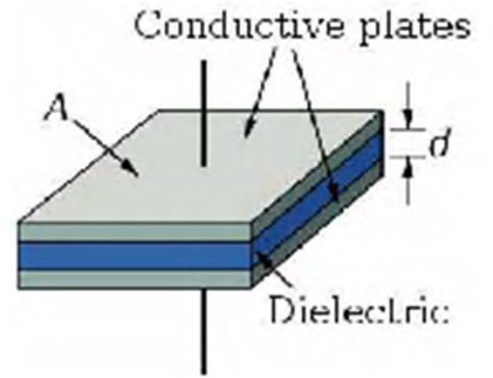
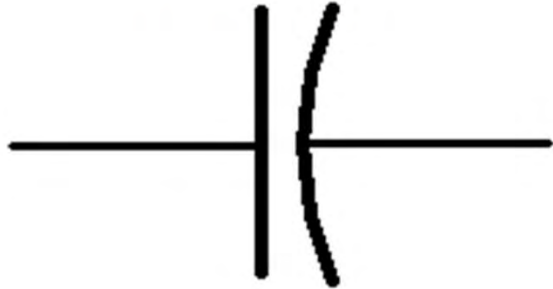


- None of the systems were bonded together

Capacitive-coupled differences in potential



Capacitor blocks dc
and passes ac

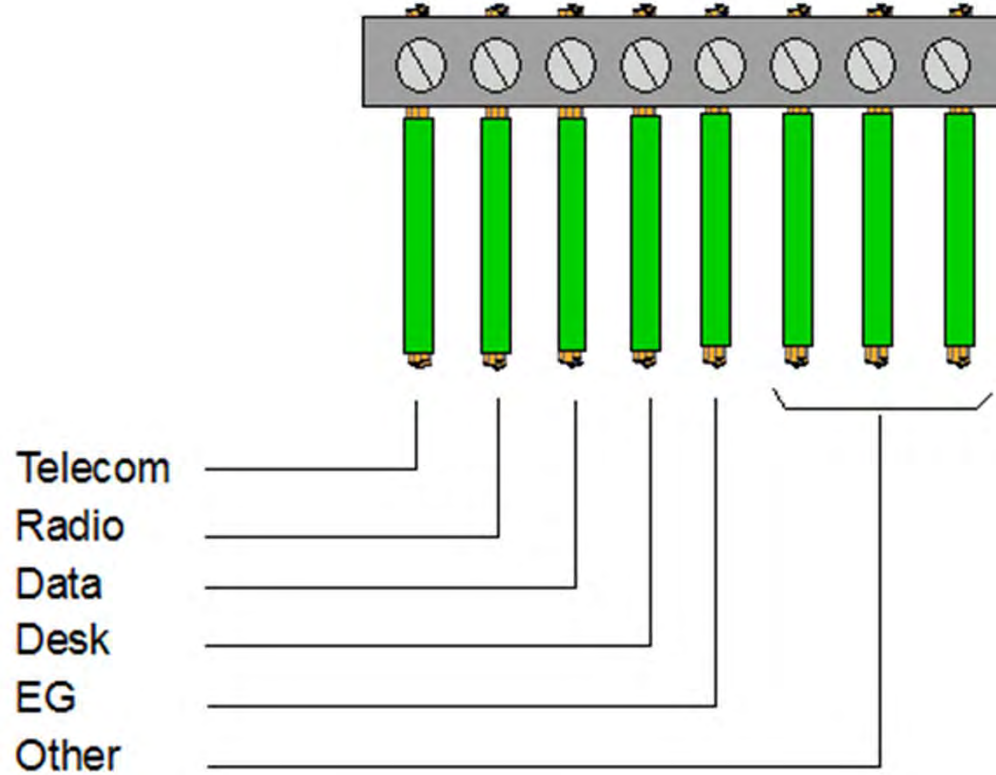


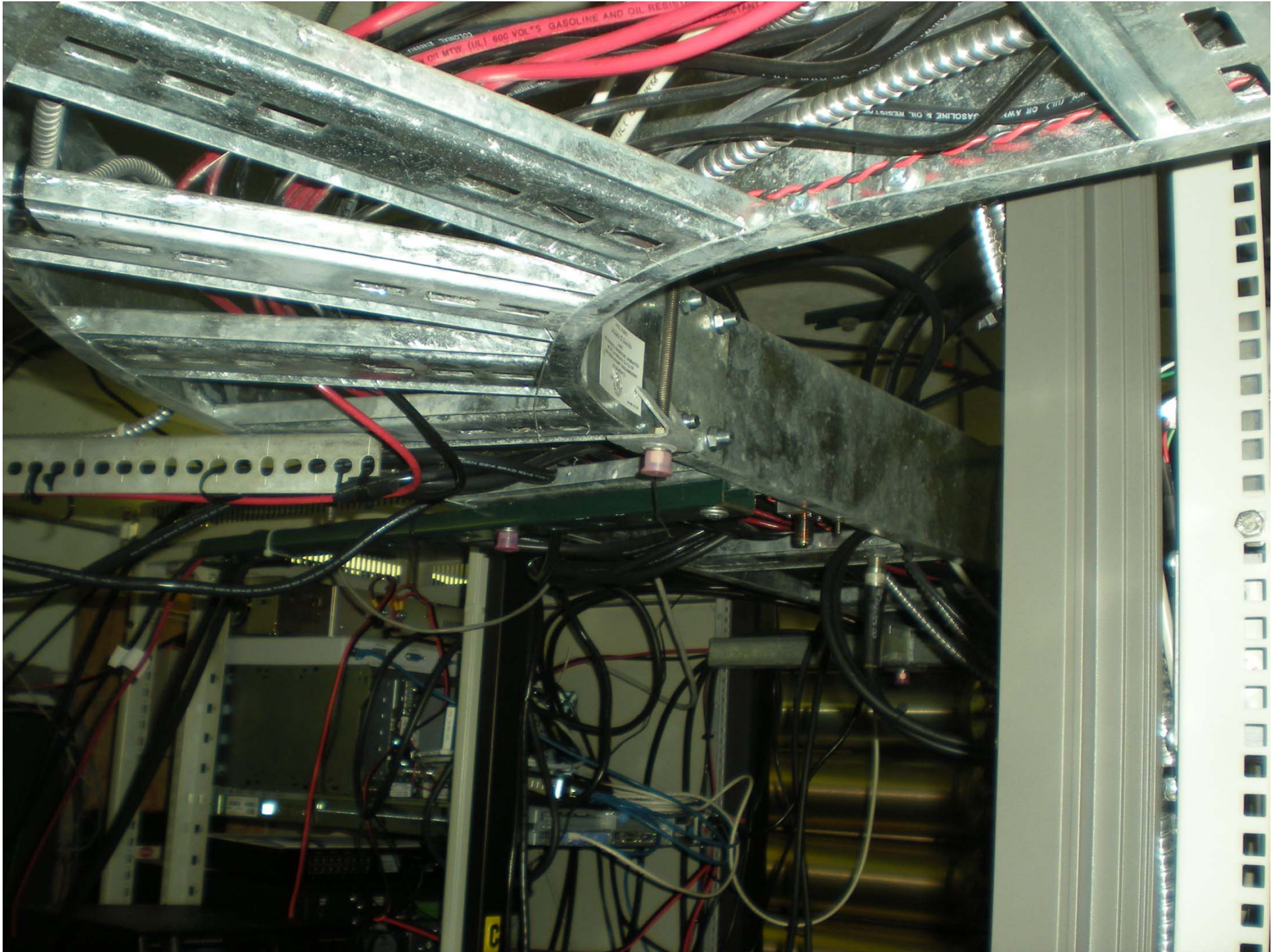
Conductor (headset element)
Dielectric ($\sim 1,500$ Ohms)
Dielectric (skin)
Conductor (body fluid salinity)



