EXISTING ELECTRICAL SYSTEMS AND OTHER CODES REQUIRING ELECTRICAL

PART ONE

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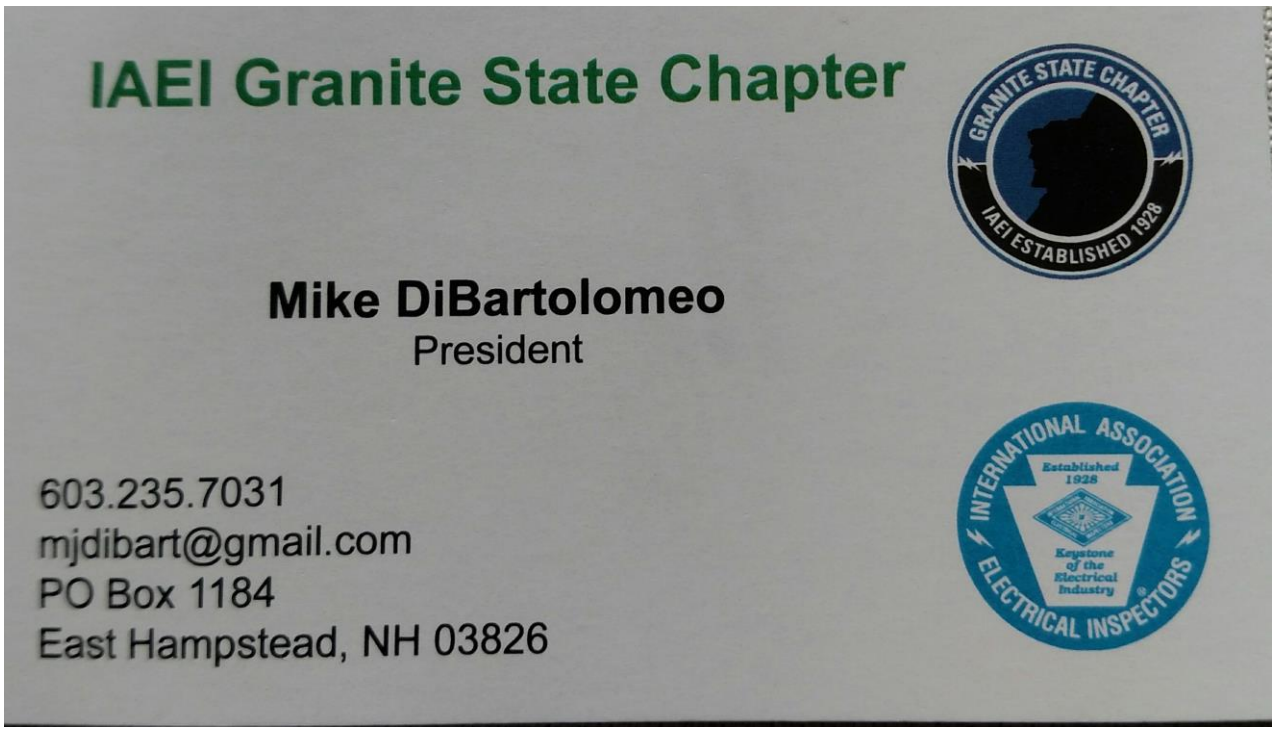
Prepared for all Advocates of Electrical Safe

NEBOEA 2019



ABOUT THE PRESENTER

EDUCATION

- 1969 Haverhill Trade School - Haverhill, Massachusetts - 4 years Electrical Construction and Maintenance
- 1970 Haverhill Trade School, Post Grad NEC Course 160 hr Exam Prep
- 1970 MA Journeyman # E18899
- 1977 NH Master # 6112
- Continuing education for a lifetime and more

ABOUT THE PRESENTER

FIELD EXPERIENCE

- Rewiring of fire damaged properties, urban and rural
- Rewiring of authentic early American homes
- Rewiring of occupied homes for electric heat conversions
- General electrical renovation and maintenance
- Res sub-divisions of 1 and 2 family, apartment and condominium
- Strip plazas, malls and small industrial(fabrication, machine, h.equip)
- Aluminum 12 and 10 gauge non metallic sheathed cable, romex

ABOUT THE PRESENTER

PROFESSIONAL AFFILIATIONS

- 1994 Member of Granite State Chapter of the IAEI, served as President 2x
- 2002 NHFPS / IAAI
- 2002 NHBOA Chapter of ICC –
- 2017 Currently serving as 1 of 4 reps to the NEBOEA
- 2002 NHSCOA
- 1996 Electrical Inspector for a community of 10K residents
- 2002 Combination inspector for a community of 4.5K and the above
- 2004 Electrical inspector for a community of 6K and the above
- 2007 Building Inspector for a community of 30K residents
- 2007 Advisory Boards for Salem and Pinkerton CTE programs

WHAT ABOUT YOU, WHO'S HERE?

We are all involved with the safe use of electricity

- Licensed Electricians/ Aprentices
- Certified Electrical Inspectors
- Combination Inspectors
- Home Inspectors
- Fire Inspectors / Arson Investigators
- Insurance inspectors / investigators
- Design Professionals, Engineers / Architects
- Teachers

CODE DEVELOPMENT

- **DOERS, WATCHERS and COMPLAINERS**
- Doers - Those who are involved with development of codes and are involved with promoting the codes.
- Watchers - Those who are content accepting what the doers are getting done with code development.
- Complainers - Those who are seldom in agreement with changes that have happened and have not been involved with code development.

REPORTED ELECTRICAL FIRES

- Our country has more reported electrical fires than any other country
- Our country has more licensed electricians per-capita than any other country.
- Seems as though the education, training and licensing is a waist of time.
- Or; home owners, handy people, non certified products, appliances are causing the majority of electrical fires ?
- Depending on the level of fire damage, the cause can be very difficult to determine.

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LEARNING OBJECTIVES

- How to recognize existing code compliant electrical systems that were installed years ago.
- How to recognize electrical systems that were never code compliant.

- PART TWO 10:30 -12 OTHER CODES REQUIRING ELECTRICAL
- Other electrical requirements from related ICC and NFPA Codes.

