

## Western Section IAEI

### 2013 Code Panel Questions

1. Do the factory wings that many fluorescent troffers have designed to fold out over the grid meet the requirements for “securely fastened to the framing”?

Reference: NEC 410.36(B)

Answer: Yes, if marked for use with the grid. 410.36(B) Requires as bolts, screws, or rivets or Listed clips identified for use with the type of ceiling framing member and luminaire.

See FLUORESCENT RECESSED LUMINAIRES (IEVV) located on page 181 in the 2013 UL White Book. States Recessed luminaires intended for use in suspended ceilings and provided with integral clips are marked for use with particular grid systems.

Separate Clips Listed under Luminaire Fittings (IFFX) on page 194 in the UL White Book

2. A 200 ampere, 277/480 volt feeder is installed in 50 feet of 2½", Schedule 80, PVC Rigid Nonmetallic Conduit on the south side of a steel building. During the winter months, the outdoor temperature differs by as much as 50 degrees (°F). How much will the conduit expand in length with this change of temperature? And would an expansion type of fitting be required?

Reference: NEC 300.7(B) Expansion Fittings

NEC 352.44 Expansion Fittings

NEC Table 352.44 Expansion Characteristics of PVC

NEMA PRP 4-2009 -Expansion Fittings for Polyvinyl Chloride (PVC) Rigid Nonmetallic Conduit

Answer: 50 feet/100 feet X 2.03" (Table 352.44) = 1.02". Yes an Expansion Fittings is required since the expansion/contraction is greater than a

¼" per 352.44.

3. Is it allowed to use the grounding grid of a swimming pool's patio to be used as the grounding electrode system for a separate structure's pool equipment room?

Answer: No, It is not listed in Part 3 of Article 250. Although It will likely be connected through the Wet Niche shell or motor housings.

The equipotential bonding is to reduce voltage gradients in the pool area

Reference 250 Part III, 250.52, 680.26(A) performance

4. Is it permissible to use 240.4(b) and round up to the next standard size over current device on a feeder tap? Example; Can 23 feet of 500 kcmil, Type THHN/THWN copper conductors be tapped off of a 1200 ampere feeder and terminated on a 400 amperes main breaker in a subpanel?

Reference: **NEC 240.21(B)(2) Taps Not over 25 ft Long**

(1) Ampacity of the tap conductor not less than one-third of the rating of the overcurrent device protecting the feeder conductors

(2) The tap conductors terminate in a single circuit breaker or a single set of fuses that limit the load to the ampacity of the tap conductors.

5. 2011 NEC 250.32 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s) requires that an EGC be installed with the feeder conductors and bonded to the subpanel in the outbuilding. In addition, a GEC is to be installed to all available electrodes at the separate structure. If there are no available electrodes and a ground rod is driven and an appropriately sized GEC installed, is it required that this ground rod be supplemented as required in Article 250.53(A)(2), or can the one ground be considered supplemented by the main electrode system using the EGC to bond them together?

It appears to me that this question is asking if the grounding electrode for the main building can be used as the supplemental electrode for the detached building by using the equipment grounding conductor required by 250.32(B)(1) as a grounding electrode conductor too.

In that case, the answer is no as 250.121 states that an equipment grounding conductor shall not be used as a grounding electrode conductor. The grounding electrode for the main building could be used as a supplemental electrode for the detached building, but there would need to be an equipment grounding conductor installed to comply with 250.32(B)(1). This would allow any of the equipment grounding conductors permitted by 250.118 and sized per T250.122 where applicable. Then there would also need to be a grounding electrode conductor installed to comply with 250.64 and sized in accordance with T250.66.

However, if compliance with the exception to 250.53(A)(2) is achieved, a supplemental grounding electrode is not required.

6. A basement is finished except for the concrete floor which remains original. Is GFCI protection required for all 120volt outlets in this area?

**Answer:** NO. 210.8 (A) (5)

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms and limited to storage areas, work areas, and the like.

7. Is an equipment bonding jumper required between a cable tray and free- standing switchgear when uncoated -type MC cables drop from the tray to the switchgear?

Reference: **300.10, 300.15, 330.10(B)(1), 392.60(C).**

**300.10** – *Metal raceways, cable armor, and other metal enclosures for conductors shall be metallicity joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets so as to provide effective electrical continuity.*

**300.15**, Requires the fittings to be listed for the wiring method

**330.10(B)(1) Cable Tray.** *Type MC cable installed in cable tray shall comply with 392.10, 392.12, 392.18, 392.20, 392.22, 392.30, 392.46, 392.56, 392.60(C), and 392.80.*

**392.60(C) Transitions.** *Where metallic cable tray systems are mechanically discontinuous, as permitted in 392.18(A), a bonding jumper sized in accordance with 250.102 shall connect the two sections of the cable tray, or the cable tray and the raceway or equipment. Bonding shall be in accordance with 250.96.*

Using the two code sections for MC Cable and for Cable Trays. I struggled with this answer. Since there really is not a fitting to connect to the MC Cable in the middle of the run to connect a bonding conductor, I was leaning on that it would not be required. I think 300.10 weighs pretty heavily on a safe installation and 392.60(C) would require an external bonding jumper from the switchgear to the cable tray.

8. In a small aircraft hangar where the aircraft has its fuel tanks in the wings, is it allowed to have electrical outlets on the side walls by the wings for servicing the aircraft?

Articles; 513.3 (C)(1), 513.4 (A), 513.10 (D), 501.140 (A) & (B), 501.145 (A) & (B).

The 5' clearance requirements and the restrictions on the use of equipment in and around the aircraft make installation of outlets highly unlikely.

9. Can PVC conduit be installed under the floor of a Commercial Garage (NEC 511) and if so are there any restrictions?

**Reference:** NEC 511.3(1)(a) and (b) Floor Areas  
NEC 511.4(A) Wiring Located in Class I Locations

NEC 501.10(A) Class I, Division 1, General

**Answer:** Assume it is a Major Repair Garage. 511.3(1)(a) tells us if the entire floor is ventilated then the floor area is “unclassified” and PVC conduit can be used

If ventilation is not provided per 511.3(1)(a) then the area is considered a Class I, Division 2 area. 511.4(A) states that wiring located within a Class I location shall conform with Article 501.

501.10(A) Exception tells us that PVC Conduit can be used when encased in 2” of concrete and buried 24” from the top of the conduit to grade. Threaded RMC or IMC shall be used for the last 24 inches of the underground run to the point of emergence or connection to the aboveground raceway.

10. Can I bond the water line to a sub panel ground bar and not at the main panel if the incoming waterline is plastic and the house waterline is copper? If so, what size wire do I need to bond it with if I’ve fed the house with 4/0 aluminum?

Answer: No Per 250.104 (A) it shall be sized per 250.66 except for Multi occupancy which is sized per 250.122. Multi buildings is also sized per 250.66. Also, Reference part V Article 250 Bonding, 250.104 (A) (1) through (3).

11. An RTU is placed on a metal frame for weight dissipation & built up to where the controller and the breaker (disconnect) is now 8’ AFF. Is it required to install a working platform 30” x 36” or is a ladder to access and service the unit NEC- compliant using the exception to 404.8 exception (2) & 240.24(a)(4)?

Reference: **NEC 404.8 and NEC 240.24**

**404.8 Accessibility and Grouping. (A) Location.**

...shall be located so that they may be operated from a readily accessible place

... shall be installed such that the center of the grip of the operating handle ...is not more than 2.0 m (6 ft 7 in.) above the floor or working platform.

*Exception No. 2: Switches adjacent to motors, appliances, or other equipment that they supply, access shall be permitted to be accessible by portable means.*

Answer: A working platform 30” x 36” must be installed

12. Are ground bushings listed for a choke on the GEC when installed in a ferrous raceway?

Let’s take a look at UL Product Category KDER located on page 224 of the 2013 UL White Book.

**Grounding and Bonding Bushings —**

Grounding bushings for use with conduit fittings, EMT fittings, threaded rigid and IMC, or unthreaded rigid and IMC have provision for the connection of a bonding or grounding wire or have means for mounting a wire connector available from the manufacturer. Such a bushing may also have means (usually one or more set screws) for reliably bonding the bushing to the metal equipment enclosure or box. Grounding bushings provide the electrical continuity required by the NEC at service equipment and for circuits rated over 250 V. Therefore the technical answer would be no, a ground bushing is not specifically listed for the choke of a grounding electrode conductor when installed in a ferrous raceway.

However Section 250.64(E) of the 2011 NEC states that the bonding methods in compliance with 250.92(B) for installations at service equipment locations and with 250.92(B)(2) through (B)(4) for other than service equipment locations shall apply at each end and to all intervening ferrous raceways, boxes, and enclosures between the cabinets or equipment and the grounding electrode. Therefore section 250.64(E) permits the use of listed grounding bushings for this application.

13. SE cable is allowed to be used for interior branch circuit or feeder wiring. It can be sized from the 75 degree column unless it is encased in insulation. Table 310.15(b)(7) allows a 200 amp main power feeder to be 2/0 copper which has an ampacity of 175 on the 75 degree column, but only 145 amps on the 60 degree column. Is 2/0 copper SE cable OK to use as a 200 amp main power feeder regardless of it being encased in insulation?

**Answer:** No. Not necessarily. Table 310.15 (B)(7) (Deleted from the 2014 NEC) was never intended to be used without taking in consideration the deration factors.

Section 310.15(B)(2) –ambient correction factors - & 310.15(B)(3) – Adjustment factors – would be applicable even with the use of Table 310.15(B)(7). In other words, I don't see the permission to ignore the adjustment factors in 310.15(B)(7).

14. What is the minimum size junction box that can be installed to enclose a power distribution block that measures 6" x 6" and has two parallel 3/0 AWG copper conductors per phase terminated on both sides of the block?