Bonding

"Fortress Bonding" at each attendant desk





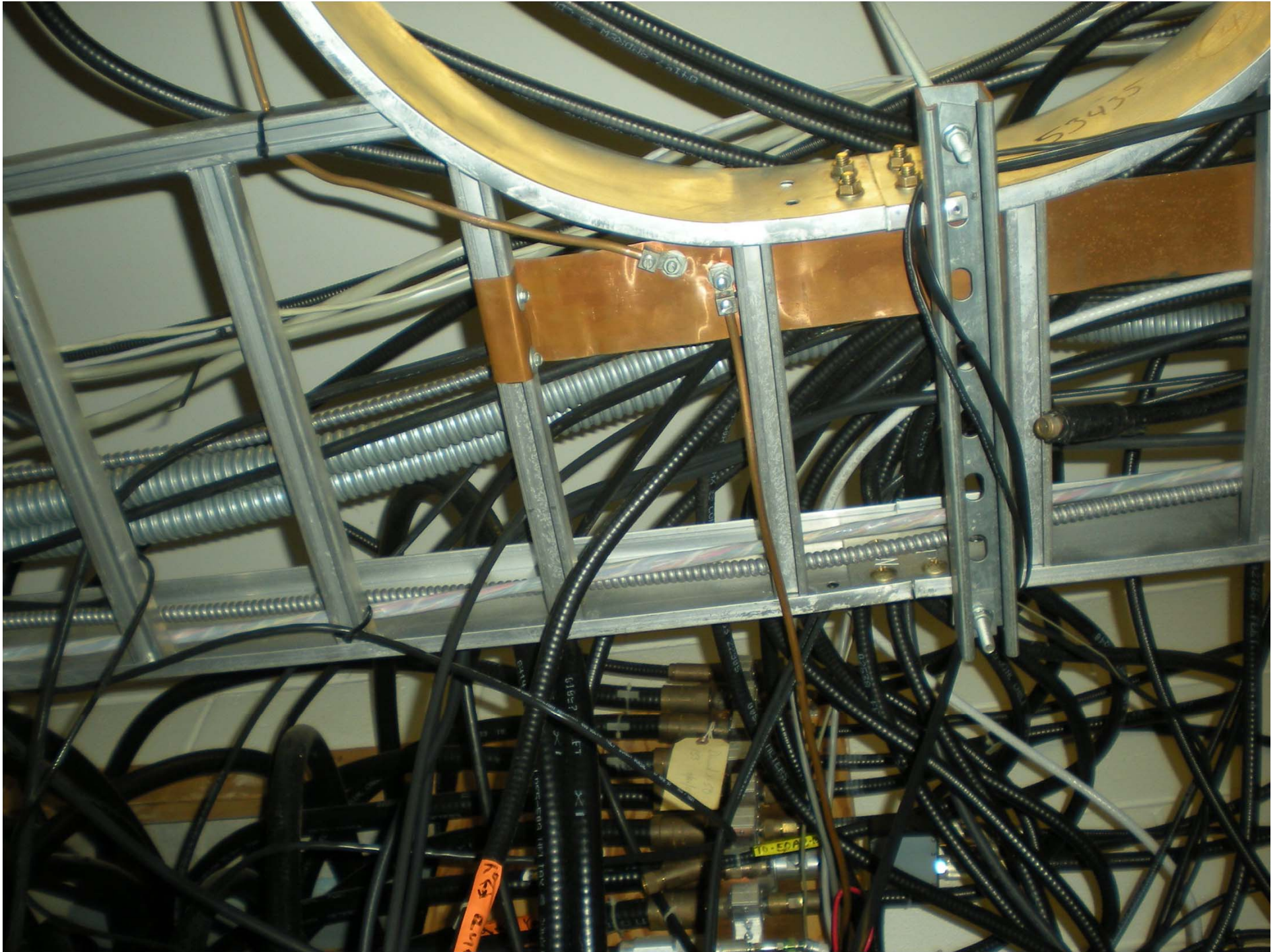


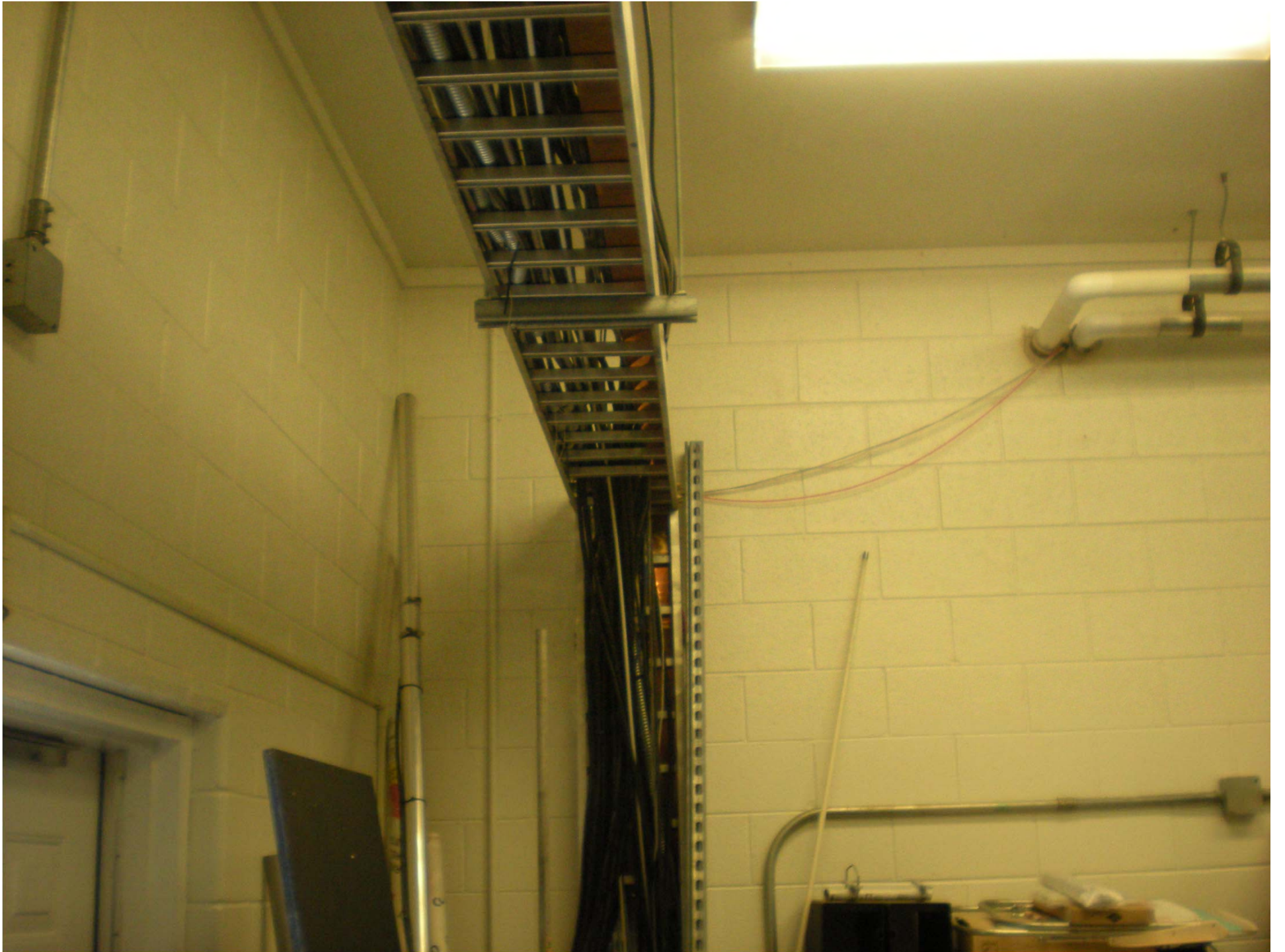
Missing Ground Lead