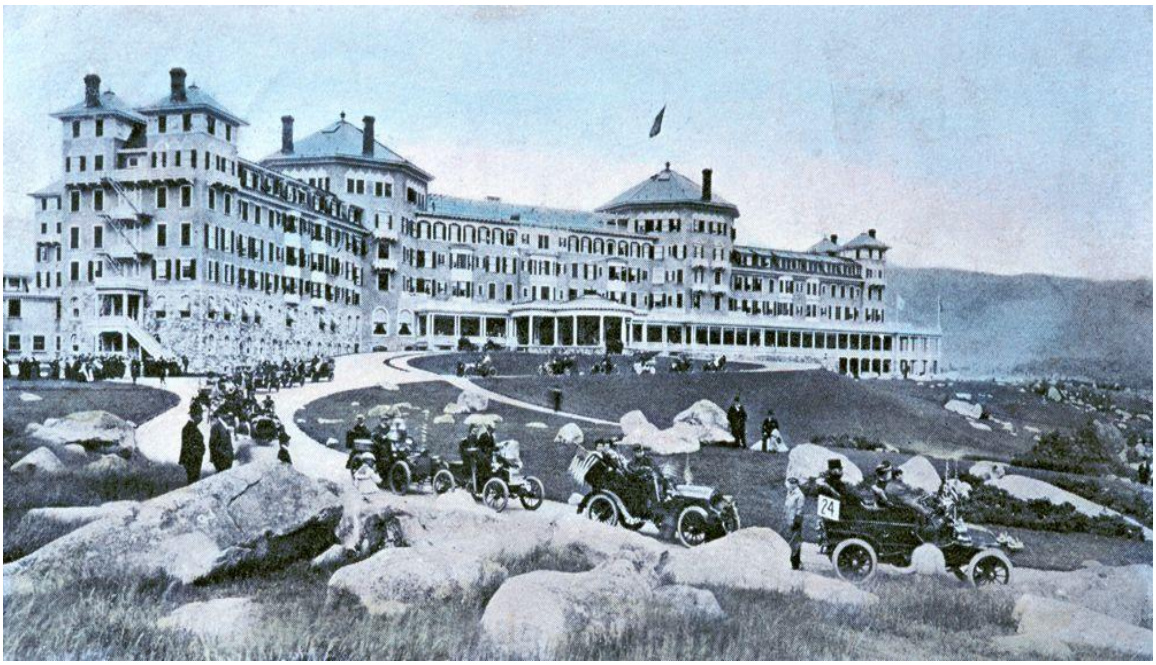
GENERAL DESCRIPTION

Please ask your questions – we can learn from each other.

- Beginning with knob and tube wiring and moving through the earliest wiring systems that we see almost every day during our inspections.
- The beginning of romex (non-metallic sheathed cable, aluminum), bx (armored clad cable), mc (metal clad cable).
- Residential, and commercial installations including acoustical ceilings as supports for wiring methods.
- Ceiling tie wire as luminaire support verses jack chain ?

NFPA 70 NEC
NATIONAL ELECTRICAL CODE
DEVELOPED IN 1897

- Article 394 Knob-and –Tube Wiring Can it remain? Can it be added to ?
- Article 334 Nonmetallic Sheathed Cable When was it first manufactured ?
- Article 320 Armored Cable (Type AC) When was it first manufactured ?
- Article 330 Metal Clad Cable (MC) When was it first manufactured ?
- Article 408 Panelboards When do they need replacement ?



AT A GLANCE:

1881

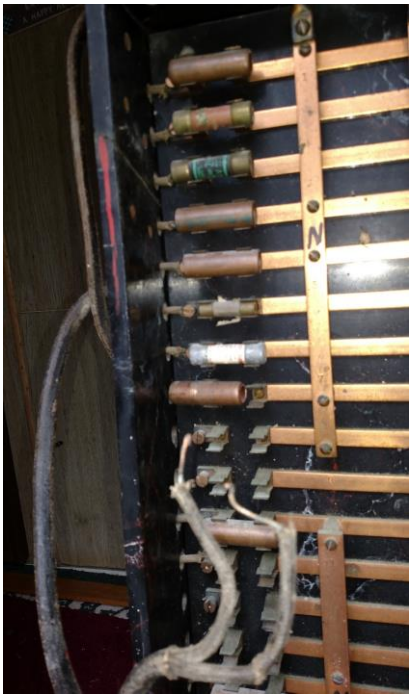
Businessman Joseph Stickney buys Mount Pleasant House up in New Hampshire's Bretton Woods. He gets "a taste for wanting to build his own grand hotel."

1900

Stickney hires architect Charles Alling Gifford and 250 Italian stone artisans. They break ground.

1902

On July 28, Mount Washington opens for its first season. The electrician, Thomas Edison, turns on the lights for the first time.



EDISON BASE GLASS FUSES
CAN THEY REMAIN?

- Yes; if they were installed correctly and maintained correctly.
- What went wrong ? 15 - 20 - 30 ampere and a penny
- Incandescent filaments replaced gas lighting fixtures
- Incandescent filaments were available up 600 watts
- Counter top appliance loads
- Refrigeration equipment replaced the Milk and Ice delivery personnel
- The additional loads caused the soldered splices to fail
- Hodge podge repairs (medallions used to hide splices)
- Fire, loss of life and property

EDISON BASE GLASS FUSES

EDISON BASE FUSES AND TYPE S ADAPTERS ARE STILL WORKING

- NFPA 70 NEC 2017 Article 240 Part V covers the installation and maintenance of these fuses.
- Most cases the rating of the main fuses are not a problem, it's the lack of branch circuits.
- 14 AWG can be attached to a maximum 15 ampere rated overload device.
- Best practice (IMO) is to remove - completely - and upgrade.
- The problem when up-grading is when removing an oversized fuse it can only be replaced with an overload device that is sized for the conductor attached to it.
- A 100 or 200 ampere service up-grade is not the best solution but only a good start.
- Best practice is to add or replace kitchen and bath room branch circuits and as much of the out dated branch circuits as practical. $$
- A 30 circuit panel - 60 ampere main instead of a 200 amp service will leave $$ for branch circuit up-grades and reduce the problems of burned out fuses.
- New branch circuits will include GFCI and AFCI protection and should include updated smoke and c/o alarms.