Reference: **314.28(E) Power Distribution Blocks.**

**(2) Size.** *In addition to the overall size requirement in the first sentence of 314.28(A)(2), the power distribution block shall be installed in a box with dimensions not smaller than specified in the installation instructions of the power distribution block.*

- Power Distribution Blocks installed in pull and junction boxes are covered in Section 314.28(E). The size of the pull or junction box cannot be smaller than specified in the installation instructions of the power distribution block and in accordance with 314.28(A)(2).

15. Are dust tight "Hoffman type" junction boxes with Meyers Hubs listed for use in a Class II, Division I location approved for use in a Class II, Division II location as a junction box when sized correctly, even though the box is not identified for use in a class II location?

Article 502.10

Yes, 502.10 (B) (1) (1) All wiring methods permitted in 502.10 (A) (Class II, Division 1) are permitted in Class II, Division 2

16. Can you run NM cable from a panel in a residence through wood walls & ceiling and then run it in ½”EMT surface-mounted? This is run to several devices in a concrete basement. Can it be done without stripping the outer jacket off the NM cable, or does it need to be removed?

**Reference:** NEC 334.10 Uses Permitted

NEC 334.15(C) In Unfinished Basements and Crawl

Spaces

**Answer:** NM Cable can be run through wood walls and ceilings including the wood joist of an exposed basement ceiling per 334.10 and 334.15(C).

NM Cable is required to be installed in a Listed conduit or tubing, such as EMT, when installed on a wall of an unfinished basement. A bushing or adapter needs to be installed at the entry of the raceway. The sheathing is required to be in place through the raceway and into the outlet box.

17. In our jurisdiction we are required to install a UFER sized, not by the NEC which has a number 4 the largest required, but based on the service entrance conductors from Table 250.66. Not only that, for services over 200 amps, we have to install 20 feet of the bare conductor in the footer. What does this accomplish?

- Answer: It makes the AHJ happy and still satisfied the minimum requirements in the NEC.
- UFER, Many of us use this term loosely but it does not appear in the NEC it refers to the concrete encased electrode required by 250.52(A)(2) (3) and is the last name of the engineer at UL who did the testing many years ago.

18. When running parallel conductors for a feeder, one phase of the parallel run has a couple of inches difference in length on one of the conductors. The electrical engineer does a voltage drop calculation that shows that one 500 KCMIL copper conductor carries 399.974 amps and the other carries 400.026 amps and says there is no problem with this installation. Because the engineering supervision is taking responsibility for this installation, is this legal?

Reference: **NEC 310.10(H)(2)**

**2) Conductor Characteristics. The paralleled conductors** in each phase, .....shall comply with all of the following:

(1) Be the same length

(2) Consist of the same conductor material

(3) Be the same size in circular mil area

Answer: Engineering supervision is not recognized as a means to address conductor length difference. Less than one amp demonstrates the difference in length is not an issue.

19. Since there is only one inverter that is third party listed as being arc-fault protected, should the requirements of NEC 690.11 be enforced for all inverters, therefore only approving 1 type that has many restrictions? Are only 3-5kws listed?

Actually, as of 7/4/13 there are two manufacturers that have UL Certified (Listed) arc-fault protection that will comply with the requirements of the 2011 NEC section 690.11. They are TIGO Energy Inc, UL File E348110 and SMA Solar Technology AG, UL File E210376. The SMA product has DC AFCI protection inherent to several models of their inverters rated 2kw through 24kw as of 6/19/13. The TIGO product model # AF-I-2 is a self-contained unit, it requires 120v premise power and is rated 600vdc and will provide DC arc-fault protection up to 10 amperes per string.

If the design profession does not choose to use the SMA inverter with integral DC AFCI protection then the TIGO self-contained DC arc-fault protection unit should be installed to comply with the 2011 NEC section 690.11 requirements.

Now to address your concern as to when there is only one manufacturer of a listed product that is required by the NEC to be listed, should the requirements be enforced. To that I say absolutely, the NEC does not state that the requirement for listed products does not apply until there is more than one manufacturer listed to manufacture this product. If it is not enforced, the AHJ is penalizing the one manufacturer that is producing a product to comply with the NEC requirements by allowing non-listed products to be installed.

How about if the listed product has limitations and cannot be installed to comply with every application? Then I would refer you to NEC section 90.4 where it states that this Code may require new products, constructions, or materials that may not yet be available at the time the Code is adopted. In such event, the AHJ may permit the use of the products, constructions, or materials that comply with the most recent previous edition of this Code adopted by the jurisdiction.

20. For Power distribution units (PDU's) inside a room designated "information technology" with field installation using MC to 4-plex receptacle boxes under the floor, is it required to secure & support the boxes and wiring methods as stated in 645.5(E)(2) Or would this installation meet the requirements of 645.5(f)?

**Answer: Article 645.5 (E) (2) would apply in this installation.**

Branch-circuit conductors installed under the raised floor of an ITE room using any of the wiring methods listed in [645.5\(E\)\(2\)](#) are required to conform to the specific article for the wiring method used. In addition, Article [300](#) applies, except where modified by Article [645](#). For example, [300.11](#) requires raceways,

cables, and boxes to be securely fastened in place, even though they are installed below a raised floor. 645.5 (F) Applies to equipment that is listed as information technology equipment which wouldn't have to comply to 645.5 (E) (2).

21. There is a residence that has a library 16' x 20' with book cases floor to ceiling along all 4 of the walls. Do I have to install floor boxes to meet wall space receptacle requirement of 210.52 or are no receptacles required?

Reference: 210.52(A) General Provisions. In every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(3).

Receptacles would be required to comply with 210.52(A). They could install floor receptacles to comply. Receptacles installed in the bookcases could also be installed to comply with the code.

22. I have two islands in my house, one is for the kitchen and one is for my wet bar in another room. They both have a receptacle within 6' of the sink installed on the back side of the island. The inspector is requiring that the one for the wet bar be GFCI protected and not requiring that for the kitchen. Is that a proper interpretation of the 2011 NEC?

Reference: NEC 210.8 (A)(6)(7)

Answer: It depends on the placement of the island outlet in the kitchen area. If the outlet is located low and is NOT intended to serve the countertop surfaces the inspectors interpretation is correct per 210.8(A)(6).

The island outlet for the other wet bar must be GFCI protected per 210.8(A)(7).

23. Does the NEC require sizing raceways and their support racks to allow for future expansion?

Reference: NEC 90.8 Wire Planning

Answer: No, the NEC does not mandate it, however, per 90.8 it does make the recommendation to plan for future expansion by providing ample space in raceways, having spare raceways, and allowing for additional spaces for increases in future electrical and/or communication expansions.

24. Conduits and their end fittings are installed at the bottom of an open-bottom switchboard. How far into the switchboard can these raceways extend?

25. Where ground-fault protection of a service disconnecting means is provided and the available fault current exceeds 10,000 amperes, what is the maximum time-delay setting for the ground-fault equipment?

Reference: **NEC 230.95 Ground-Fault Protection of Equipment.**

**(A) Setting. The ground-fault protection system shall operate** to cause the service disconnect to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 1200 amperes, and the maximum time delay shall be one second for ground-fault currents equal to or greater than 3000 amperes.

Answer: Maximum time-delay setting is **one** second

26. Can a ground rod be used on a light pole or other equipment rather than installing an equipment grounding conductor with the circuit conductors?

No. Take a look at the Effective Ground-Fault Current Path requirements of 250.4(A)(5). Electrical equipment and wiring and other electrically conductive material likely to become energized shall be installed in a manner that creates a low-impedance circuit facilitating the operation of the overcurrent device or ground detector for high-impedance grounded systems. It shall be capable of safely carrying the maximum ground-fault current likely to be imposed on it from any point on the wiring system where a ground fault may occur to the electrical supply source. **The earth shall not be considered as an effective ground-fault current path.**

There is similar language in 250.4(B)(4) for ungrounded systems.

27. What is the NEC definition of a "Permanent Barrier" as used in 314.28(D). Does this mean it has to be welded, screwed, etc...?

**Answer:** Some types of boxes (both metal and nonmetallic boxes) are capable of accepting fixed barriers that are accessory features provided by the box manufacturer. Check with the box manufacturer for the type of box that can be equipped with a barrier to meet the requirements of this section. The proper type box must be installed during the rough-in.

28. Can you explain the grounding requirements for a service that consists of up to six switches or six circuit breakers in a group of separate enclosures?

Reference: **250.64(D) 250.66**

- Section 250.64(D) has the requirements for the grounding electrode conductor installation for a service with multiple disconnecting means. There are a few options for grounding multiple service disconnects.

- Sub-section (D)(1) allows the use of a common grounding electrode conductor sized based on Table 250.66, based on the combined totals of the circular mil area of the service conductors.
- Example if you had a service consisting of three service disconnects from three meters and all the service conductors rated 3/0 the combined total  $167,800 \times 3 = 503,400$  kcmil, using Table 250.66 the Common grounding electrode conductor would be a 1/0. This conductor is routed from the grounding electrode to the area of the service disconnects. Taps from each service disconnect sized from Table 250.66 based on the conductors for each service. In this example a 4 AWG conductor from each disconnect connected to the common grounding electrode conductor.
- Sub-section (D)(2) would allow you to route a grounding electrode conductor from each service disconnect to the grounding electrode system, sized based on the size of service conductors for that service and 250.66. Example if you had a 200 amp residential service using 2/0 conductors and a 60 amp service for an electrical vehicle supply equipment using 6 AWG conductors. The GEC from the 200 amp would be a 4 AWG and the GEC to the 60 amp would be an 8 AWG.
- Sub-section (D)(3) for a Common Location would apply if you had a wireway or other accessible enclosure on the supply side of the service disconnects. Lets take that same example of an installation with a 200 amp service using a 2/0 and a 60 amp using a 6 AWG. This section would allow us to size this installation based on the conductors at the common location. Table 8, Chapter 9, 2/0 is 133,100 cm and a 6 AWG is 26,240, together is 159,240 and then using 250.66 to find we need a grounding electrode conductor sized to a 4 AWG.