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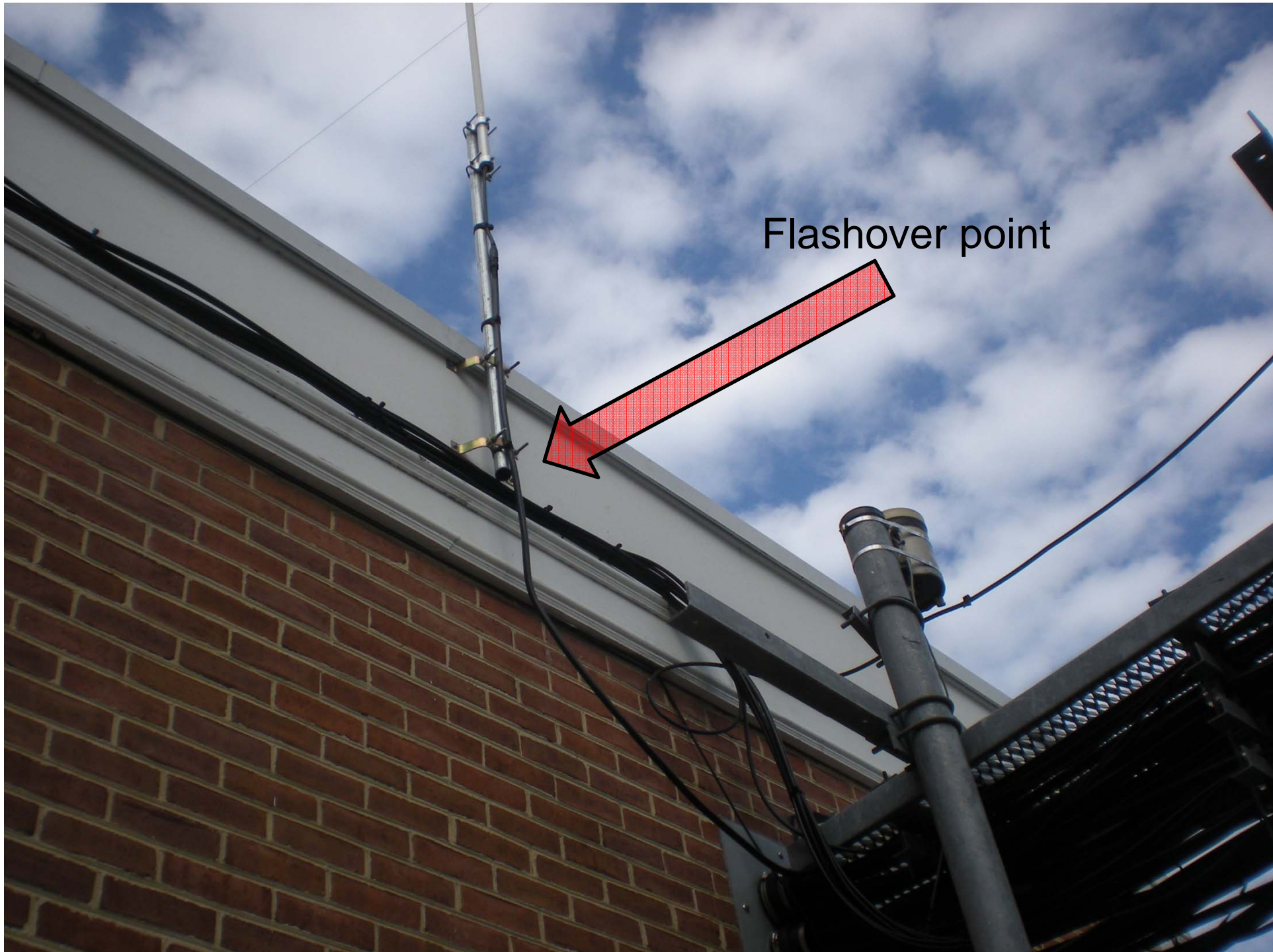












Flashover point

HVAC Redundancy?



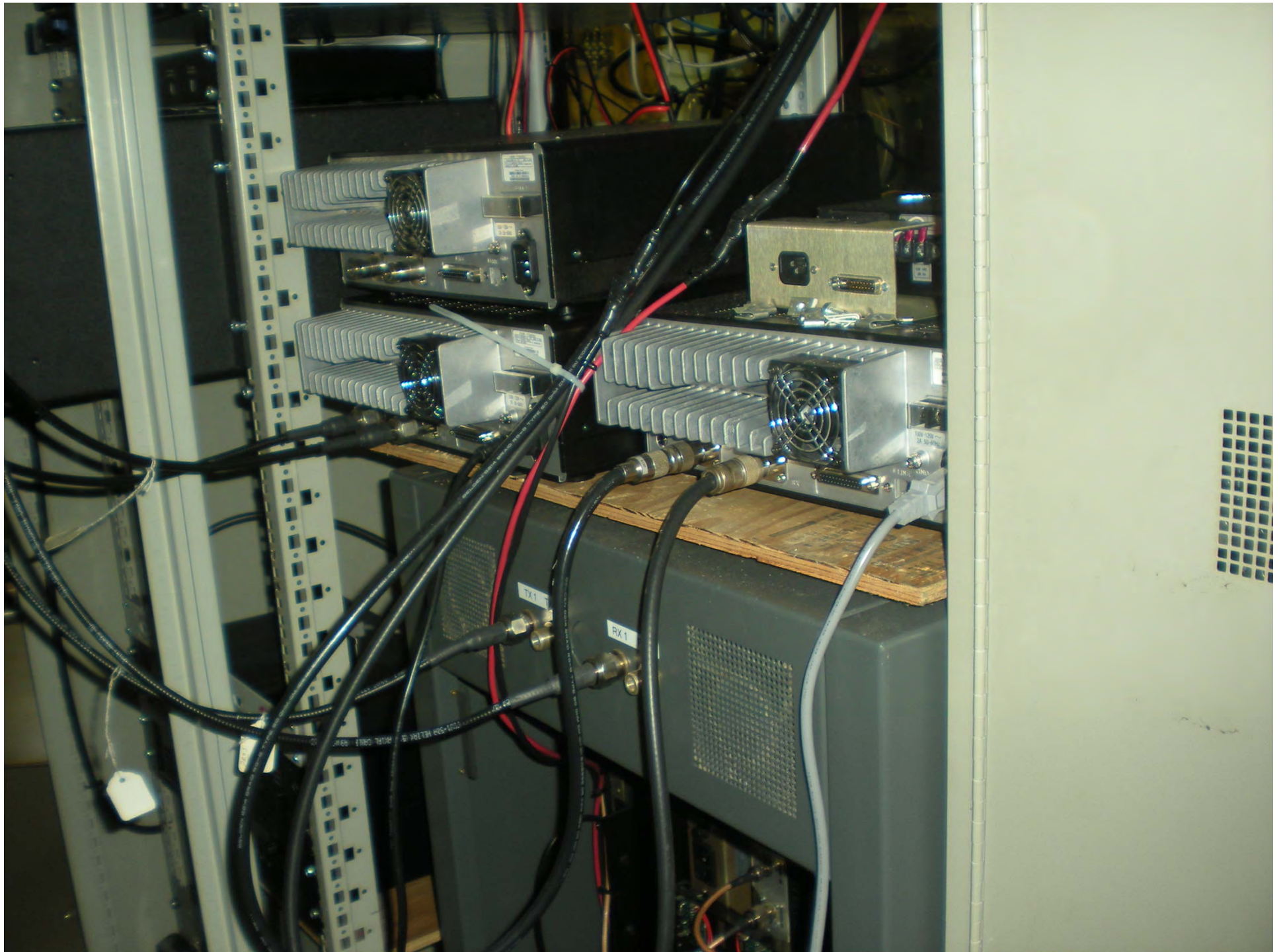
Got HVAC? Wasps?