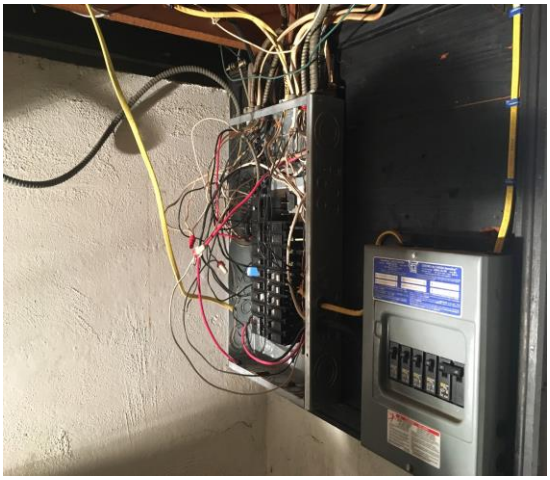
EDISON BASE FUSES AND TYPE S ADAPTERS

- When properties are being transferred, generally, a loan will not be approved without a home inspection report.
- Generally, Insurance Underwriters will not approve policies when glass fuses are in place.
- A Home Inspector, residential or commercial, will almost always require an upgrade to replace the Edison Base Glass Fuses with modern circuit breaker type equipment.
- This is when the other wiring can be addressed.
- Each branch circuit lands on an appropriate overload device.
- An existing branch circuit that is not extended and is in compliance with the NEC when installed, shall be allowed to remain as is.

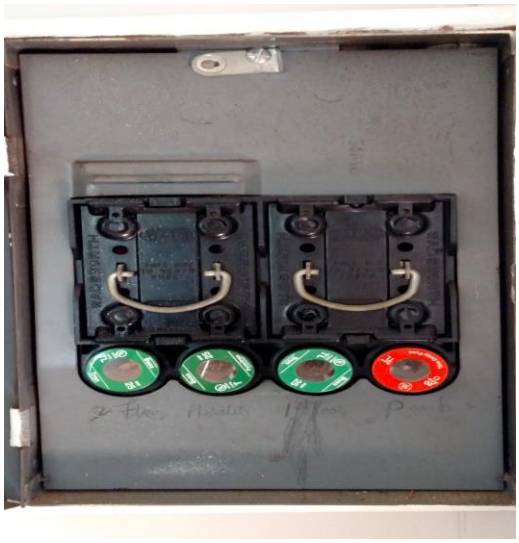
This is the time to take out the old and install the new

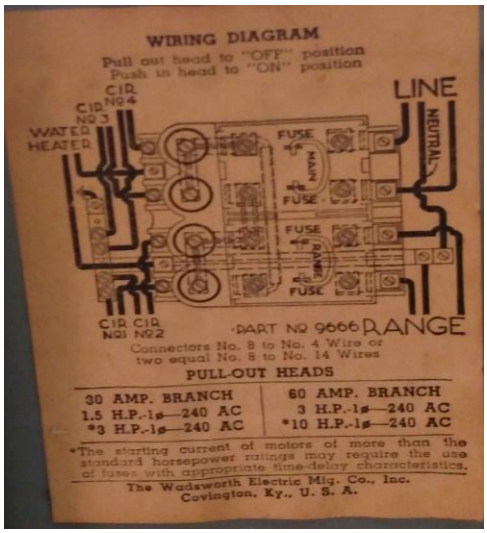
Was this in compliance when installed ?