29. In a residence I have an electrical panel located in a mechanical room 12'w x 8'd x 8'h meeting all the requirements of 110.26 for space and clearances, but it is only accessed through the crawl space which is only 4 feet in height and 10 feet long. Is this an acceptable location for the electrical panel for the house?

- Article 110.26 (C)(1) Minimum Required. At least one entrance of sufficient area shall be provided to give access to and egress from working space about electrical equipment.
- The “sufficient area” is sufficiently vague that this is a judgment call by the AHJ. All factors must be analyzed and evaluated by the AHJ.

30. Can we install Nonmetallic Sheathed Cable in a wet location above ground if we place it inside a raceway?

**Reference:** NEC 334.12(B)(4) Uses Not Permitted  
NEC 300.9 Raceways in Wet Locations Abovegrade

**Answer:** No, 300.9 makes it clear that the interior of a raceway is considered a wet location when the raceway is installed in a wet location abovegrade. 334.12(B)(4) tells us that NM Cable cannot be used in a wet location.

31. Can a neutral conductor be used for bonding a meter enclosure to a panelboard mounted right beside the meter? I have installed PVC conduit between the enclosures. The inspector has requested I install a bonding jumper in addition to the neutral in the PVC. Which is correct?

32. The main service disconnect switch in a 277/480 volt panelboard is rated 1200 amperes. The calculated load would allow 900 amp fuses. Would GFI protection of equipment (GFPE) be required since the fuses are less than 1000 amperes?

**Reference: NEC 230.95 Ground-Fault Protection of Equipment.**

The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed

Answer: Yes – GFPE is required

33. Does UL or other NRTL list aerosol cans of smoke that can be used to test smoke alarms?

Yes, UL Product Category URRQ (Smoke-automatic Fire Detector Accessories) located on page 391 of the 2013 UL White Book includes aerosol cans of smoke. A quick search of the UL Online Certification Directory identified 5 different manufacturers of UL Certified Aerosol tester spray (Smoke in a Can). These products are intended for smoke entry and alarm actuation per NFPA72, paragraph 14.4.2.2-14G. Hazards of the pressurized container have not been investigated.

34. The interior of a panelboard got a little overspray from the drywall installation. How do we determine what to do with the panel interior?

**Answer: 110.12 (B) Integrity of Electrical Equipment and Connections.** Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating. It may need to be replaced, contact the manufacturer for further information.

35. If a metal cover is installed on a concrete hand hole installed in the ground, is the cover required to be grounded? I could not find a reference, but heard it was required.

Reference: **314.30(D)**

**314.30(D) Covers.** *Handhole enclosure covers shall have an identifying mark or logo that prominently identifies the function of the enclosure, such as “electric.” Handhole enclosure covers shall require the use of tools to open, or they shall weigh over 45 kg (100 lb). **Metal covers and other exposed conductive surfaces shall be bonded** in accordance with 250.92 if the conductors in the handhole are service conductors, or in accordance with 250.96(A) if the conductors in the handhole are feeder or branch-circuit conductors.*

36. Should the lightning protection system ground terminals be bonded to the electrical grounding electrode system of a building?

Article 250.106 Lightning Protection Systems. The lightning protection system ground terminals shall be bonded to the building or structure grounding electrode system.

The obvious answer is yes.

37. I installed a short rigid nipple out the back of a panel to an LB that has a 5' length of EMT to a disconnect switch for an AC unit. It only has #10 copper wires in the conduit and the inspector wants a bushing on the inside of the panel. Is he correct?

**Reference:** NEC 300.4(G) Insulated Fittings

**Answer:** The inspector is always correct. However, 300.4(G) states that raceways containing 4 AWG or larger are required to have an identified fitting with a smoothly rounded insulating surface shall be installed to protect the conductors.

38. Does the equipment for the requirement for intersystem bonding in 250.94 have to be weather-proof?

Answer: generally yes, 110.11 “no conductors or equipment shall be located in a wet or damp location unless identified for the location” 300.6 must “be suitable for the environment in which they are installed”

Ref. 250.94, 300.6 and 110.11

39. Can a dry type transformer be loaded to its full rating (i.e. can a 75 kva transformer be used with 75kva of load) or is the maximum load 80%?

Reference:

NEC 450.3 Transformer Protection

NEC 240.21(C) Transformer Secondary Conductor Protection

Answer: It can be used at its full rating. Make sure you review the review the Nameplate.

Transformer protection ... 125% - Primary Only

Conductor & OCPD ... permitted at 125% of Transformer Rating

(Keep in mind the protection of the conductor is set at 125% of the continuous load plus 100% of the noncontinuous load)

Ex: 75KVA (480/240V) – 3 Phase – 180A at 240V

Transformer Protection – 125%(90A) = 112A (protect at 125A)

Secondary Conductor size 4/0 – 230A (Land in 225A Breaker)

40. Does a building ground ring need to be sized per 250.66 or is the minimum size of #2cu per 250.52 sufficient for any size service?

No, NEC section 250.52 (A)(4) only requires the ground ring to be a minimum of a #2 AWG, there is not a requirement for it to be any larger. Section 250.66 is for sizing the grounding electrode conductor, not the grounding electrode. Even section 250.66(C) states that where the grounding electrode conductor is connected to a ground ring, that portion of the conductor **that is the sole connection to the grounding electrode** shall not be required to be larger than the conductor used for the ground ring.

Now, if the ground ring is part of a daisy-chained grounding electrode system where NEC section 250.64(F) would be applicable. The ground ring actually becomes a bonding jumper interconnecting the grounding electrodes and would be required to be sized in accordance with 250.66 as required by 250.53(C).

41. Are there differences on how a 15 and 20 amp receptacle is constructed?

- **Answer:** UL White Book information:
- **RECEPTACLES FOR PLUGS AND**
- **ATTACHMENT PLUGS (RTRT) Page 361 of the 2012 edition.**
- Differences:
- 15 amp have the ability of stab-lock of 14 gauge wire
- 20amp have screws to mechanically secure the wire to the device
- The faces will have a different NEMA configurations are different between the 15amp and 20amp.

- The 20amp will have a 1hp rating where a 15 amp is rated for ½ hp

42. My grounding electrode system consists of a water pipe, a UFER, and a ground rod. My service conductors are 500kcmil copper. Can I run a 1/0 cu grounding electrode conductor to the water pipe, then a #4 cu conductor from the water pipe to the UFER, then a #6 cu from the UFER to the ground rod?

Reference: **250.64(F)**

Yes,

250.64(F) references the grounding electrode conductor and bonding jumpers interconnecting grounding electrodes.

- **250.64(F) Installation to Electrode(s).** *Grounding electrode conductor(s) and bonding jumpers interconnecting grounding electrodes shall be installed in accordance with (1), (2), or (3). The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all the electrodes connected to it.*
  - (1) The grounding electrode conductor shall be permitted to be run to any convenient grounding electrode available in the grounding electrode system where the other electrode(s), if any, is connected by bonding jumpers that are installed in accordance with 250.53(C).*
  - (2) Grounding electrode conductor(s) shall be permitted to be run to one or more grounding electrode(s) individually.*
- **250.53(C) Bonding Jumper.** *The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70.*

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Also 250.66(A) and (B) for connections to the Ground Rod and to the UFER (Concrete Encased Electrode) respectfully.

43. When determining the Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Device using Table 430.52, do I use the motor amperages shown in Tables 430.247 through 430-250 for all type of motor applications or the nameplate rating on the motor(s)? Why?

Reference: 430.6(A)(1), 430.52(C)

Answer: The sizing of the short circuit and ground fault protective device is based on the NEC table values and not the nameplate value on the motor. The tables are utilized in lieu of the nameplate to allow for future replacement motors which may be of a higher value. There has been proposals to allow the nameplate in lieu of the table values, the Code Panel has rejected these proposals.

- 7.5 hp @ 480 volt, 3 phase
- Table 430.150 – 11 amps
- Motor nameplate – 9.3 amps

7.5 hp @ 230 volt, 3 phase

Table 430.150 – 22 amps

Motor nameplate – 18.6

44. Can the concrete pillars used to support a manufactured home be used for the UFER grounding electrode?

**Answer: Depends.... How is the pillar constructed?????**

**NEC Reference 250.52 (A)(3)**

**(3) Concrete-Encased Electrode.**

*A concrete-encased electrode shall consist of at least (20 ft) of either (1) or (2):*

1) *1/2" Rebar*

2) *#4 CU*

*Metallic components shall be encased by at least 50 mm*

*(2 in.) of concrete and shall be located horizontally within that*

*portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with*

*the earth.*

45. I am installing a 20 amp duplex receptacle fed with a 20 amp multi-wire branch circuit. Each half of the duplex receptacle will have a 16 amp load for a total on the duplex of 32 amps. Is each half of the duplex receptacle rated 20 amps, or is the rating for the entire duplex receptacle?

**Answer:** Each half of the duplex receptacle is rated 20 A, 125 V.

**Reference:** *UL Product Standard 498 (Attachment Plugs and Receptacles), 2013 UL White Book RTRT, 210.21(B), Table 210.21(B)(2)*

46. Is it permissible to utilize Table 310.15(B)(7) and install two parallel runs of 4/0 aluminum SER cable for a 400 ampere main power feeder for a single family dwelling?

Reference: **NEC 310.15(B)(7) – 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders.**

Answer: **YES For a Main Power Feeder.**  
**No if (2) individual feeders to separate 200 AMP sub-panels.**

47. I have a duplex dwelling that has the electric hot- water heaters for both units located in the basement of one of the units. They are being fed from circuit breakers in the electrical panels in each unit with breaker locks at the water heaters. If a problem arises with the water heater where the person does not have access to correct the issue, is this a code violation of Art. 210.25?

Reference: NEC 210.25(A)

NEC 240.24(A) and (B)

Answer: Yes, several violations. 210.25(A) requires that branch circuits in one dwelling unit supply only loads within that dwelling unit.

240.24(A) requires that overcurrent devices shall be readily accessible and they would not be readily accessible in this case. 240.24(B)

Requires that each occupant have ready access to overcurrent devices protecting conductors within that occupancy.