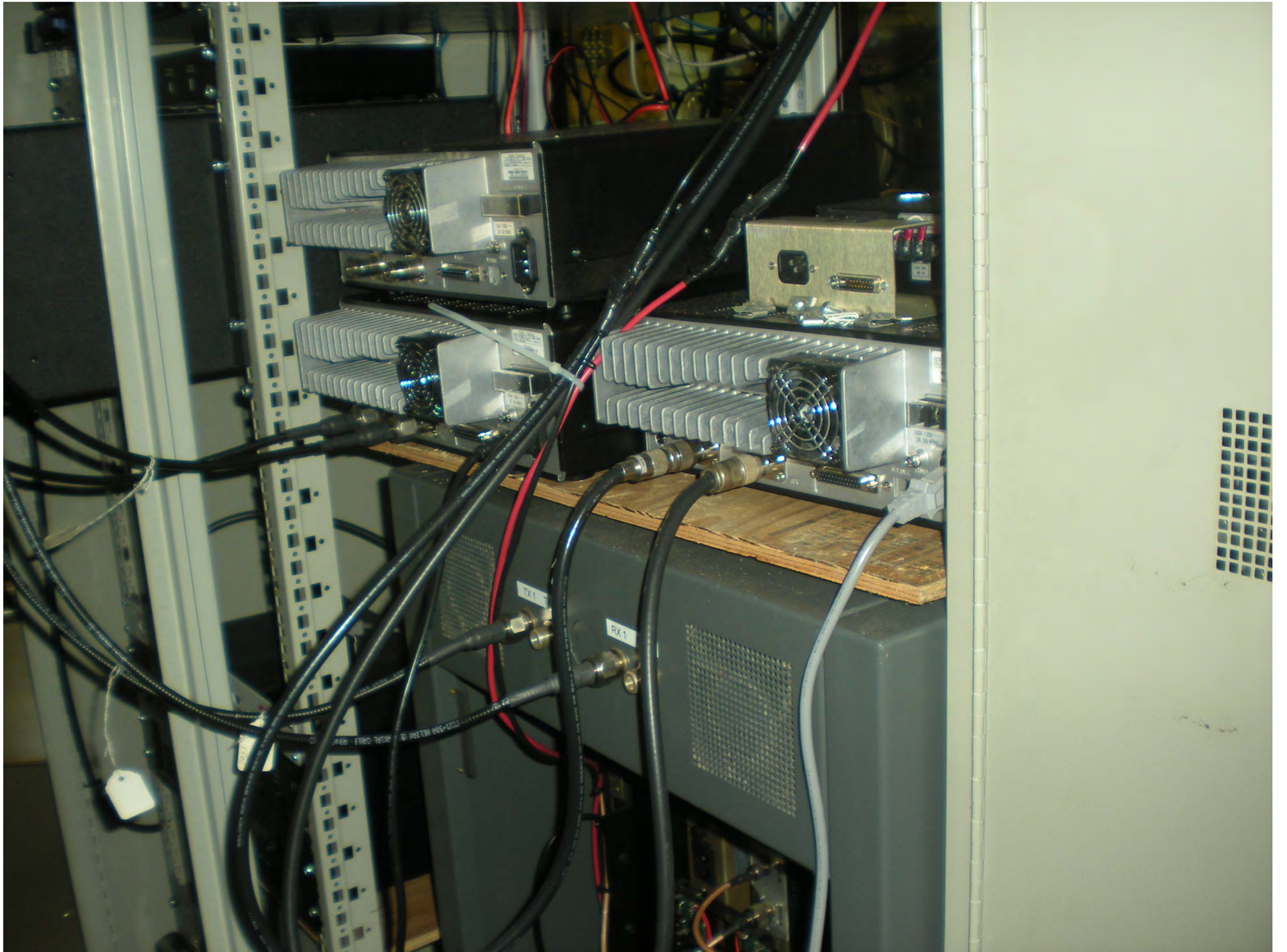


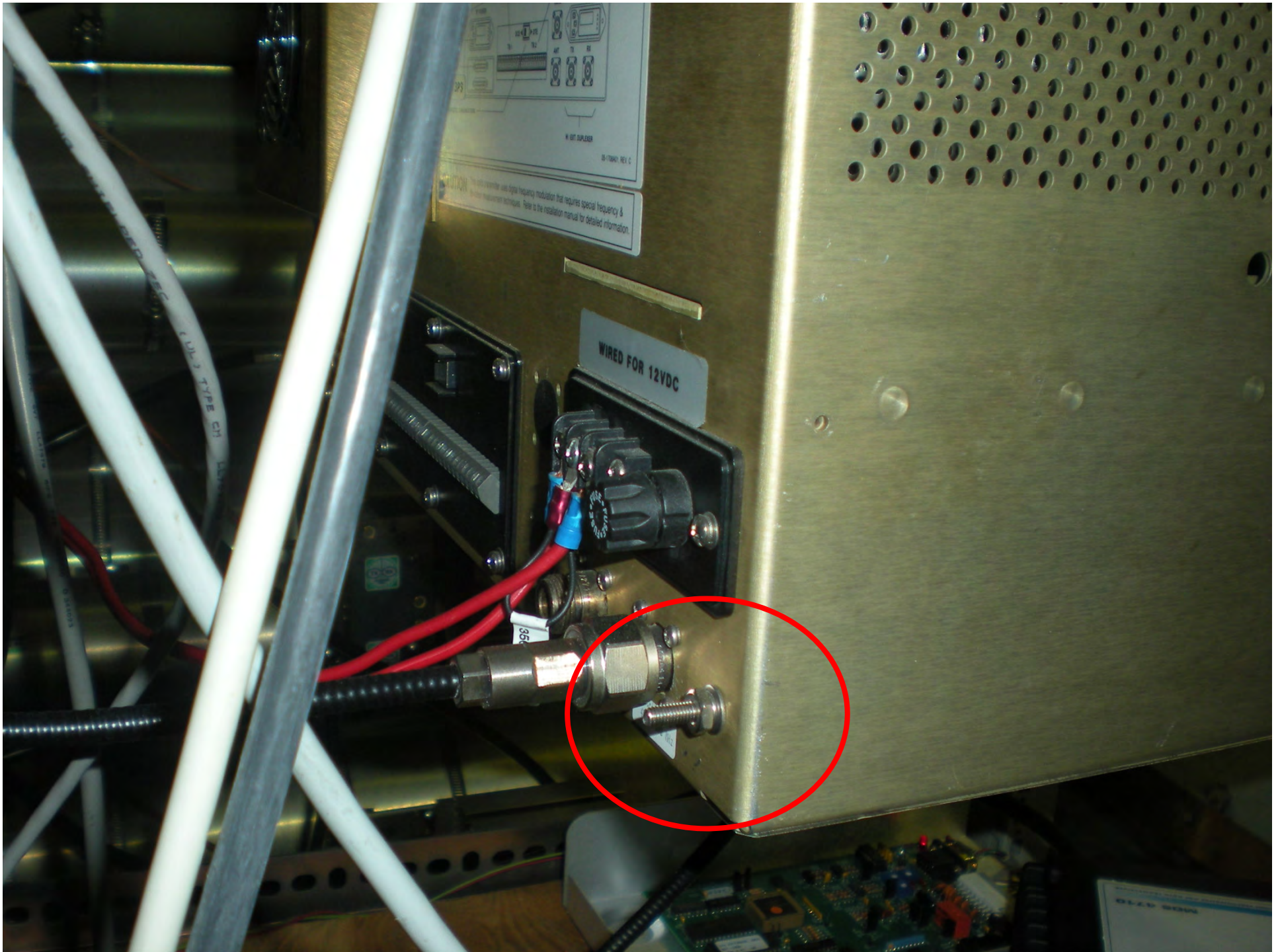