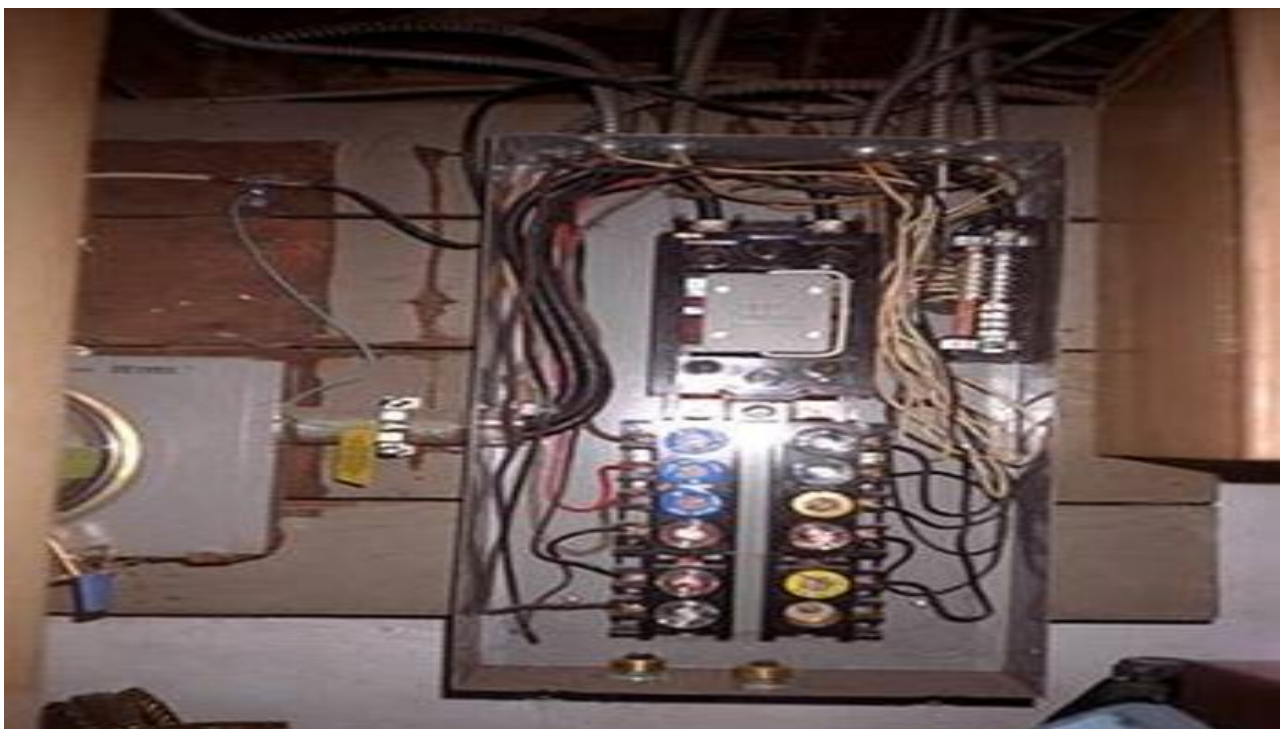
EXISTING INSTALLATIONS



EXISTING INSTALLATIONS





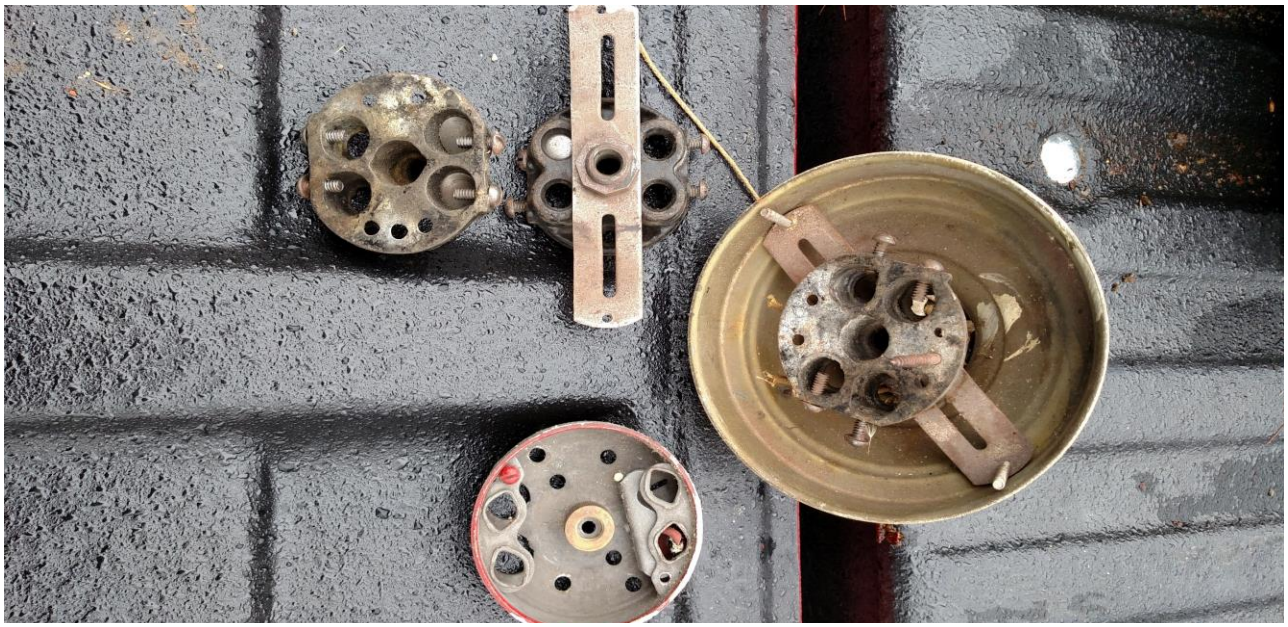


FROM THE LATE 1800s' GAS TO ELECTRIC LIGHTING CONVERSIONS WERE POPULAR FOR APROXIMATELY 50 YEARS

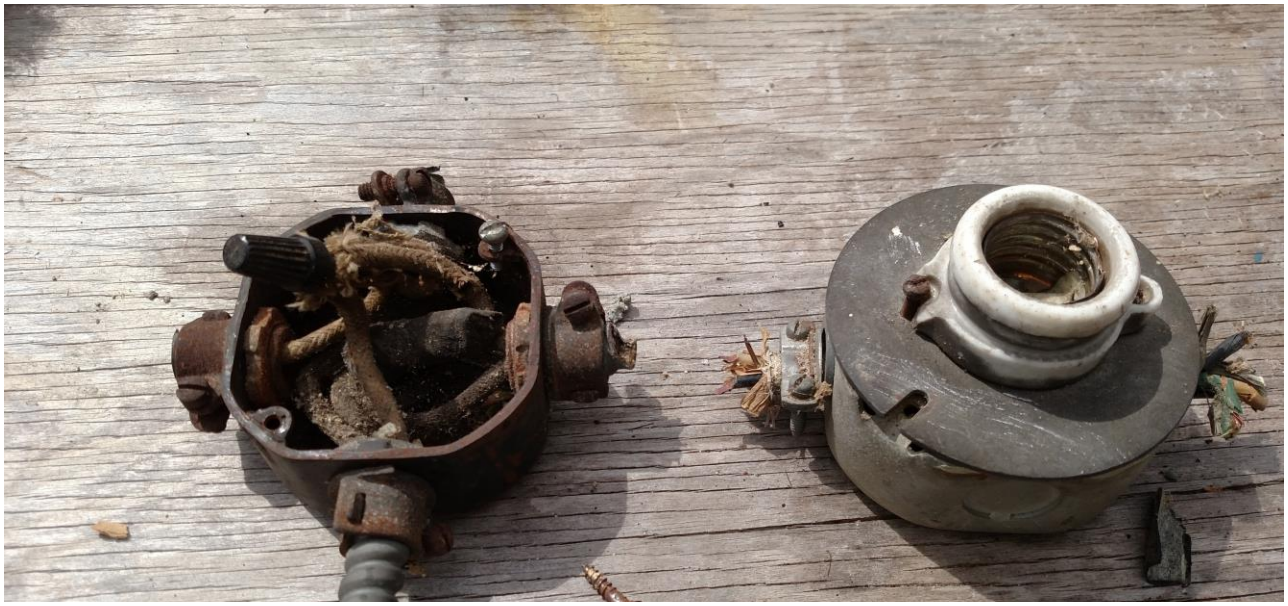
FROM THE MIDDLE 1960s' GAS / OIL TO ELECTRIC HEATING CONVERSIONS WERE POPULAR FOR 10 OR MORE YEARS
(nuclear power plant incentives)

ELECTRIC WATER HEATERS REMAIN POPULAR
ELECTRIC HEATING IS POPULAR FOR BACK-UP OR SMALL ROOM ADDITIONS/RENOVATIONS

AC cable canopy plates; note the blanks for the unused openings (no more 100 watt incandescent)



NEC 2017 ARTICLE 314.16 OUTLET BOXES



AC CABLE WITH SOLDERED SPLICES

common use of the adapter is for sump pumps, freezers, refrigerators

NEC ARTICLE 334

NON- METALIC SHEATHED CABLE

ALUMINUM NON-METALIC SHEATHED CABLE ROMEX

- Common use during 1970 – 1972
- Aluminum romex failed catastrophically resulting in loss of property and life.
- Aluminum romex was used in all buildings.
- Contributing factors were the onset of electric water heater and electric heat loads.
- Training for splicing the aluminum was non-existing.
- Apartment buildings, 1 and 2 family and mobile homes that were total electric heat were common place for failing splices within months of the installation.

COPPER CLAD ALUMINUM ROMEX

- During the early 1970's to approximately 1974 copper-clad was introduced as a remedy for the aluminum.
- The same problems remained and eventually the #12 or #10 aluminum or copper-clad were not allowed as a permanent wiring method.
- There is plenty of it remaining in service today.
- The wiring device manufacturers were successful in developing wirenuts and devices to help reduce problems with the existing wiring systems.

