

## 2008 WESTERN SECTION CODE PANEL QUESTIONS

**1. What is the intent of the NEC Section 230.70(A)(1) “installed at a readily accessible location...inside nearest the point of entrance of the service conductors”? This seems to be an ambiguous statement. There is no length of conductors identified. Also, if installed within the structure, how is this considered readily accessible to first responders?**

*(2008 NEC Reference Section 230.70(A)(1)) The requirement of 230.70(A)(1) is to minimize the length of the service-entrance conductors installed in a building. Where there are various possible installation situations (i.e. industrial, dwelling, construction considerations) involving the service-entrance conductors, the NEC does not specify a conductor length but requires a disconnecting means to either be installed outside the building or inside nearest to the entrance point. The AHJ decides if the disconnecting means is installed in a location so as to meet the requirement. Within the scope of the NEC, there is no requirement that this disconnect be made readily accessible to first responders.*

**2. I have received plans for a residential addition. Because of the grade change, the service disconnect will be mounted one foot off the ground. Is there a minimum allowable height for a service disconnect on a residential home?**

*(3) Height of Working Space. The work space shall be clear and extend from the grade, floor, or platform to the height required by [110.26\(E\)](#). Within the height requirements of this section, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.*

*110.26(E) Headroom. The minimum headroom of working spaces about service equipment, switchboards, panelboards, or motor control centers shall be 2.0 m (6½ ft). Where the electrical equipment exceeds 2.0 m (6½ ft) in height, the minimum headroom shall not be less than the height of the equipment.*

*Exception: In existing dwelling units, service equipment or panelboards that do not exceed 200 amperes shall be permitted in spaces where the headroom is less than 2.0 m (6½ ft).*

*HOWEVER: Check with the Utility in the area they may have a minimum. Ex; WPS in Wisconsin has a 24” to the bottom of the disconnect.*

**3. Can NM-B cable be installed in a piece of EMT conduit without a bushing?**

*Response; Yes, or you can require one but it is a bit of a stretch. If you are using the EMT as physical protection as permitted in 334.15(B) and (C) , then 300.10Ex1 allows this w/o mech or elec continuity.*

*334.30 allows this piece of EMT to satisfy the support requirements. But if you apply 358.22 which permit NM in EMT then I believe you can require a bushing as required in 300.4 and 300.4(G),*

*250.86 EX 2 allows this installation to not be bonded to the EGC*

**4. I have been trying to locate wire ties or tie wraps in the UL white book to no avail. I have read that some jurisdictions have been requiring them for support of MC Cable in horizontal runs. I would like to know where to find information on this in the UL White Book and the NEC. Can you assist me with this matter?**

*The NEC does not specifically reference “tie wraps” but does reference in all the cable articles securing and supporting of cables. For example:*

*330.30 Securing and Supporting.*

*(A) General. Type MC cable shall be supported and secured by staples, cable ties, straps, hangers, or similar fittings or other approved means designed and installed so as not to damage the cable*

*In any of the chapter 3 article for cables and conduits, the parallel numbering of xxx.30 will give the requirements and the accepted methods to complete this as above. The CCN is (ZODZ) Positioning Devices,*

found on page 392. This appears on page C58 of the Index of Product Categories and Industry Terms under “zip ties” which is another industry term used for this product.

**5. Can I use Type NM cable to connect recessed fluorescent fixtures in a suspended lay-in ceiling in a retail store? Section 334.30(B)(2) seems to permit this.**

No, Section 334.30(B)(2) provides the installation provisions for cables being unsupported above a suspended ceiling. Which states:

*(B) Unsupported Cables. Nonmetallic-sheathed cable shall be permitted to be unsupported where the cable: (2) Is not more than 1.4 m (4 1/2 ft) from the last point of cable support to the point of connection to a luminaire or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling.*

*Section 334.12(A)(2) prohibits nonmetallic-sheathed cables installed as exposed in the space above accessible hung ceilings with the exception for one- two or multifamily family dwellings.*

*(2) Exposed in dropped or suspended ceilings in other than one- and two-family and multifamily dwellings*

**6. In a large box-type store, similar to a Sam’s Club or Costco, is it allowable to drop Type SO cord down from the ceiling and terminate it in a suspended outlet box containing a receptacle or cord cap-type receptacle? Can I hardwire it to an island end cap or display case?**

No, Cords cannot be used for a substitute for fix wiring of a structure 400.8. No, you cannot use it to an island unless it meets one of the uses permitted in 400.7. The island is a fixed piece of equipment that does not need flexibility since islands don’t move. If it moves it must be a boat?

**7. Can a load center be mounted in a horizontal position?**

Article 8, page 71 of the 1925 NEC

The term “horizontal” can be interpreted two ways:

- 1) Rotated on the wall 90 degrees
- 2) Mounted on the ceiling or on or under the floor

Code Reference: 240.33 and 240.81

The issue over horizontal mounting goes back to the 1925 NEC. The specific issue was to prohibit fused switches from being mounted on the ceiling (under a floor) where the constant vibration from the floor traffic could cause the fuse to dislodge from a fuse clip and drop against the enclosure creating a ground fault.

The language in 240.33 was changed in the 2002 NEC with a substantiation that revolved around rotating the enclosure 90 degrees not from wall to ceiling or floor.

240.33 Vertical Position.

Enclosures for overcurrent devices shall be mounted in a vertical position unless that is shown to be impracticable. Circuit breaker enclosures shall be permitted to be installed horizontally where the circuit breaker is installed in accordance with 240.81. Listed busway plug-in units shall be permitted to be mounted in orientations corresponding to the busway mounting position.

240.81 Indicating.

Circuit breakers shall clearly indicate whether they are in the open “off” or closed “on” position.