48. Is it compliant to run Health Care Facility cable through PVC in the concrete floor as long as it is not slab on grade, for dental chair receptacles?

**References:** 517.13, 330.10, 330.40

**Answer:** Maybe, if the HCMC cable can be properly terminated to a listed box or assembly at or beneath the dental chair

49. Is it a violation to install a GFCI receptacle for the vending machine behind the vending machine indoors in a hallway of a commercial building?

**Reference:** **2011 NEC:** 110.26; 422.51

**2014 NEC:** 110.26; 422.5; Article 100: Accessible, Readily; 422.51(A) and (B)

**Answer:** 110.26 applies to all electrical equipment and requires, “Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and

maintenance of such equipment.” Note the rule requires “Access ... to permit ready and safe operation and maintenance ...”

Continued:

210.8(B) does not clearly apply as the vending machine is located indoors in a hallway.

422.51 requires the GFCI protection to be provided in the supply cord. The rule does not specifically require or exclude “ready access to the GFCI protection.” Logic or manufacturer’s instructions may require “ready access for monthly testing”.

### **2014 NEC Rules**

110.26; Unchanged in the 2014 NEC

422.5; New requirement that “The device providing GFCI protection required in this article shall be readily accessible.”

Continued **2014 NEC Rules:**

**Article 100: Accessible Readily**, requires access to the GFCI device without moving the vending machine.

#### **422.51(A) Cord-and Plug-Connected.**

Continues to require GFCI protection in attachment cap or within 12 in. of cord cap.

#### **422.51(B) Other Than Cord-and Plug-Connected.**

These are required to have GFCI protection in supply branch circuit.

**Bottom line 2014 NEC, GFCI protection is required to be readily accessible whether cord-and-plug connected or directly wired.**

50. Some conference rooms where I work are being equipped with a ceiling lift for the overhead projector that raises the projector to a position above the ceiling when not in use. The lift has a control panel for power connection so it is hard wired. My question concerns the projector cord connection that is above the ceiling when in the up position. NEC 400.8, uses not permitted lists instances where flexible cords are not permitted. Can a cord- connected projector comply with 400.8(5) when in the up position? NEC 400.7(8) could be interpreted by some to allow this installation although it does not specifically state above ceiling locations.

Reference: NEC 400.8(5)

Answer: The flexible cord is not allowed to be installed above the suspended ceiling in accordance with 400.8(5), there are options which will allow the installation & meet the Code requirements.

400.7(8) is not applicable with this installation due to 400.8(5)

- Projector housing for plenum ceiling installations to comply with NEC 300.222014 ROP 6-103 Proposed Code language
- 400.8(A)(9) Connection of accessory equipment associated with mechanical equipment, alarms, or antennas using a listed non-detachable power supply cord 6 ft or less above an accessible suspended or dropped ceiling where not prohibited by 300.22. **[ROP 6–103]**
- 2014 ROC 6-73 –This comment rejected the proposed language. This will not be part of the 2014 NEC.

51. Regarding the use of Underground Feeder and Branch-circuit cable (UF) in conduit. Section 340.10 of the NEC “uses permitted”, and section 340.12 “uses not permitted” is silent on this question. Therefore I have allowed the use of UF cable within conduit for physical protection or other reasons due to the fact the NEC does not prohibit this type of installation in section 340.12. Am I correct?

**Answer: You are correct- the only limiting factor would be the where and how it is installed.**

***NEC Reference 340.12 Uses Not Permitted.***

- (1) *As service-entrance cable*
- (2) *In commercial garages*
- (3) *In theaters and similar locations*
- (4) *In motion picture studios*
- (5) *In storage battery rooms*
- (6) *In hoistways or on elevators or escalators*
- (7) *In hazardous (classified) locations, except as specifically permitted by other articles in this Code*
- (8) *Embedded in poured cement, concrete, or aggregate, except where embedded in plaster as nonheating leads*  
*where permitted in 424.43*
- (9) *Where exposed to direct rays of the sun, unless identified as sunlight resistant*
- (10) *Where subject to physical damage*

**There are obvious installations where it could be used.**

***NEC Reference 300.5(D) Protection from Damage.*** *Direct-buried conductors and cables shall be protected from damage in accordance with 300.5(D)(1) through (D)(4).*

- (1) *Emerging from Grade.* *Cables emerging from grade shall be protected extending from the minimum cover distance below grade 18 in. below grade to a point at least 2.5 m (8 ft) above finished grade.*
- (4) *Enclosure or Raceway Damage.* *Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in RMC, IMC, RTRC-XW, Schedule 80 PVC conduit, or equivalent.*

52. Insulated service-drop or overhead service conductors of the quadruplex type are used for a 480Y/277-volt service to a swimming pool dressing room, pump room, and rest room building. What is the minimum clearance in any direction required between this service drop and a diving platform?

**Answer:** 4.4 m (14.5 ft)

**Reference:** Table 680.8

53. I have mounted transformers in the attic to feed low- voltage light track fixtures in a dwelling living room. Are the 120- volt circuits required to be arc- fault protected?

Reference: NEC 100 – Outlet NEC 210.12(A)

Answer: NO

**210.12(A) Dwelling Units.** All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

**Article 100 “Outlet.”** A point on the wiring

system at which current is taken to supply

utilization equipment.

- Section 210.12(A) requires AFCI protection 125 volt 15 and 20 ampere outlets in living. The tracking lighting would be an outlet by definition however is low voltage, not 125 volt. Depending on the installation method the feed in the attic which is 125 volt and probably 15 or 20 ampere, an attic is not an area mentioned in 210.12(A) as requiring AFCI protection.

54. There is a 150 amp 120/240 volt Federal Pacific circuit- breaker panel with spare spaces in a house. They want to add a new 20 amp 120 volt branch circuit in the kitchen. If I can find a breaker for this panel is it allowed? (Installation of equipment from a company no longer in business with known problems for faulty products acceptable).

Reference: NEC 210.8(A)(6)

NEC 210.12(A)

Answer: Yes, it is allowed. 210.8(A)(6) requires that the branch circuit be GFCI protected, and new 210.12(A) requires the branch circuit to be AFCI protected. New FPE CBs with GFCI are still available and AFCI receptacles are now available from at least one manufacturer.

55. In an operating room that has been identified as a “wet procedure location” can a regular receptacle trim plate be used?

References: 406.9(B) and 517.2

**Answer:** YES

56. What would be the minimum size of grounded service conductor that would be required for an industrial facility with a 2000 ampere service consisting of 5 parallel runs in 5 conduits of 600 KCMIL Type THWN-2 copper conductors? (there are no neutral loads on the system)

**Reference:** 2011 NEC: 250.24(C)(2), 250.24(C)(1), Table 250.66  
2014 NEC: 250.24(C)(2), 250.24(C)(1), Table 250.102(C)(1)

**Answer:** By reference to Table 250.66 (2011 NEC) or Table 250.102(C)(1) (2014 NEC), a minimum 1/0 AWG grounded conductor is required in each conduit.

57. What size of equipment grounding conductor is required for a 480 volt, 3-phase, 7.5 HP, 11 amp motor fed by # 14 THHN conductors? Is NEC 250.122(D)(1) applicable?

Reference: NEC 250.122(D)(1) or (D)(2), Table 250.122, 430.52(C)(1) & Table 430.52

Answer: Yes – 250.122(D)(1) is applicable, the size of the equipment grounding conductor (EGC) is determined by the size & type of ground fault short circuit protective device installed for the motor.

- 250.122(D)(1) requires table 250.122 to be used based on the size of the overcurrent device used for the installations, but in no case requires the EGC to be sized larger than the ungrounded conductors.
- 250.122(D)(2) allows when using an Instantaneous trip circuit breaker to size the equipment grounding conductor to be sized based on using the values in 250.122(A) using the maximum permitted rating of a dual element time delay fuse in accordance with 430.5(C)(1) Exception #1
- Is NEC 250.122(D)(1) applicable?
- Reference: NEC 250.122(D)(1) or (D)(2), Table 250.122, 430.52(C)(1) & Table 430.52
- **Example 1:** 480 volt, 7.5 hp motor with inverse time circuit breaker Table 430.250 – 11 amperes
- 430.52(C)(1) & Table 430.52 = 250% multiplier
- 11 amperes x 250% = 27.5 amperes
- 430.52(C)(1) Ex #1 - 27.5 amperes, round up to 30 amp OCPD
- Table 250.122 = #10 EGC for 30 amp OCPD
- 250.122(D)(1) Not required to be larger than ungrounded conductors, therefore #14 EGC is acceptable.

- **Example 2** : 480 volt, 7.5 hp motor with instantaneous trip circuit breaker (ITCB)
- Table 430.250 – 11 amperes
- 430.52(C)(1) & Table 430.52 = 800% multiplier x 11 amperes = 88 amperes
- 430.52(C)(1) Ex - 88 amperes, round up to 30 amp OCPD
- Table 250.122 = #8 EGC for 80 amp OCPD
- 250.122(A) Not required to be larger than ungrounded conductors , therefore #14 acceptable.
- 250.122(D)(2) May use the time delay fuse multiplier for sizing the EGC when utilizing a ITCB.
- **REMINDER:** 430.52(C)(3) Instantaneous Trip Circuit Breaker. An instantaneous trip circuit breaker shall be used only if adjustable and if part of a listed combination motor controller having coordinated motor overload and short-circuit and ground-fault protection in each conductor, and the setting is adjusted to no more than the value specified in Table 430.52.

58. We are installing 26 – campground RV pedestals that have a 50 amp / 30 amp / 20 amp outlet in them. We are installing a 200 amp feed and connecting 6 pedestals to each 200 amp feeder. We are installing 4 wires to each pedestal. Do we still need to install 2 ground rods per pedestal. We are having a lengthy debate here at the shop and would like to know your thoughts on this installation.