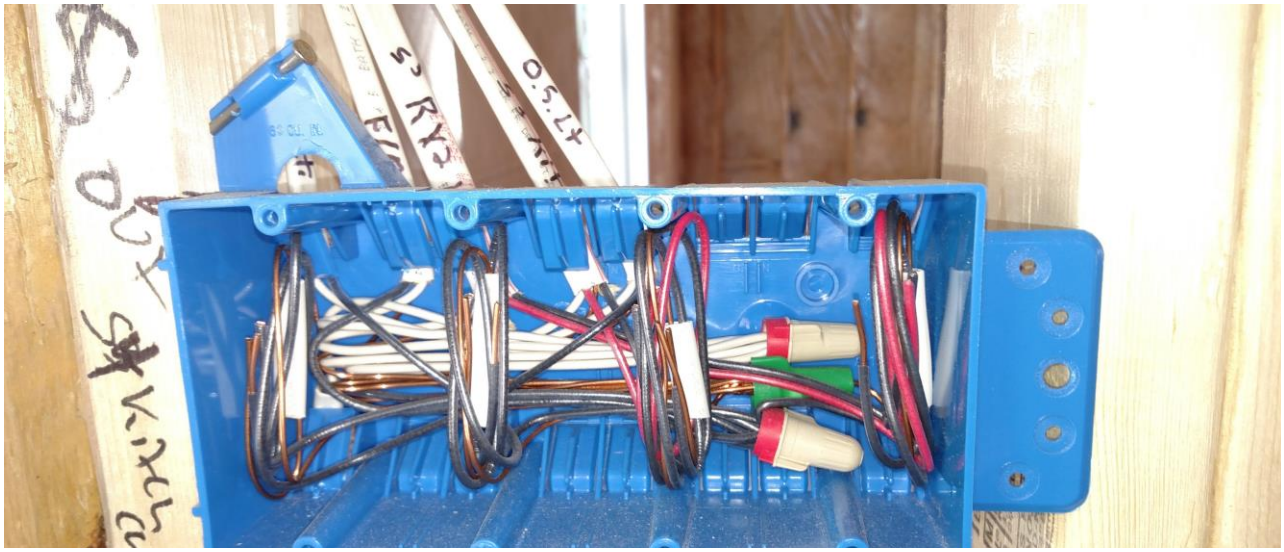
NEC ARTICLE 334.30

NM (ROMEX) SHALL BE SUPPORTED (unless it's fished)