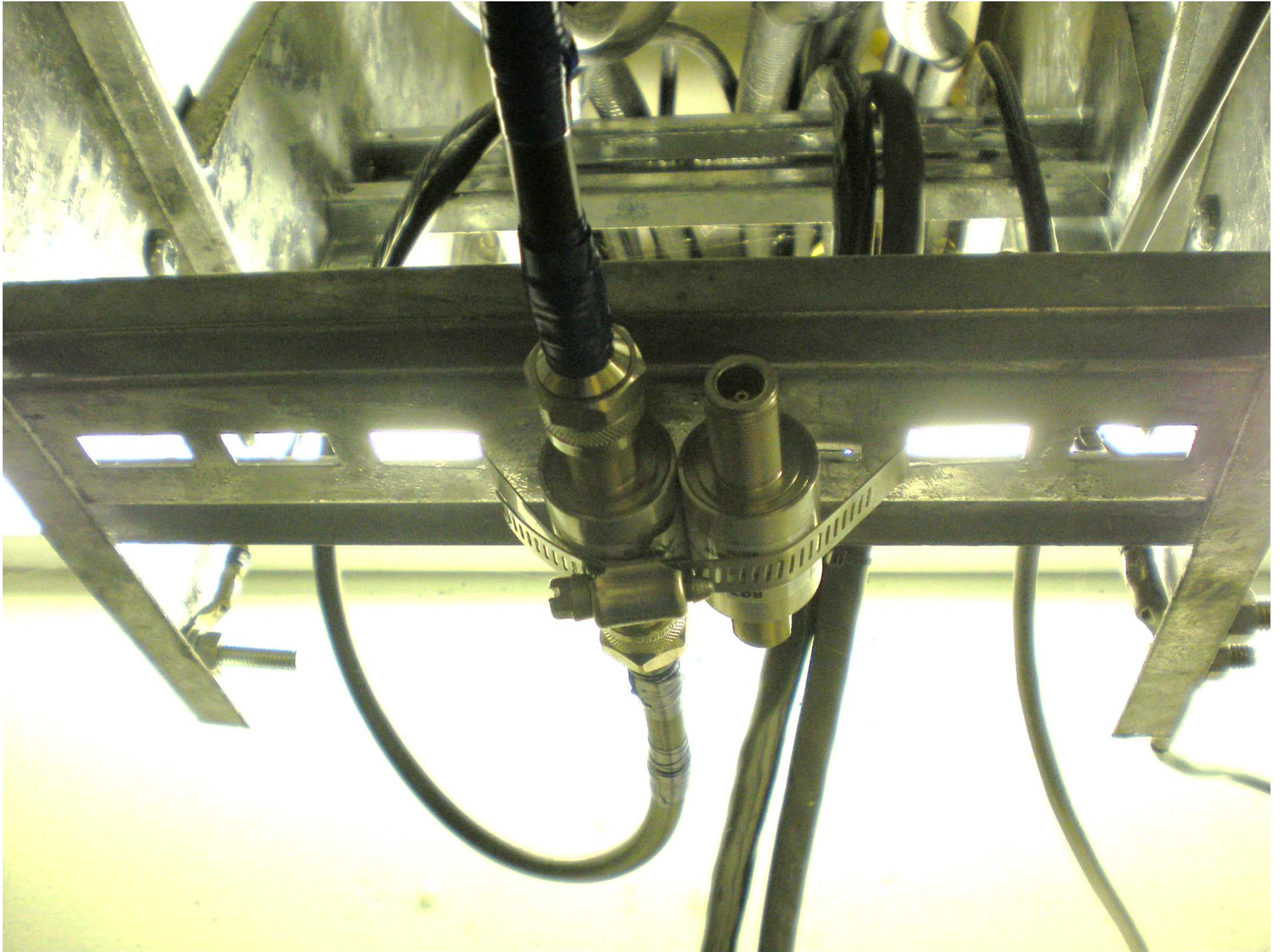


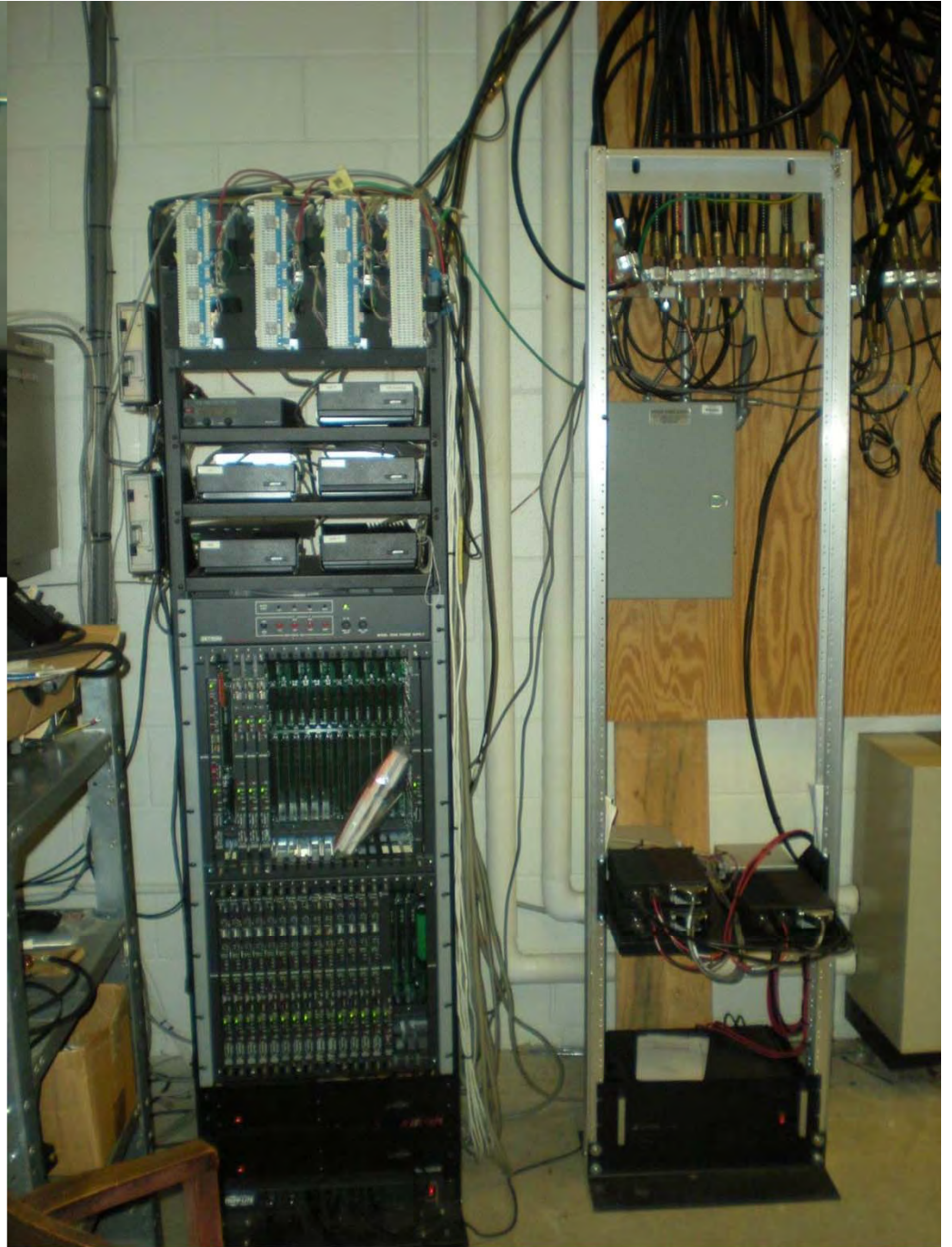
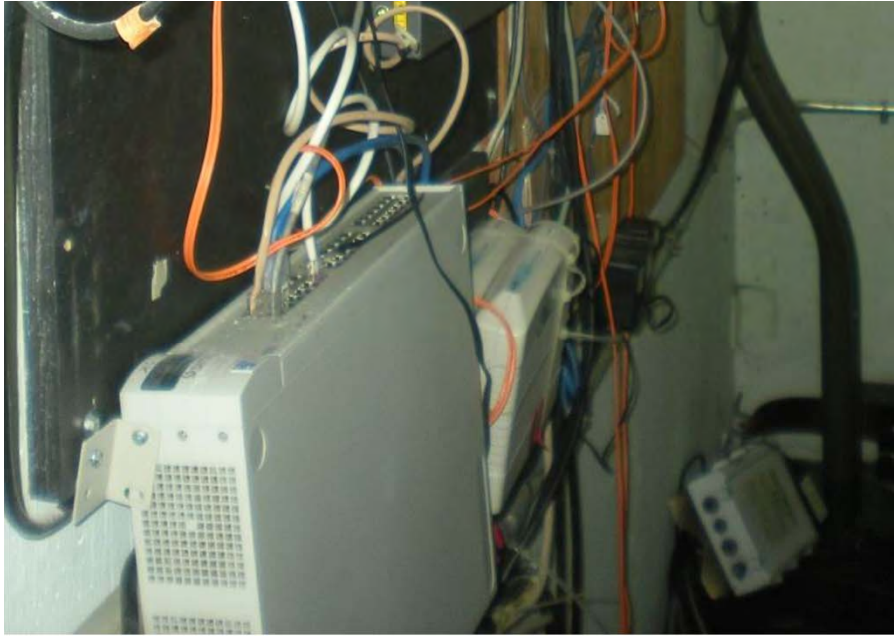