#### **2008 ROP.**

Proposal 19-99 (Reject)

551.75 FPN: The use of a grounding electrode as provided in Article 250,Section 250.52, shall not be required for RV pedestals that are supplied by a common feeder.

Panel Statement:

The panel agrees with the Submitter's conclusion that RV pedestals **are to be treated as separate structures**, and, therefore, require grounding electrodes per 250.32. 250.4(A)(1) provides the reasons for the use of a grounding electrode at each structure.

Proposal 19-99 (Reject)

551.75 FPN: The use of a grounding electrode as provided in Article 250,Section 250.52, shall not be required for RV pedestals that are supplied by a common feeder.

Panel Statement:

#### **2014 ROP.**

Proposal 19-79 (Accept)

***551.75 Grounding.*** All electrical equipment and installations in recreational vehicle parks shall be grounded as required by Article 250. ***For the purposes of this section a RV pedestal shall be considered a separate structure and shall comply with 250.32***

Panel Statement:

The panel and now the submitter are clear **that a RV pedestal is considered a separate structure**, but many in the industry are not clear and this change will ensure that the pedestals are properly grounded.

Comment 19-28 (Reject)

“A factory-built RV pedestal should not be considered a structure. RV pedestals are “equipment”. The requirements of Article 250.32 should not apply. The action taken by CMP-19 to accept Proposal 19-79 and define the RV pedestal as a separate structure, requiring the provisions of 250.32 to be met, was not justified by any technical substantiation”.

**Answer:** You could argue a grounding electrode could be required under the current code based on the 2008-ROP. However, based on the 2014 ROC the grounding electrode will not be required.

*NEC Reference 551.75 Grounding. All electrical equipment and installations in recreational vehicle parks shall be grounded as required by Article 250.*

*Informational Note: See 250.32(A), Exception, for single branch circuits.*

59. I need your opinion, we will be wiring a hotel project. Each guestroom is being heated/ cooled by an individual fan coil unit, with horsepower ratings between .04 to .17 at 115V. They are being serviced by chilled and hot water. Do you feel Article 422.12 applies to these units where individual branch circuits are needed for each unit? In my opinion, it does not because these FCU's are not central. I feel article 424 covers these units were multiple FCU's can share a circuit.

**Answer:** No, 422.12 does not apply. In my opinion, these units are fixed electric space-heating equipment.

**Reference:** Article 422, Article 424, 422.12, 422.10, 422.10(A)

60. I am installing 12- volt low voltage cable lighting in a family room in a residence. The transformer is located in the attic, is this branch circuit required to be on an arc-fault circuit breaker?

Reference: NEC 100 – Outlet NEC 210.12(A)

Answer: NO

**210.12(A) Dwelling Units.** All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

**Article 100 “Outlet.”** A point on the wiring

system at which current is taken to supply utilization equipment.

- Section 210.12(A) requires AFCI protection 125 volt 15 and 20 ampere outlets in living. The tracking lighting would be an outlet by definition however is low voltage, not 125 volt. Depending on the installation method the feed in the attic which is 125 volt and probably 15 or 20 ampere, an attic is not an area mentioned in 210.12(A) as requiring AFCI protection.

61. Where ground-fault protection is required for solidly grounded wye systems, what is the maximum ampere setting of the ground fault protection?

Reference: NEC 230.95(a)

Answer: Maximum setting is 1200 amperes.

62. Am I allowed to install cord and plug connected heat mats by a swimming pool or hot tub outdoors? The manufacturer's plug comes with ground-fault protection of equipment, do I need to have ground-fault circuit interrupter protection also?

Reference: 210.8

**Answer:** Yes, if the receptacle is located outdoors, which it better be because per 400.8 cords cannot be run through doorways.

63. I am wiring the front counter of a restaurant that has sensitive electronics that require an isolated ground circuit. Can I install 12/3 MC cable and tape the red wire green, or strip the red wires and use it for my isolated ground? Can I use Medical MC cable or Medical AC cable?

**Reference:** 2011 NEC: 250.146(D), 250.119, 250.119(B)

**2014 NEC: 250.146(D), 250.119, 250.119(B)**

**Answer:** Yes, you are permitted to mark the red wire green and use it for the isolated ground. If the red insulation is removed, use it for the regular, not isolated, ground. The isolated ground wire is required to be insulated. Yes, the insulated equipment grounding conductor is permitted to be used for isolated grounding.

64. A solenoid valve for an automatic irrigation pump oilier has 15" leads that will not reach the j-box. Can these leads be spliced in a "C" Condulet fitting?

Reference: NEC 314.16(C)(2)

Answer: YES.

The NEC allows those conduit bodies that are marked by the manufacturer with their volume shall be permitted to contain splices, taps, or devices. The maximum number of conductors shall be calculated in accordance with 314.16(B). Conduit bodies must be supported in a rigid and secure manner.

ROP # 9-48 in the 2011 NEC Code cycle relocated these requirements from NEC 314.5 to 314.16. 314.16(C)(3) does not allow splices in short radius conduit bodies such as capped elbows and service entrance elbows. The requirements for these types of fittings are now all located in one Code section.

65. Can SO cord be dropped from a bar joist to a display shelf (end cap) and hard-wired to a junction box on that display unit or does it have to be installed in conduit?

**Answer: It must be a permanent wiring method.**

***NEC Reference 400.8 Uses Not Permitted.***

*Unless specifically permitted in 400.7, flexible cords and cables shall not be used for the following:*

*(1) As a substitute for the fixed wiring of a structure*

66. Walls separating (separation walls) dwelling units in the same building are required to meet the integrity provisions of fire partitions. What options are available for receptacle outlets on opposite sides of the wall separating these units when 24 inch horizontal separation is not possible?

**Answer:** *Cellulose loose-fill or mineral fiber insulation (BPHX), fire-blocking (BPVV), wall opening protective materials (CLIV or QCSN) such as putty pads, inserts or gaskets, Listed nonmetallic outlet boxes and fittings classified for fire resistance (CEYY or QBWY)*

**Reference:** *300.21 and the UL White Book*

67. A long-standing requirement in the National Electrical Code (NEC) is to provide a service disconnecting means for each building or structure served by electricity. The concept is simple; the disconnecting means serves as a ready means for the occupant or other responder to remove all power from the building by operating the service disconnect. What is meant by the term “grouped” as it is used in Section 230.72 of the NEC?

Reference: NEC 230.72(A)

Answer: AHJ Determination

- 230.72 Grouping of Disconnects.
- **(A) General.** The two to six disconnects as permitted in 230.71 shall be grouped. Each disconnect shall be marked to indicate the load served.
- The NEC does not state how close the two to six disconnects must be in order to be considered grouped in any one location. The judgment is left up to the AHJ for good a reason. For example two mains on either side an aisle may be considered grouped, but that depends on how clearly they are identified and how readily they could be operated. The AHJ should make this decision based

on the intent of the NEC, that is, based on safety considerations. It is simply a reasonable requirement and limitation for readily and quickly disconnecting power, when necessary.

68. Are general-use Rigid Metal Conduit compression-type fittings allowed in a Class 1 Division 2 location?

Reference: NEC 501.10(B)(4)

Yes. Note that the wiring methods for Class 1 Division 2 do not call out for fittings listed for the application.

501.10(B)(4) Boxes and Fittings. Boxes and fittings shall not be required to be explosionproof except as required by 501.105(B), 501.115(B)(1), and 501.150(B)(1).

This is a bit confusing because of the wording in UL 514B. The Scope of UL 514B Conduit, Tubing, and Cable Fittings states in Clause 1.6, "These requirements do not cover conduit NIPPLES, threaded ELBOWS, and threaded COUPLINGS intended for use with rigid metal conduit, intermediate metal conduit, or electrical metallic tubing." Clause 1.4 restricts 514B fitting from use in hazardous location and states that, "These requirements do not cover FITTINGS intended for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the Standard for Electrical Installations, NOM-001-SEDE."

But the text in 501.10(B)(4) clarifies the question.

69. Is it allowed to install a fire alarm panel in the crawl space of a residence?

## **NFPA 72 Chapter 29 Single Multiple Station Alarms Household Fire Alarm Systems**

### **29.8 Installation.**

(2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other *spaces* where temperatures can fall below 40° F

### **110.26 Spaces About Electrical Equipment**

Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment

**References:** 760.3(D)110.3, 110.26

**ANSWER:** Maybe - consider clearances, listing and environment

70. I would like to have a clarification on approved methods about installing Metal Clad (MC) cable. I had an interesting discussion with a coworker. He said MC cable did not require or need an anti-short bushing

(red head). So, I went diving into NEC 2011 but did not find anything saying that it is needed like it does for AC cable (320.40). Does the NEC require the anti-short for all MC cable?

**Reference: 2011 NEC: 330.40**  
**2014 NEC: 330.40**

**Answer:** An anti-short bushing is not required for Type MC cable terminations. The combination of cable construction and fitting design offer suitable protection. See [www.nema.org](http://www.nema.org) NEMA Bulletin 90 and [www.nacmaonline.com](http://www.nacmaonline.com) for its publication.

71. Can we use pieces of scrap copper wire to secure electrical metallic tubing in a metal stud wall?

Reference: NEC 110.2, 110.3, 100, 358.30(A)&(B)

Answer: NO, listed straps are available for this purpose.

NEC 110.2 The conductors and equipment required or permitted by this Code shall be acceptable only if approved.

NEC 100 Approved. Acceptable to the authority having jurisdiction.

NEC 110.3 (A) Examination. In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with the provisions of this Code

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided.

Reference: NEC 110.2, 110.3, 100, 358.30(A)&(B)

Reference: NEC 110.2, 110.3, 100, 358.30(A)&(B)

358.30(A) EMT must be securely fastened in place at least every 10 ft. In addition, each EMT run between termination points shall be securely fastened within 3 ft of each outlet box, junction box, device box, cabinet, conduit body, or other tubing termination.

Exception No. 1: Fastening of unbroken lengths shall be permitted to be increased to a distance of 5 ft where structural members do not readily permit fastening within 3 ft.