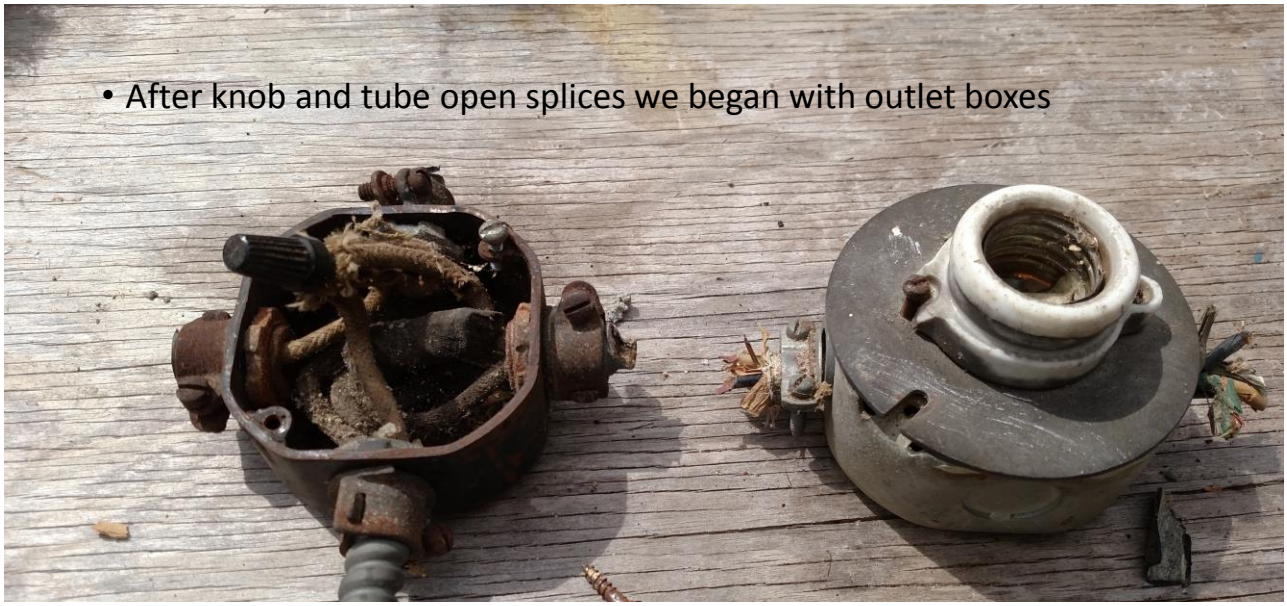
WITHIN 12” and AT LEAST EVERY 4 ½ ‘

NEC ARTICLE 334.15 (B)
PROTECTION FROM PHYSICAL DAMAGE

NEC ARTICLE 300.14
LENGTH OF FREE CONDUCTORS

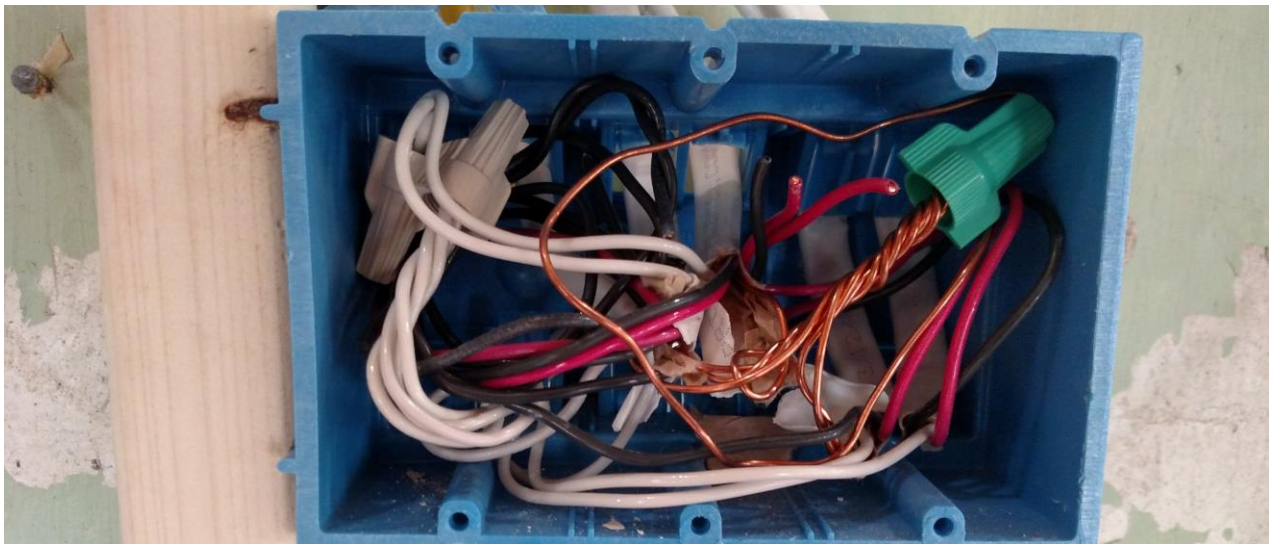


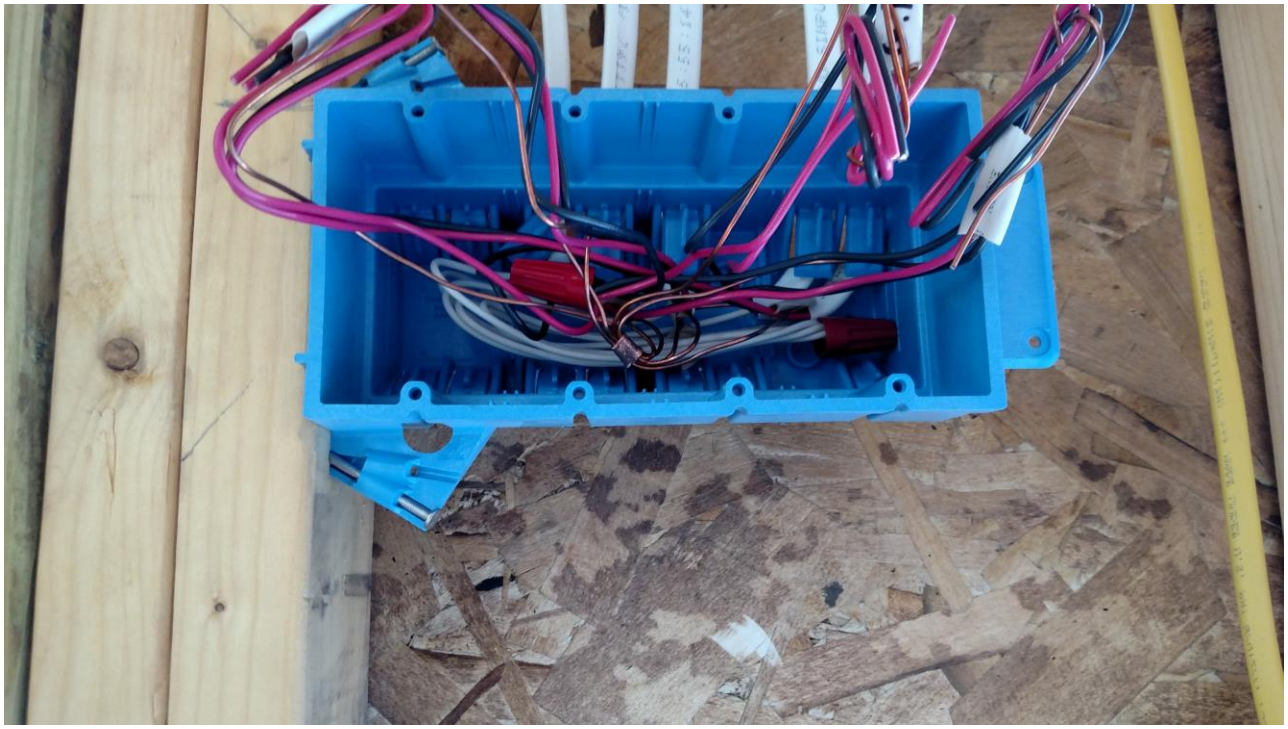
ARTICLE 300.14 LENGTH of FREE CONDUCTOR AND 314.16 NUMBER of CONDUCTORS

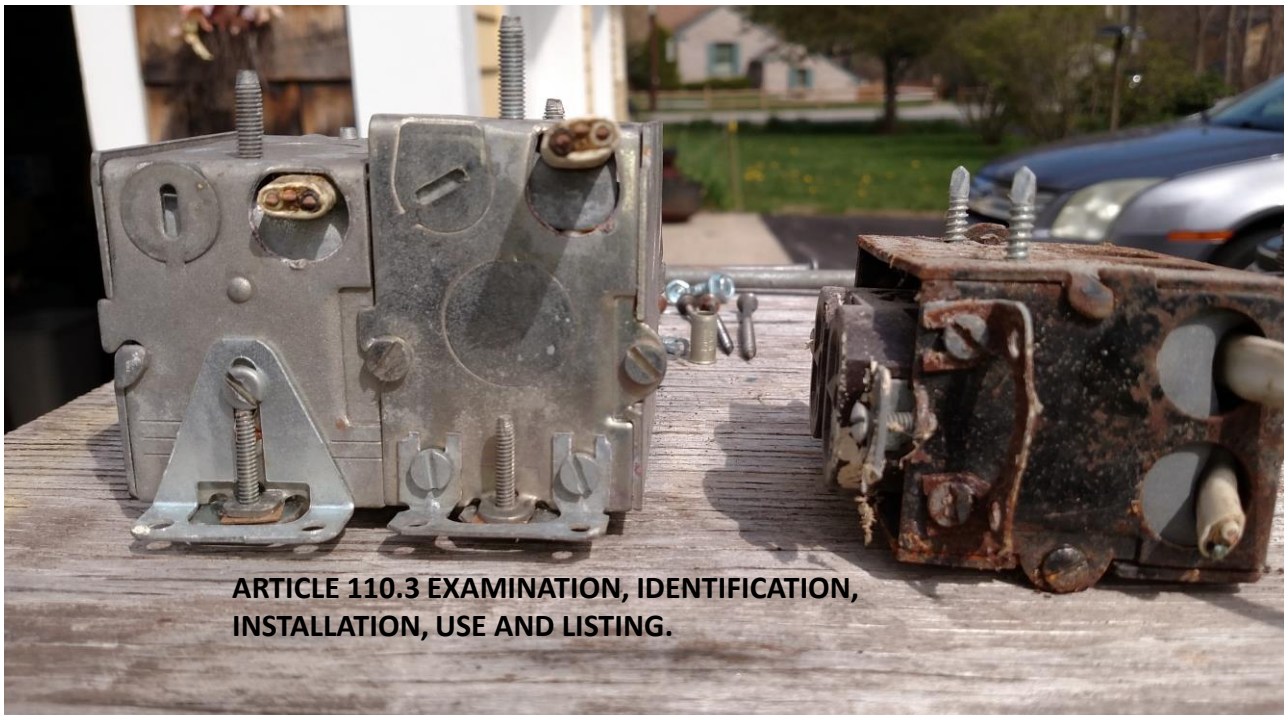


EQUIPMENT GROUNDING CONDUCTORS ARE A ?