CHUCK
LEND
WINSTON

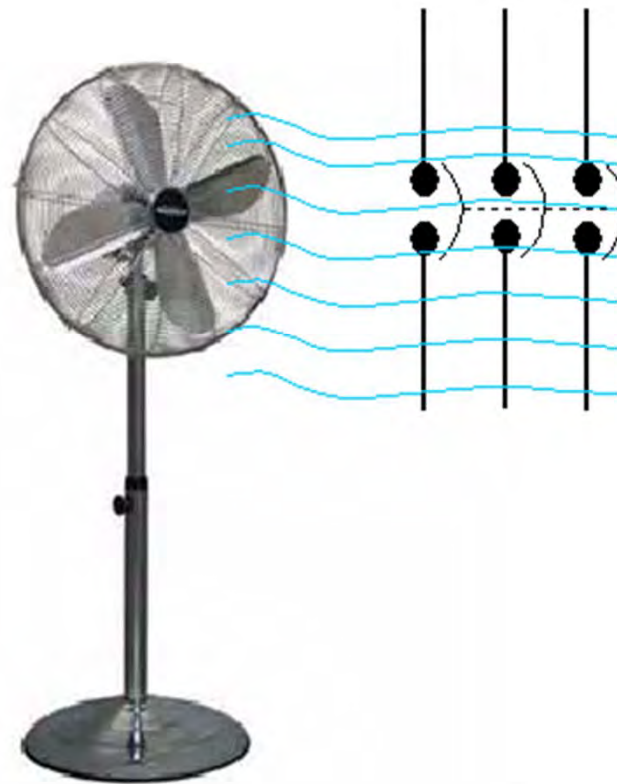
SURGE
LSX
PolyPhaser
US PATENT NO. 6,001,322
US PATENT NO. 6,116,221
PROTECTED

RESISTANT II 600V A.M.W. CORP.