(B) Supports. Horizontal runs of EMT supported by openings through framing members at intervals not greater

10 ft. and securely fastened within 3 ft. of termination points shall be permitted.

72. Does a utility-required disconnect (pedestal breaker) meet the requirements of 230.70(A)? What is the minimum distance that this device can be from the structure?

**Answer: Depends**

*NEC Reference 230.66 Marking. Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use*

*as service equipment. All service equipment shall be listed.*

*NEC Reference 100 Definitions- Service Point. The point of connection between the facilities of the serving utility and the premises wiring.*

**What is the minimum distance that this device can be from a structure?**

**Answer: Outside or inside nearest point of entry**

*NEC Reference 230.70 (A)(1) Readily Accessible Location.*

*The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.*

73. Can I use a 4-foot long piece of 1” liquidtight flexible metal conduit, with listed fittings, as an equipment-grounding conductor on a 40-amp circuit where flexibility is not required?

**Answer: Yes**

**Reference:** *Article 350, 350.6, 350.60, and 250.118(6)*

74. Are there conductor fill requirements for signaling circuits?

**Code References:**

**725.3(A) and 300.17**

**Answer: YES**

**NEC Section 725.3(A)**

- **725.3 Other Articles.** 725.3 Other Articles Circuits and equipment shall comply with the articles or sections listed in 725.3(A) through 725.3(G). Only those sections of Article 300 referenced in this article shall apply to Class 1, Class 2, and Class 3 circuits.

**(A) Number and Size of Conductors in Raceway** Section 300.7.

**NEC Section 300.17 Number and Size of Conductors in Raceway**

The number and size of conductors in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductors without damage to the conductors or to their insulation.

**Informational Note:** See the following sections of this *Code*: ... Class 1, Class 2, and Class 3 circuits, Article 725...

The number of control and signaling cables installed in a raceway are limited to the percent fill limitations of Chapter 9, Table 1. This requirement of proposal 16-36 in the 2001 ROP. This proposal did not intend required Class 2 or Class 3 cables to comply with the raceway fill limitations. Although this may or may not have been the intention of the submitter. In reality there is no physical way to install these cables anywhere near the 40% fill allowed in Chapter 9, Table 1 without destroying them, in which would be a violation of the main test of Section 300.17.

Reference 725.3(A) and 300.17.

75. What rating is needed for a disconnect switch for a long-time rated X-ray machine?

Reference: NEC 517.72

Must be rated for 100% of the long-time rating.

## **517.72 Disconnecting Means.**

**(A) Capacity.** A disconnecting means of adequate capacity for at least 50 percent of the input required for the momentary rating or 100 percent of the input required for the long-time rating of the X-ray equipment, whichever is greater, shall be provided in the supply circuit.

**(B) Location.** The disconnecting means shall be operable from a location readily accessible from the X-ray control.

**(C) Portable Equipment.** For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug and receptacle of proper rating shall be permitted to serve as a disconnecting means.

76. When are hospital grade receptacles required? I see them in medical and dental clinics.

77. What would be the proper way to bond a rigid metal 90-degree “ell” used inbetween rigid PVC conduit on a service installation?

**Reference:** 2011 NEC: 250.80 and Exception; 250.92(B)(2); 250.8

2014 NEC: 250.80 and Exception; 250.92(B)(2); 250.8

**Answer:** See the following 3 slides

Bonding of metal pulling elbows not required if isolated from contact by not less than 18 in. of cover.

250.80 Ex.

Metal pulling elbows bonded by connection to bonded metal conduit.

250.92(B)(2)

External bonding jumper permitted not greater than 6 ft long.

250.102(E)(2).

Clamp suitable for direct burial. 250.8(A)

78. Where multiple service disconnects are installed in separate enclosures (three in this case) and grouped in accordance with 230.72, do these disconnects have to be within sight from each other?

Reference: NEC 230.72, NEC 100 “within sight” definition.

Answer: Yes – The disconnects are required to be within sight of each of the service disconnects to be considered grouped together, although there is no definition of “grouped” in NEC.

Article 100 – Within sight of is defined as “the specified equipment is to be visible and not more than 50 ft. distance”.

Reference: NEC 230.72, NEC 100 “within sight” definition.

Webster’s Dictionary is not much help either!! This will be up to AHJ to determine what “grouped” is.

Grouped – all in same room ?

Grouped – all within sight ?

Grouped – all within touch of each other ?

Grouped – all immediately adjacent to each other ?

Grouped – different meaning to different people!!!

79. What is the minimum distance a receptacle must be located away from a sink? What about a bathtub with a shower?

**Answer:**

Over the sink- The NEC is silent. Generally- GFCI protection will be required. NEC 210.8

Bathtub and shower is addressed in NEC 406.9 (C)

**NEC Reference 406.9(C) Bathtub and Shower Space.** *Receptacles shall not be installed within or directly over a bathtub or shower stall.*

80. Are there any specific NEC rules for splicing copper and aluminum conductors?

**Answer:** Yes. Conductors to be spliced or joined with splicing devices identified for the use

**Reference:** 110.14 , 110.14(B)

81. I have been told that I must keep telephone (communication) cables at least two inches away from power cables in a dwelling. Where is this requirement in the NEC?

Reference: NEC 800.133(A)(2)

**(2) Other Applications.** Communications wires and cables shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a*

*raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

Article 800 covers Communications Circuits. Section 800.133(A)(2) requires a minimum of 2" separation between communication and power cables.

82. A 100 hp, 3-phase, 480 volt motor is fed with #2/0 AWG, Type THHN/THWN, copper conductors protected with Type NON-400 ampere fuses and a #6 AWG copper EGC. Are the motor circuit conductors, EGC, and fuses properly sized?

Reference: 430.52, 430.250, 110.3(B), Table 310.15(B)(16), Table 250.122

Answer: From Table 430.52 a non-time delay fuse can be sized as high as 300% of FLA, which is 124 amperes from Table 430.250.  $3 \times 124 = 372$  amperes. Exception No. 1 allows the next standards size, which 240.6 shows as a 400 ampere fuse, which agrees with the question. However, the fuse in question is only a 250 volt fuse, so it would be a violation of 110.3(B) to use the 250 volt fuse on a 480 system. An NOS 400 fuse would be required for this application. If the fuses were installed in a switch, the switch would also have been a 250 volt switch, which would also have been a violation of 110.3(B). 430.22 requires that the motor circuit conductor have an ampacity of at least  $1.25 \times 124 = 155$  amperes. Table 310.15(B)(16) shows a 2/0, 75 degree C conductor to have an ampacity of 175 amperes. Table 250.122 would indicate that a 3 AWG conductor is adequate for the EGC, so the 6 AWG conductor would also be in violation.

83. I want to wire a 75 KVA, 3-phase, 480-volt primary, 208-volt secondary transformer, with both sets of the wiring in the same conduit from a large j-box. There is OC protection on the primary conductors. Is this a NEC violation?

References: 300.3 and 310.15(B)(3)(a)

**Answer:** No. While not specifically prohibited, the necessary reduction in the ampacity of both sets of conductors may make this an unworkable installation

84. My water pipe ground clamp accepts up to a #2 wire size. Can I attach a lug to it to accept a larger conductor?

**Reference:** 2011 NEC: 110.3(B); 250.8

**2014 NEC: 110.3(B); 250.8**

**Answer:** Generally, the clamp should be used to secure only the range of wire sizes (both the smallest and largest) identified on the connector or box the clamp is shipped in.

85. Can two outside breakers of adjacent four -pole, common trip breakers be utilized as a common trip breaker for 240 volt loads, if they are tied with an approved handle tie?

**Reference:**

UL White Book, UL 489

**Answer:** No. The outside poles of the two four-pole breakers must be independent trip and not common trip.

- **Independent Trip** — A 2-pole circuit breaker that does not have an internal common trip feature is marked “Independent Trip” or “No Common Trip.” An external handle tie alone does not qualify as a common trip mechanism — a breaker of this type is marked to indicate it is an independent trip breaker.
- **Common Trip** — A multi-pole circuit breaker constructed so that all poles will open when any one or more poles open automatically.

**To achieve this goal the outside poles would have to be independent trip.**

86. Is it a code violation to have general purpose receptacles on the same lighting circuit that has required battery- backup emergency lights?

**Battery backup ‘unit equipment’ is found in 700.12 ‘F’ that requires it to be on the same branch circuit as serving the normal lighting in the area, ahead of any switches.**

**So if ‘lighting in the area’ also have receptacles in this case there seems to be no violation.**

*[Not to be confused with 700.15 that is for the ‘lighting circuit’]*

87. 550.25 states that AFCI protection is required and shall comply with 210.12. Why do these panels leave the factory without the AFCI protection installed?

Reference: 24 CFR Part 3280, 2010 Revision, Manufactured Home Construction and Safety Standards

Answer: The U.S. Department of Housing and Urban Development mandates federal standards for design, construction, and installation of manufactured homes. These standards preempt state and local laws that are not identical to the federal standards.

88. A 3-phase 120/208-volt generator nameplate shows the rating to be 275KW and 285KVA. The load calculation by the engineer shows the load on the generator to be 790-amperes. Is this acceptable?

Reference: 110.3(B)

Answer: Yes, generator is rated for 792 A output

Power Generator Formula for 3 phase

1 x E x 1.73

1000

89. Why are sunrooms specifically listed to be AFCI protected but not an enclosed porch or patio?

Reference: NEC 210.12(A)

Answer: This becomes a call by the AHJ. AFCIs are required to be located throughout a dwelling unit other than for outlets installed in kitchens, laundries, bathrooms, unfinished basements, garages, and outdoors. While 210.12(A) specifically lists sunrooms, an enclosed porch or patio could fall under the purview of "similar rooms." Also included for reference, the definition of a sunroom addition is found in the IRC. I did not find a definition of an enclosed porch or patio.

90. Does the NEC allow a 4" square box for a t-grid lighting fixture branch-circuit conductor to be attached to the t-grid if a support bracket made for this purpose is used?