Meanwhile, electricians and others claim “not enough room for free conductors”







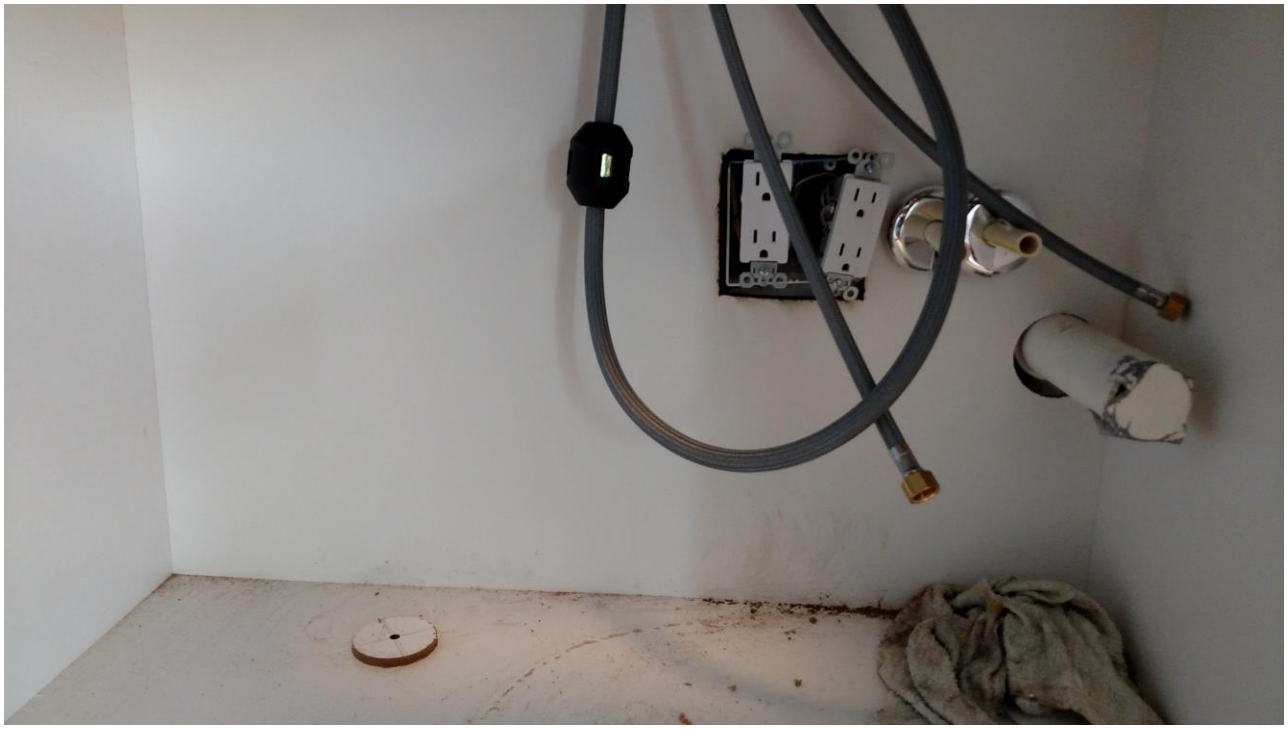
- **Is there anything here that can be used for grounding and bonding?**

Five lbs. of not having to go to the supply house

NEC ARTICLE 314.20
BOXES MOUNTED IN COMBUSTABLES

BOXES MOUNTED IN NON-COMBUSTABLE SHALL BE WITHIN ¼" FROM THE FINISH SURFACE
BOXES MOUNTED IN COMBUSTABLES SHALL BE AT LEAST FLUSH TO THE FINISH SURFACE

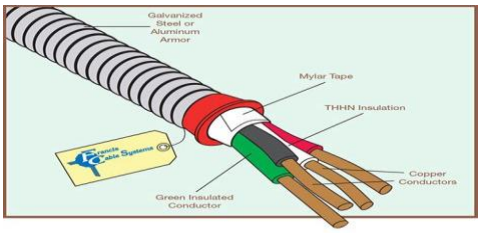
- Kitchen cabinets, combustible interior finishes, exterior luminaires, are some examples of where outlet boxes are not installed compliance.
- There are manufactured products for an easy remedy.



NEC ARTICLE 330 METAL CLAD CABLE

330.30 (B) SECURING AND SUPPORTING #10 with 4 or fewer conductors within 12" and at least every 6' – there are variables , look it up !

- MC has been manufactured for decades and continues to evolve. Used almost everywhere including healthcare facilities. MC cable is manufactured from 14 awg to 750 kcmil, multi conductor. MC can be color coded for several purposes and is practically unlimited for uses. Many installations use MC in place of raceways.



NEC ARTICLE 300.11 (A) SECURING AND SUPPORTING

- This section of article 300 covers installations above suspended ceilings including the use of support wires.

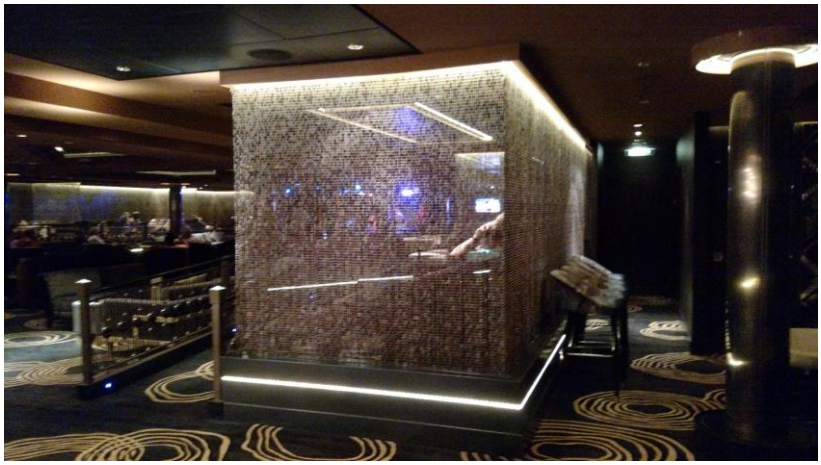
NEC Article 410.36 (B) Suspended Ceilings

Framing members of suspended ceiling systems used to support luminaires shall be securely fastened to each other and shall be securely attached to the building structure at appropriate intervals. Luminaires shall be securely fastened to the ceiling framing member by mechanical means such as bolts, screws, or rivets. Listed clips identified for use with the type of ceiling framing member(s) and luminaire(s) shall also be permitted.