Fan cooling a molded case bkr

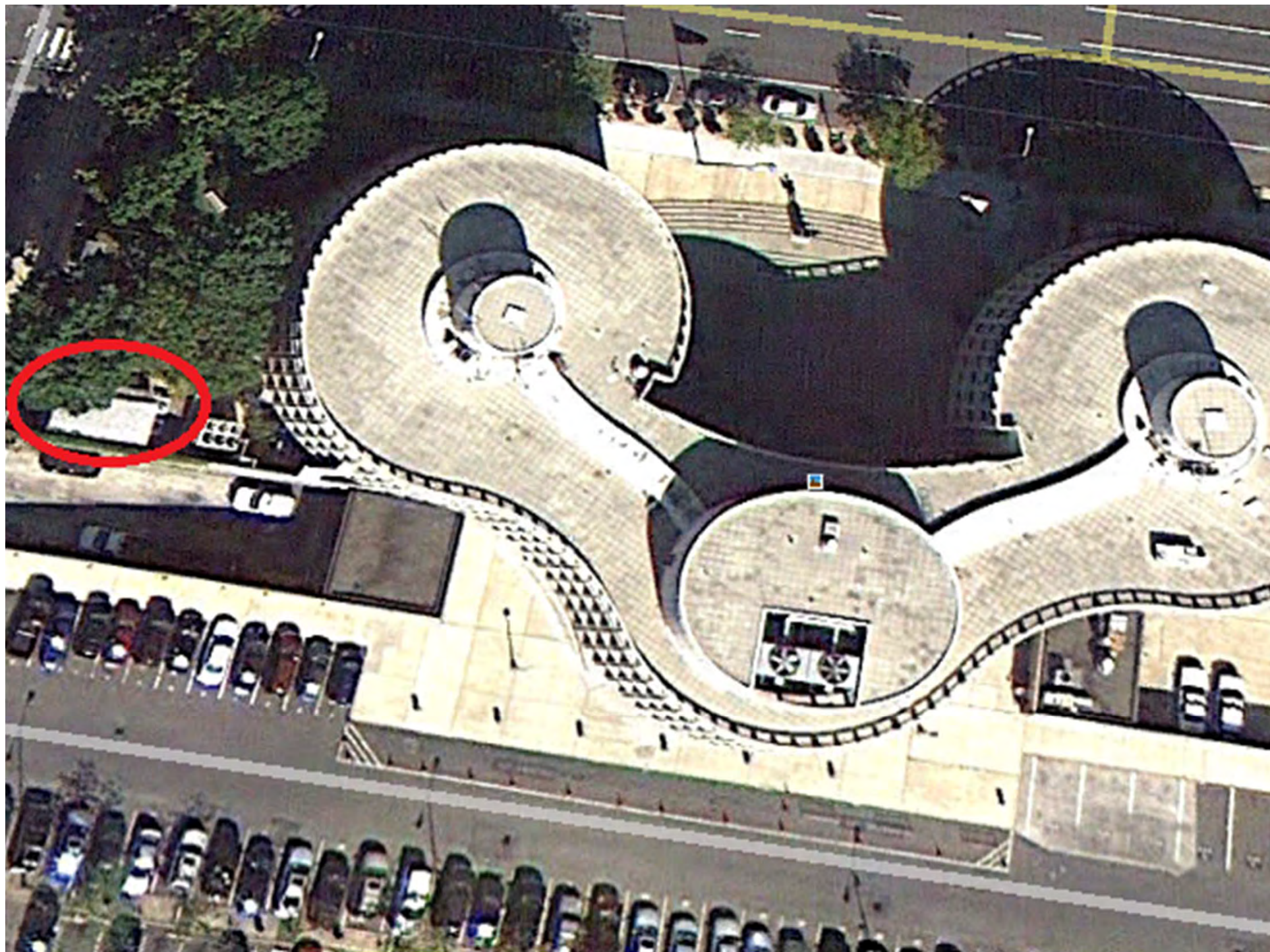


208V 600A

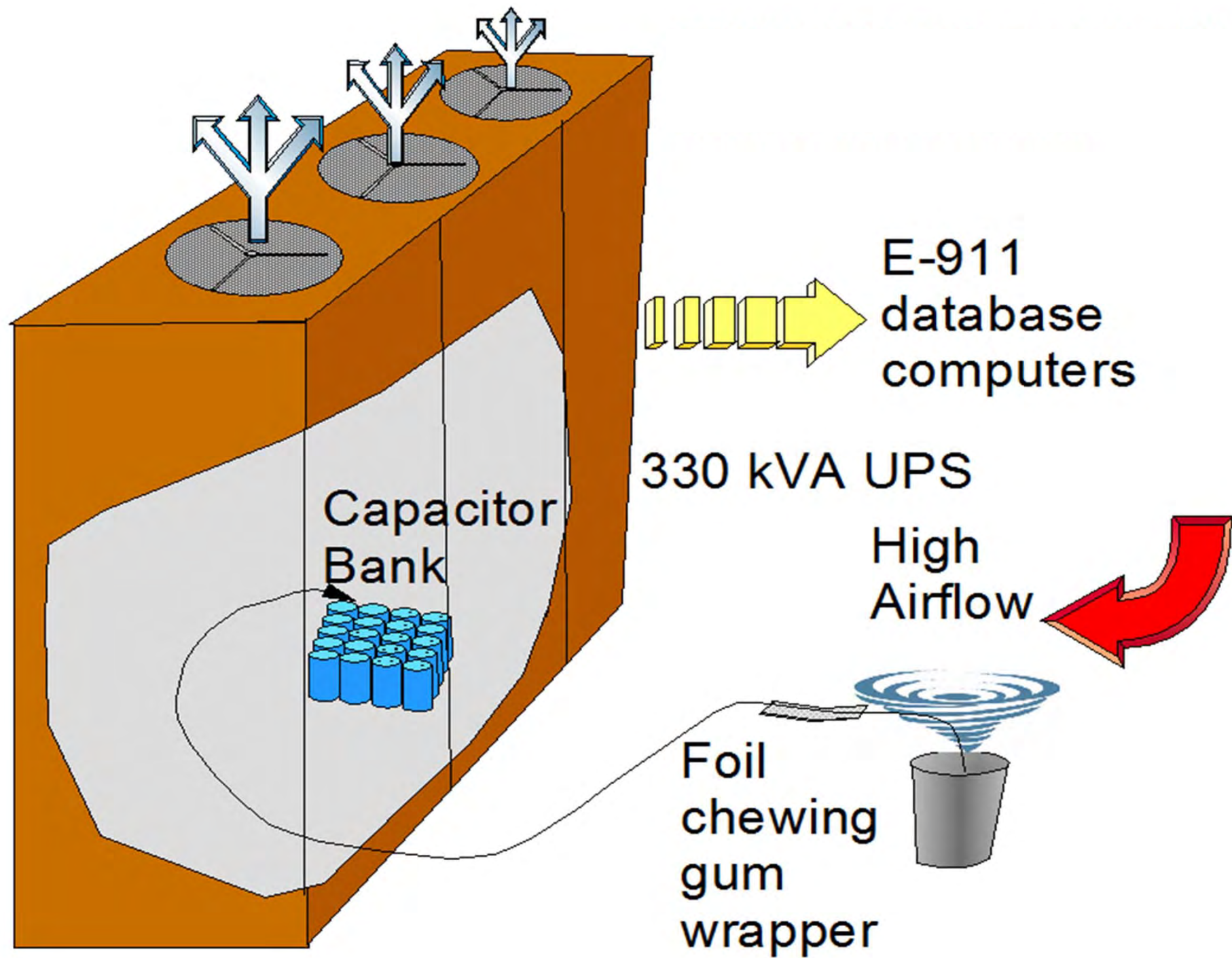
Communications

Center

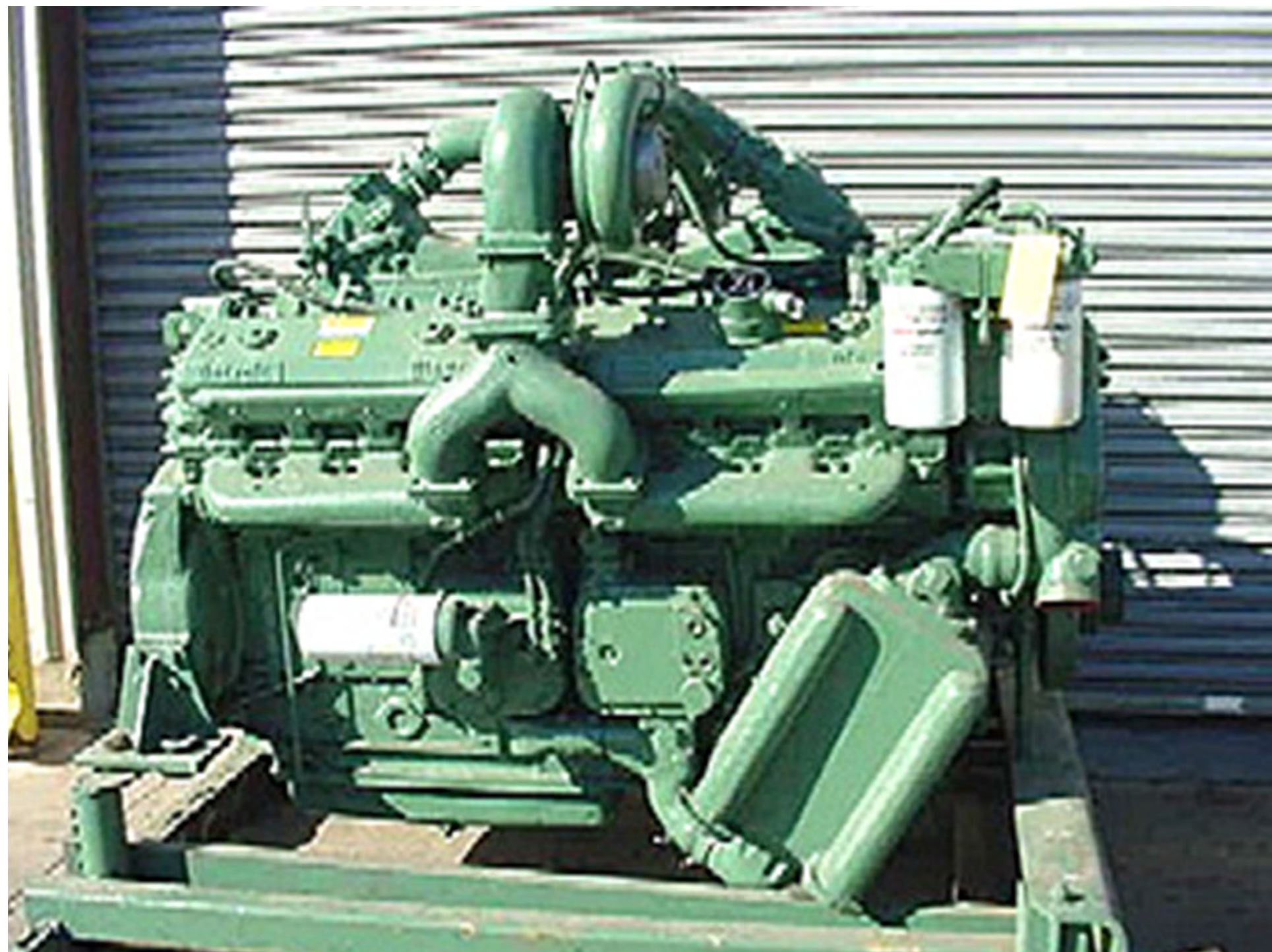


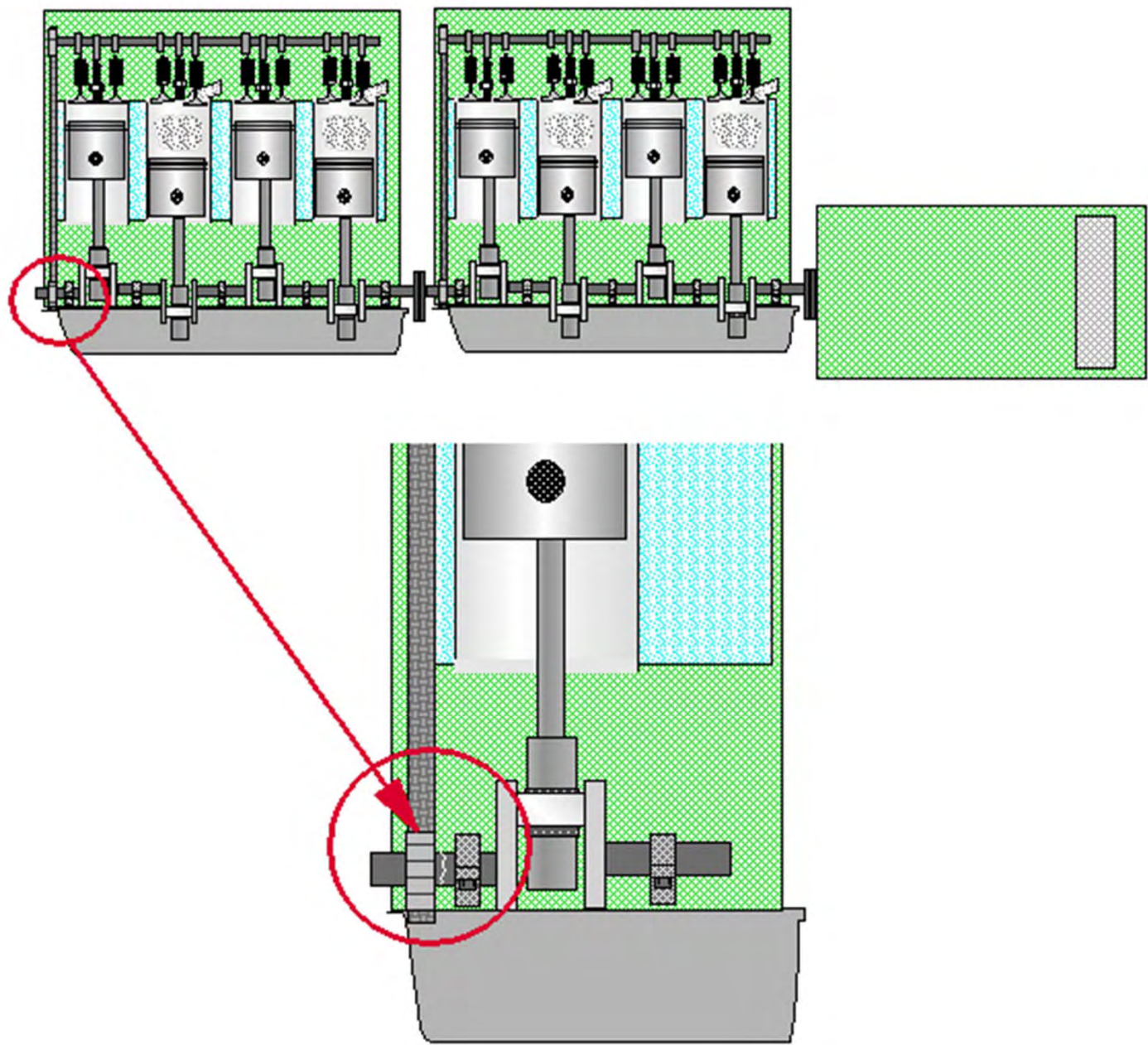


















FLUKE 87 III TRUE RMS MULTIMETER

AUTO DC
2.032 V
+ 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

PELIGRO
CUBRA SUS OJOS. GASES EXPLOSIVOS PUEDEN CAUSAR DAÑOS O CEGUERA.
NO CHISP. FLAM. CIGARR.

DANGER / POISON
GASES NO SPARKS FLAMES SHOCKING
SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS
FLUSH EYES IMMEDIATELY WITH WATER. GET MEDICAL HELP FAST. KEEP OUT OF THE REACH OF CHILDREN. DO NOT TIP. KEEP VENT CAPS TIGHT AND LEVEL.

MIN MAX RANGE HOLD
REL Δ Hz

4 1/2 DIGITS
1 Second

PEAK MIN MAX

mV Ω +
V ~ V
mA A
μA

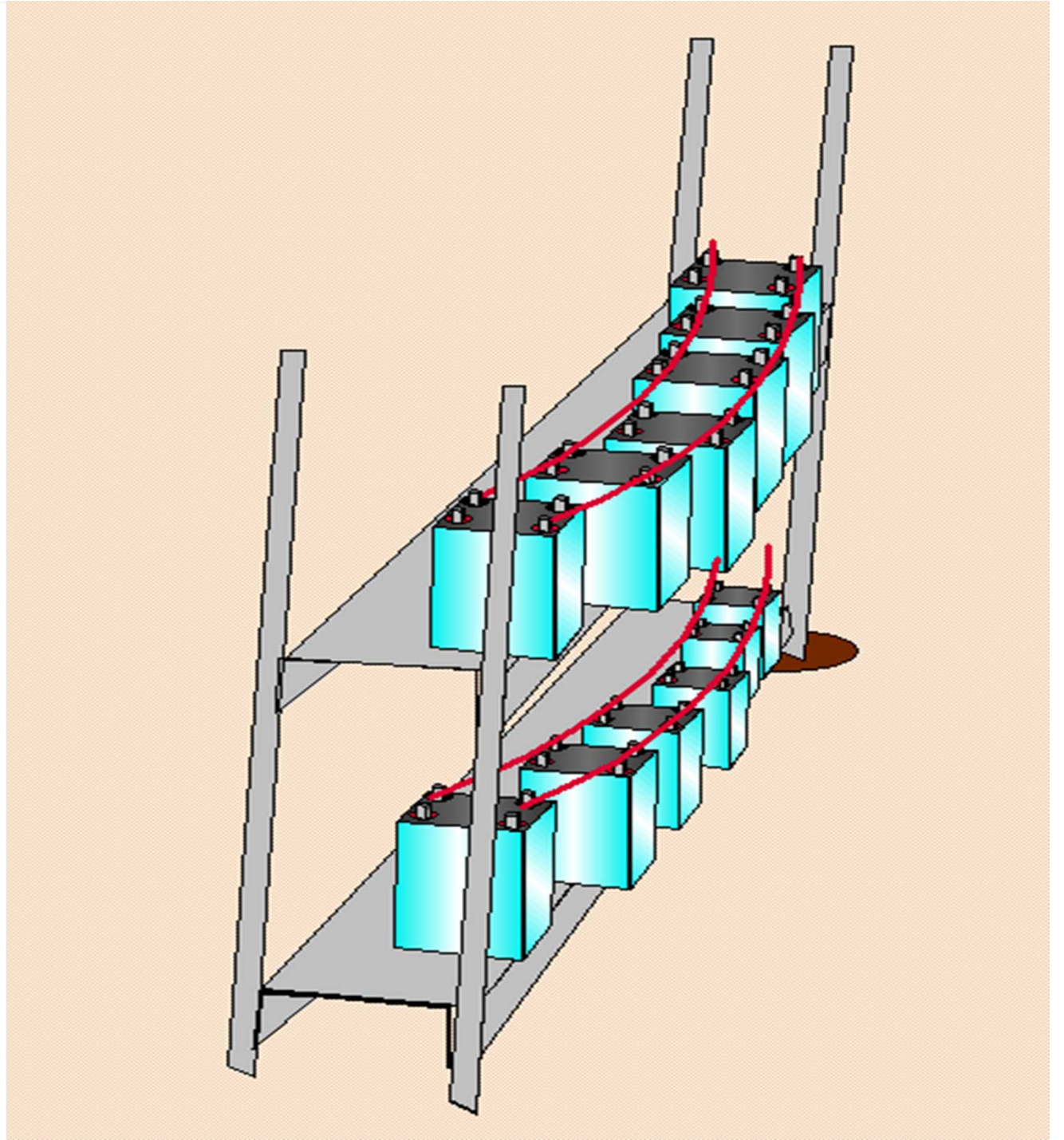
OFF

A mA μA COM


10A MAX FUSED
400mA FUSED
CAT 1000V











Article 708 COPS

- Code requirements for mission Critical facilities
 - Electrical systems must continue to operate during the full duration of an emergency and beyond.
 - Examples needing (COPS) include police stations, fire stations, and hospitals.



Article 708 COPS

- Risk Assessment
- Commissioning
- Physical Security
- Witness Testing
- Periodic Testing
- Feeders
- Branch Circuits
- SPDs
- Genset
- Transfer Equip
- Bypass Isolation
- Selective Coord
- Emergency Ops Plan

NFPA 70 (NEC[®])