Reference: NEC 314.23 (D) (2)  
NEC 300.11 (A) (1) & (2)

Answer: Yes, the 4"sq box can be attached but not supported by the t-grid.

314.23 (D) tells us that junction boxes not exceeding 100 cubic inches may be installed above a suspended ceiling provided they are securely fastened in accordance with either (D) (1) or (D) (2). (D) (2) Support Wires, states the installation must comply with 300.11 (A). The enclosure shall be secured, using methods identified for the purpose, to ceiling support wires, including any additional support wires installed for that purpose.

Support wires used for enclosure support shall be fastened at each end so as to be taut within the ceiling cavity.

300.11 (A) Raceways, cable assemblies, boxes, and fittings shall be securely fastened in place. Support wires and associated fittings that provide secure support and are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids, but shall be permitted to be attached to the assembly. Where additional support wires are used they must be distinguishable by color, tagging, or other effective means.

91. I have a detached 2- car garage. I am supplying 100amp power from the house feeding the garage panel. I have 6-20 amp breakers in the panel feeding lights and receptacles. The inspector wants me to install a main breaker. Does the 6 switch rule in NEC Art 230.71 apply?

**Reference:**

225.30, 225.31, 225.32 & 225.33

**Answer:**

You do not need a main breaker in the garage panel when you have no more than 6-20Amp breakers in the panel. But not because of 230.71, rather because of 225.33

Your reference of Section 230 is incorrect as it is for services. The 100amp circuit to the garage panel is a Feeder not a Service. Article 225 must be consulted for this application.

- Section 225.30 tells us we can only have one feeder serving this location.
- Section 225.31 tells us we need a single disconnect and
- 225.32 tells us where it needs to be.
  
- Section 225.33 tells us the maximum number of disconnects at this location.
- **225.33 Maximum Number of Disconnects.**
- **(A) General.** The disconnecting means for each supply permitted by 225.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard. There shall be no more than six disconnects per supply grouped in any one location.
- *Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.*

92. If I have a separate underground service for a fire pump entering the fire pump controller at the nearest point of entry, and the controller has a disconnecting means built into it (they are all service rated by code), do I need an additional disconnecting means ahead of the controller?

No. 695.4 states to use A or B. 'A' States to *direct connect* to a Listed fire pump controller or Listed combination fire pump controller and power transfer switch. 'B' *allows*, but not requires, another disconnecting means as long as it follows the rest of the requirements found in B1,2,3.

93. A 500 gallon gravity fed gas tank has no electrical power to it. The bottom of the tank is 5' off the ground. What, if any, is the classified area around the tank?

Reference: NEC 500.5(B)(2), 514.3(B)(1), Table 515.3

Answer: 500.5(B)(2) Class 1, Div 2, storage of flammable gas, outside the tank. From Table 515.2, within 10 ft from shell, ends, or roof of tank; also, area inside dike to level of top of dike wall.

94. Is it permissible to install compact fluorescent lamps in existing 6-inch recessed luminaires?

Reference: NEC 110.3(B)

Answer: Yes, See 2013 UL White Book, Pg. 289 for OOLR-CFL's, OOLV –LED's. UL Certifies (Lists) CFL's under the product category Lamps. Self Ballasted and Lamp Adapters (OOLR) and LED lamps under Lamps, Self Ballasted, Light-Emitting Diode Type (OOLV). The Guide Information states These products have been investigated for use in the smaller of a 6- or 8-in. diameter, totally enclosed, recessed luminaire, if they will physically fit, unless marked not for use in a totally enclosed luminaire.

95. A filling station has leakage sensors installed. Is the conduit for the sensors required to be sealed off?

Answer: Yes - 504.70 Sealing. Conduits and cables that are required to be sealed by 501.15, 502.15, 505.16, and 506.16 shall be sealed to minimize the passage of gases, vapors, or dusts. Such seals shall not be required to be explosionproof or flameproof but shall be identified for the purpose of minimizing passage of gases, vapors, or dusts under normal operating conditions and shall be accessible.

The intrinsically safe system is required to be installed in accordance with the requirements of the applicable control drawings.

The control drawing is required for installation and inspections of intrinsically safe circuits and systems.

96. I am installing recessed can lights in a dwelling. The 12/2 NM attaches to a junction box that is built off to the side of the can (a typical recessed can). The j- box is, strictly speaking, located in the attic space and not in the living room. An outlet, by NEC definition is where the wiring attaches to the energy using device. If the outlet is in the attic, it does not require arc fault protection, correct?

Reference: NEC 210.12 (A)

Answer: 210.12 (A) States all 15- and 20- ampere branch circuits supplying outlets installed "in" dwelling unit family rooms, dining rooms, etc.-----shall be protected by a listed arc-fault circuit interrupter, combination-type,-----

The submitter wants to use the language of the code to say that these lights do not need to be AFCI protected due to the junction box or "outlet" being located in the attic, and not technically in the room. While there may be some validity to this argument. I am sure the CMP never intended the interpretation of this language to be what the submitter of the question is trying to achieve. There is no question that the recessed can is supplying light to the living room, and I believe it must be AFCI protected.

This may be a good argument for a code proposal to tweak the language to say "supplying outlets installed in and those that serve" dwelling unit family rooms, dining rooms, etc."

97. An existing strip mall has been split into smaller spaces. The new spaces do not have access to the overcurrent devices in their tenant space and no maintenance personnel are on site. Is this a violation of Section 240.24(B)?

**Reference:**

240.24(B)

**Answer:**

Yes, the tenants in the new spaces need to have access to their overcurrent devices as per section 240.24(B)

98. If I size a service I use calculated load per the 220 of the NEC. If I size a generator to carry the entire premises wiring I have to use the connected load. Is this is true for optional and required standby loads?

*Legally Required are classed by Governmental authorities and usually are HVAC, communication, pumping or lighting etc. that if stopped could create a hazard or hamper fire/rescue operations and must activate within 60 sec.*

*Optional Systems are for items when Life/Safety is not dependent on the performance and can be Automatic or Manual.*

Yes and No;

Legally Required is found in 701.4 Capacity and Rating.

Legally required standby system shall have adequate capacity and rating for the supply of all equipment intended to be operated at one time,  
And can supply both the Legal and Optional standby as long as the capacity is great enough, or automatic load shedding is needed.

Optional systems are found in 702.4 Capacity and Rating.

(B) System Capacity. The calculations of load on the standby source shall be made in accordance with Article 220 or by another approved method.

[1] if using Manual Transfer shall have adequate capacity for supplied loads.

[2] if using Automatic Transfer then either [a] enough for Full Load OR  
[b] enough for max load connected to a Load Management System

99. I have a 10KW 120/240 generator with 100amp automatic transfer switch supplying a house with 100amp service, gas heat and gas stove. The transfer switch will supply either utility or generator power. The calculated load is 60 amps and the inspector says I have to use load shedding. Why?

Reference: NEC 702.4(B)

Answer: Based on the description, this system would be considered an Optional Standby System and the requirements of Article 702 would apply. In this case, the generator is not large enough to serve the calculated load per Article 220 so 702.4(B) would require load management

**Optional Standby System - 702.4(B) System Capacity**

**2) Automatic Transfer Equipment.** Where automatic transfer equipment is used, an optional standby system shall comply with (2)(a) or (2)(b).

(a) Full Load. The standby source shall be capable of supplying the full load that is transferred by the automatic transfer equipment.

(b) Load Management. Where a system is employed that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum

load that will be connected by the load management system**2) Automatic Transfer Equipment.** Where automatic

transfer equipment is used, an optional standby system shall comply with (2)(a) or (2)(b).

(a) Full Load. The standby source shall be capable of supplying the full load that is transferred by the automatic transfer equipment.

(b) Load Management. Where a system is employed that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum

load that will be connected by the load management system

100. Are all lighting fixtures required to be listed and labeled?

Reference: NEC 410.6

Answer: Yes, 410.6 requires all lampholders, luminaires and in the 2014 NEC, retrofit kits to be Listed.

101. In a residential building does the 2011 NEC have requirements for how many lights can be installed on 1- 20 amp circuit? How about how many receptacles? What about combination lights and receptacles?

Reference: NEC 220.12, Table 220.12, 220.12(J) & 210.11(B)

Answer: There is no maximum number. Section 220.12 specifies a unit load of not less than that specified in Table 220.12 for occupancies specified therein shall constitute the minimum lighting load. Table 220.12 specifies a unit load of 3 VA per sq ft. Section 220.12(J) states outlets specified in (J)(1), (J)(2), and (J)(3) are included in the general lighting load calculations of 220.12. No additional load calculations shall be required for such outlets.

210.11(B)... This load shall be evenly proportioned among multioutlet branch circuits within the panelboard(s). Branch-circuit overcurrent devices and circuits shall be required to be installed only to serve the connected load.

102. Now that some jurisdictions have passed the 2012 IRC the inspector requires an additional smoke detector in the living room and Carbon monoxide detectors. What Code reference is he using?

Reference: 2012 IRC Section 314 & 315

Answer: First, I am assuming the inspector referenced in the question is the Building Inspector. Since smoke detection and carbon monoxide detection requirements are in the building code, not in the NEC. The 2012 IRC requires smoke detectors be installed in the following locations: 1) In each sleeping room. 2) Outside each separate sleeping area in the immediate vicinity of the bedrooms. And 3) On each additional story of the dwelling.

The additional stories include basements and habitable attic spaces but does not include crawl spaces. Provided these locations are covered, the IRC does not require any additional detectors to be installed. The local building inspector may feel there is a need for additional detectors, but there is no code reference to support this. These requirements are unchanged in at least the last 2 editions of the IRC.

The requirement for CO detection is also found in the 2012 IRC, in fact this requirement first appeared in the 2009 IRC. It states that for new construction an approved CO alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in dwelling units with fuel-fired appliances or an attached garage.

Smoke detection and CO detection are also required for alterations, repairs, or additions to an existing dwelling where a permit is required for the work being performed in the dwelling. The required detection would be the same as for a new dwelling.