When is a Ceiling Suspension System Secure?

- IBC Section 808 Acoustical Ceiling Systems Refers to Manufacturer's Installations and Shall be Installed in Accordance with the Provisions of ASTM 635 and ASTM C 636
- ASTM C 635 Standard Specification for the Manufacture Performance and Testing
- ASTM C 636 Standard Practice for Installation of Metal Ceiling Suspension Systems Acoustical, Tile, and Lay-in Panels.
- ASTM A 641/A 641M Standard for Galvanized Carbon Steel Wire

JACK CHAIN OR TYE WIRE ?



SHEET ROCK SCREWS ?

NEC ARTICLE 110.13 (A)
SHALL BE FIRMLY SECURED

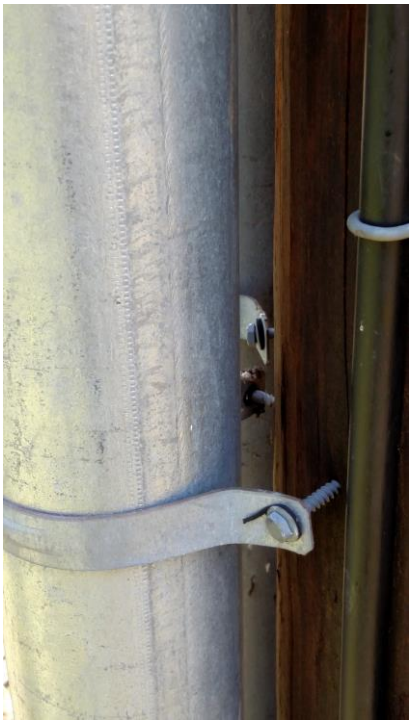
NEC ARTICLE 406.5
RECEPTACLE MOUNTING

- SHALL BE MOUNTED WITH MACHINE SCREWS WITH 32 THREADS PER INCH
- SHEET ROCK SCREWS OR WOOD SCREWS ARE NOT ALLOWED

NEC ARTICLE 404.10 (B)
MOUNTING OF SNAP SWITCHES

- Flush type box mounted snap switches mounted in boxes shall be mounted with machine screws that are 32 threads per inch or part of a listed assembly.
- Again the tile or handy person can not use sheet rock screws, nails, or bent over coat hangers.

SHEET ROCK SCREWS ARE NOT THE ANSWER



NEC ARTICLE 300.5 (J)
UNDERGROUND INSTALLATIONS
EARTH MOVEMENT

- The installation of expansion fittings are most common.
- The manufacturers installation directions require the cylinder part of the fitting to be secured so the piston part of the fitting is free.

IS THE SUPPORT COMPLIANT ??

RIGID POLYVINYL CHLORIDE CONDUIT PVC

- PVC raceways that are exposed to different ambient temperatures are require to follow Table 352.44. for expansion and d contraction.
- All raceways exposed to different temperatures shall be sealed, for example exterior to interior or interior to walk-in coolers.
- PVC fittings require bushings 352.46 and 300.4(G) #4 and larger.
- PVC shall be installed as a complete system and allow for thermal expansion and contraction.
- PVC expansion fittings require the barrel to be secured and allow the piston to move. (manufactures installation instructions)


SOLAR DISCONNECT
East PV System
ON
OFF
SOLAR DISCONNECT
ON
OFF


ICC-ES ESR
AT 1.0
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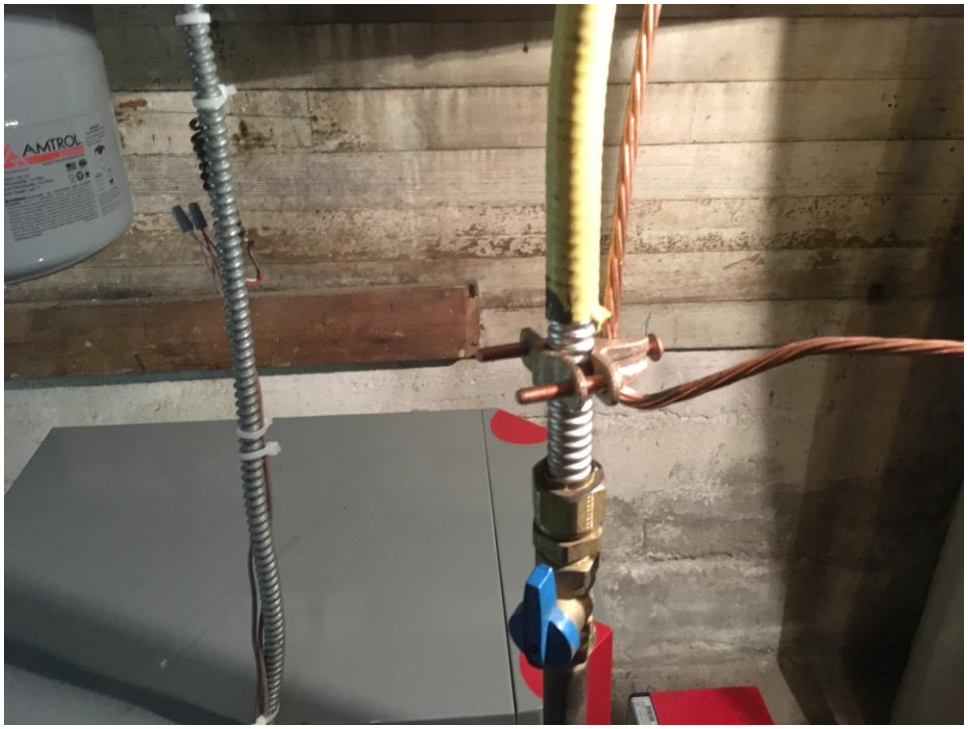
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