- Does Article 708 govern telecom central offices, MSCs etc.?
- Should it?





NFPA 70 (NEC[®])

- 90.2 (B) **Not Covered.** This *Code* does not cover the following:
 - (4) Installations of communications equipment under the exclusive control of communications **utilities** located outdoors or in building spaces used exclusively for such installations (emphasis added)



NFPA 70 (NEC[®])

- Section 90.3 of the National Electrical Code states, "Chapter 8 covers communications systems and is not subject to the requirements of Chapters 1 through 7 except where the requirements are specifically referenced in Chapter 8."

NFPA 70 (NEC[®])

- Article 100 (Definitions)

Communications Equipment. The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment.



NFPA 70 (NEC[®])

- Chapter 8- Communications Systems, Article 800 covers Communications Circuits.
- There is no reference to power or COPS in Chapter 8.



W. 28335.



We've come a long way Baby









An aerial, high-angle view of a city, likely New York City, showing a dense grid of buildings and streets. The image is somewhat dark and grainy, typical of a live broadcast from a helicopter. In the lower portion of the frame, there is a white text overlay with a black drop shadow. The text reads "LIVE FROM CHOPPER" in a bold, sans-serif font, followed by a large, stylized number "6".

LIVE FROM
CHOPPER

6







No
Comment...