103. We are installing a 277/480Y, 1200 A frame, main electronic trip circuit breaker with a 1200A sensor for a service disconnect. The ampere rating is set at .75 and in effect giving the circuit breaker a 900 ampere trip rating. The trip unit has a removable and sealable cover in compliance with Section 240.6(C)(1) for restricted access adjustable-trip circuit breakers. Is ground-fault protection of equipment required for this installation?

**Reference:**

230.95

**Answer:**

Yes it would because as per 230.95 . . . “The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed or the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.”

104. If an LED emergency light has only one driver does that meet the redundancy requirement of Article 700?

Answer; Depends on AHJ definition of ‘element’ & ‘lamp’. An LED luminaire is made up of individual elements [filaments] or lamps, so if one burns out you may have some left. If you look at the luminaire with 28 diodes as ‘one’ lamp then another whole ‘one’ may be needed.

700.16 states the lighting system is to be designed that ‘failure of any individual lighting *element*, such as burning out of a lamp’ can’t leave the area in total darkness.

If your definition of ‘element’ is any component, then if the driver fails that would be an issue. The code does not mention a driver or ballast etc.

*In many opinions the intent of the code is carried out with a normal multiple type LED as in this picture*

105. Are there special grounding requirements for vehicle mounted generators?

Reference: NEC 250.34(B)

Answer: Yes, see 250.34(B).

**250.34(B) Vehicle-Mounted Generators**

The frame of a vehicle shall not be required to be connected to a grounding electrode as defined in 250.52 for a system supplied by a generator located on this vehicle under the following conditions:

(1) The frame of the generator is bonded to the vehicle frame, and

(2) The generator supplies only equipment located on the

vehicle or cord-and-plug-connected equipment through receptacles mounted on the vehicle, or both equipment located on the vehicle and cord-and-plug-connected equipment through receptacles mounted on the vehicle or on the generator, and

(3) The normally non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame.

106. Are there any special termination requirements for copper wire?

Reference: NEC 110.14, 110.3(B), UL White Book AALZ (Pg. 50)and ZMVV (Pg. 495)

Answer: The NEC requirements for conductor terminations is located in NEC 110.14. You can also see the UL general requirements for terminations in the Guide Information for Electrical Equipment for use in Ordinary Locations (AALZ) starting on page 50 in the White Book. Also see the Guide Information for Wire Connectors and Soldering Lugs (ZMVV) located on page 495 in the 2013 UL White Book. Also see the markings on the product and the specific product category Guide Information in the White Book for the product or devices such as Receptacles for Plugs and Attachment Plugs (RTRT) Pg. 375 in the White Book.

107. The NEC is not a design manual. Good engineering practice would include 3 way switching at the top and bottom of all stairways. Section 210.70 (A)(2)(c) requires a switch at each floor level and landings for interior stairways for what should be noted as the heading of 210.70 (A) is Dwelling Units. In a commercial building we are renovating we can find no reference to required switching for the stairways. If we do not install switches at the top and bottom is it a violation?

Reference: NEC 90.1(A)  
NEC 210.70(A)

Answer: No. There are specific locations in the NEC® calling for lighting outlets for dwelling units and guest rooms and guest suites. In 210.70(C) there are requirements for other than dwelling units, but they are more limited in where lighting is required. Requirements for lighting for other occupancies are found in the life safety code and the building codes.

108. We are installing a single-phase 208 Volt coffee maker next to the sink in the kitchen of a new restaurant. It will be plugged into a 30 ampere receptacle. Is GCI protection required?

Reference: NEC 210.8 (B)

Answer: No. 210.8 (B) Other Than Dwelling Units, All 125-volt single phase 15- and 20- ampere receptacles installed in the locations specified in 210.8 (B) (1) thru (8) shall have GFCI protection for personnel. (2) is kitchens and (5) identifies receptacles within 6ft of the edge of a sink. Since your coffee maker is 208-volt, no GFCI protection is required.

109. I have a 3000 amp generator with no main breaker, the conductors from the generator terminals to the first distribution switchboard is over 115% of the nameplate current of the generator. The overcurrent protection is set at 3200 amps. Is this OK?

**Reference:**

240.21(G), 445.13

**Answer:**

Section 240.21(G) provides requirements for protection of conductors from generator terminals. It refers to Section 445.13, which requires the conductors to be sized at 115% of the nameplate current rating

of the generator. These conductors would have an ampacity of 3450 amperes. A 3200 A overcurrent device would adequately protect the conductors

110. Can a panelboard be installed in a stairwell? The inspector says it is not permitted.

No. 110.26 working space and specifically 240.24F for overcurrent protection “not be located over steps of a stairway”.

111. Does the emergency generator for a high-rise building need to be sized for the locked-rotor current of the fire pump in addition to the other emergency loads it will carry?

Reference: NEC 695.3(B)(2), 695.4(B)(2)(b)

Answer: No. 695.4(B)(2)(b)

(b) On-Site Standby Generators. Overcurrent protective devices between an on-site standby generator and a fire pump controller shall be selected and sized to allow for instantaneous pickup of the full pump room load, but shall not be larger than the value selected to comply with 430.62 to provide short-circuit protection only. [20:9.6.1.1]

112. Can commercial cooking equipment be installed within a dwelling unit?

Reference: NEC 110.3(B), KNGT pg. 233 in UL White Book

Answer: No, see Commercial Cooking Appliances (KNGT) on page 233 in the UL White Book. The Guide Information states commercial cooking equipment is Listed for commercial use in unclassified (ordinary) locations in accordance with ANSI/NFPA 70, "National Electrical Code" (NEC), and are intended to be installed in accordance with ANSI/NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations."

Listing assumes installation in commercial kitchen, not installed next to wooden cabinets or where kids will access such as household appliances.

113. Can USE cable with dual rated conductors (RHH, RHW or THWN) be taken into a structure? An example would be from the load side of a meter base to a main disconnect.

Reference: NEC 338.12(B)(1)

Answer: No. Type USE conductors are not permitted inside of a building.

114. Does the NEC allow the Grounding Electrode Conductor to be connected to the cold water pipe at the water heater area if it is the only accessible point in a finished basement for a service upgrade to avoid unnecessary damage to finished ceilings?

Reference: NEC 250.68 (C) (1) Exception:

Answer: 250.68 (C) (1) Interior metal water piping located not more than 5ft from the point of entrance to the building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system.

Exception: In industrial, commercial, or institutional buildings or structures, if conditions of maintenance and supervision ensure that only qualified persons service the installation, interior metal water piping located more than

5ft from the point of entrance to the building shall be permitted as a bonding conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor, if the entire length, other than short sections passing perpendicular thru walls, floors, or ceilings, of the interior metal water pipe that is being used for the conductor is exposed.

Residential structures are not listed where this exception can be used, so unfortunately the answer is no.

115. Are hold-down clips or screws required for PV system back-fed breakers?

**Reference:**

Article 690 and 705

**Answer:**

It depends . . . on the code version to which you must enforce or install:

- 2008 NEC Section 690.64(B)(6) – NO
- 2011 NEC Section 690.10(E) – YES (Stand-Alone Systems)
- 2011 NEC Section 705.12(D)(6) – NO (Utility Interactive Inverters)

116. What is the “service factor” that is required to be marked on Fire Pumps?

Maximum of 1.15 per NFPA 20 9.5.2.2 and required to be marked as part of normal labeling per NEMA MG-1 standard.

117. Does a circuit breaker used to control the lighting in a tenant area have to have the SWD mark on the breaker?

Reference: NEC 240.83

Answer: The requirements for marking are found in 240.83 and permit either SWD or HID to be used. For SWD, the UL 489 product safety standard permits marking for any 15 or 20 A, 347 ac or less breaker to be marked since the performance requirements validate use as a switch.

240.83 Marking.

(D) Used as Switches. Circuit breakers used as switches in 120-volt and 277-volt fluorescent lighting circuits shall be listed and shall be marked SWD or HID. Circuit breakers used as switches in high-intensity discharge lighting circuits shall be listed and shall be marked as HID.

118. Is a standard wire-nut approved for a wet location as in an outside j-box? Is there a listed wet location wire-nut other than the ones approved for direct burial or in below grade j-boxes?

Reference: UL White Book, ZMVF Pg. 495 and

ZMWQ Pg. 497

The interior of an outdoor rated junction box installed above grade is considered a dry location. By virtue of the Listing as suitable for outdoor use, the inside is not to accumulate water or moisture so that it would deteriorate the devices or products inside the enclosure or box.

Therefore the standard wire nut Listed under the product category Wire Connectors and Soldering Lugs (ZMVF) would be acceptable. Where the connection is made below grade, either direct burial or in a below grade junction box, where water is expected to accumulate, then the sealed type wiring connector Listed under Sealed Wire-connector Systems (ZMWQ) is required.

119. Does the requirement for eight foot clearance above roofs with less than a 4/12 pitch only apply to non-utility owned services or feeders since the utility has a four foot minimum requirement?

Reference: NEC 230.24(A)

Answer: Utility owned conductors are outside of the scope of the NEC®. This requirement only applies to conductors downstream of the service point.

120. A freestanding bank is built having about 75% full-length windows mostly for security reasons. Is it required to have the contractor install show window receptacles every 12' per 210.62 even if the engineer does not design them, stating the bank will not hang any electric signs in them?

Reference: NEC 210.62 and 100 Definitions

Answer: 210.62 At least one outlet shall be installed within 18in of the top of a show window for each (12 linear ft) or major fraction thereof of show window area measured horizontally at its maximum width.

Now we need to look at the definition of a “show window”

Article 100 states that a Show Window is “any window used or designed to be used for the display of goods or advertising material”

I think we could all agree that there are certain types of establishments (retail stores, restaurants, bars etc.) that it would be hard to argue that they are not “Show windows”.

But I believe this definition provides the latitude for the engineer, owner and AHJ to say that the windows of this bank are not “Show windows”, and would not require these outlets.