Where circuit breaker handles are operated vertically rather than rotationally or horizontally, the “up” position of the handle shall be the “on” position.

**8. I have several electricians who have been using 14 AWG conductors from a switch to a light on a 20 amp circuit. Some cite tapping, others point to fixture wire sizing to allow them to do it. I have rejected this installation in both cases as it is my understanding that the weakest link in the circuit needs to be the OCPD (Over Current Protective Device). They often state that the light is only using half an amp etc. and they are they correct?**

*Reference 210.19(A)(4) Exception No.1 (b) and 410.117. No, the contractor is incorrect to install a 14 AWG conductor from the switch to the luminaire on a 20 amp circuit. 210.19(A)(4) Exception No.1(b) allows the 14 AWG to be used as long as it applies to 410.117 (410.67 prior to the 2008 NEC). 410.117 allows for only 1 foot of tap conductors to be used before terminating into an outlet box. The Tap Conductors shall be installed in a suitable raceway. If Type AC or Type MC Cable is being used then it is allowed to be between a minimum of 18” to a maximum of 6 feet in length and does not required to be installed in a raceway.*

*We may also want to look at 210.20(B) which takes you to 240.4(D) specifying the OC protection for branch circuit conductors. Branch circuit tap conductors are covered by 240.21(A), which refers to 210.19 and 210.20. It may be that there is confusion in the use of fixture wire used as a tap conductor for a luminaire covered by 402.10, 410.117(C), 240.5(B)(2). It seems you could have 14AWG fixture wire used as a tap conductor for a luminaire on a 20A OC device but the length restrictions of 410.117(C) apply.*

*My understanding is that you cannot have a 14 AWG branch circuit conductor protected by a 20A OC device.*

**9. A contractor is installing a combination meter standby system purchased from Power Company. It has a 200 amp main and a 100 amp standby breaker. Doesn't this make the existing panel in the basement a sub-panel and require installing a 4-wire feeder and changing the grounding arrangement?**

*(2008 NEC Reference Sections 230.82, 250.24 and 408.40) With the new system/equipment now considered as service equipment, the existing equipment in the basement becomes a feeder panelboard (subpanel). With this change, the new service equipment is required to have a grounding electrode system installed and the feeder to the subpanel is required to have an equipment grounding conductor. Equipment that is permitted to be connected to the supply side of the service disconnect is indicated in 230.82.*

**10. Can I use a 3-wire w/ground NM cable for temporary wiring on a construction site as a multiwire branch circuit if I feed temporary receptacles on one circuit and lighting on the other circuit?**

*No.*

*590.4(D) Receptacles. All receptacles shall be of the grounding type. Unless installed in a continuous metal raceway that qualifies as an equipment grounding conductor in accordance with 250.118 or a continuous metal-covered cable that qualifies as an equipment grounding conductor in accordance with 250.118, all branch circuits shall include a separate equipment grounding conductor, and all receptacles shall be electrically connected to the equipment grounding conductor(s). Receptacles on construction sites shall not be installed on branch circuits that supply temporary lighting. Receptacles shall not be connected to the same ungrounded conductor of multiwire circuits that supply temporary lighting.*

**11. Can flexible metal conduit be used outdoors for A/C units?**

*Response; Not any more, This was permitted for as long as I can remember, but a change in the 2008 NEC disallowed this long practice the substantiation was that liquid tight flex is available and it should be used in a wet location. 348.12(1)*

**12. Can fluorescent fixtures permanently secured to a ceiling be cord-and-plug connected?**

*Yes, NEC 410.24 permits the use of flexible cord to supply luminaires that are connected independent of an outlet box. If the luminaire is of the adjustable type, then the provisions of 410.62(B) must be met including using hard service cord and providing the cord is not subject to strain or physical damage. It also allows installation without a cord cap. Specific to electric discharge luminaires, the provisions of 410.62(C) apply. In this section the luminaire must be directly below the outlet or busway. In addition the cord must be visible*

for the entire length, no subject to strain or physical damage, is terminated in a grounding type plug or busway plug or is part of a listed assembly incorporating a manufactured wiring system. Lastly, a new provision for the 2008 NEC is that a cord can go through a canopy and through a suspended ceiling for no more than 6 inches of a raceway to an outlet box installed above the suspended ceiling.

#### *410.24 Connection of Electric-Discharge Luminaire.*

*(A) Independent of the Outlet Box. Electric-discharge luminaires supported independently of the outlet box shall be connected to the branch circuit through metal raceway, nonmetallic raceway, Type MC cable, Type AC cable, Type MI cable, nonmetallic sheathed cable, or by flexible cord as permitted in 410.62(B) or 410.62(C).*

*410.62(B) Adjustable Luminaires. Luminaires that require adjusting or aiming after installation shall not be required to be equipped with an attachment plug or cord connector, provided the exposed cord is of the hard-usage or extra-hard-usage type and is not longer than that required for maximum adjustment. The cord shall not be subject to strain or physical damage.*

#### *410.62(C) Electric-Discharge Luminaires.*

*(1) Cord-Connected Installation. A luminaire or a listed assembly shall be permitted to be cord connected if the following conditions apply:*

- (1) The luminaire is located directly below the outlet or busway.*
- (2) The flexible cord meets all the following:*
  - a. Is visible for its entire length outside the luminaire*
  - b. Is not subject to strain or physical damage*
  - c. Is terminated in a grounding-type attachment plug cap or busway plug, or is a part of a listed assembly incorporating a manufactured wiring system connector in accordance with 604.6(C), or has a luminaire assembly with a strain relief and canopy having a maximum 152 mm (6 in.) long section of raceway for attachment to an outlet box above a suspended ceiling*

### **13. When installing a floor receptacle, can I use a standard j-box and a damp location cover?**

*No, If you take a look at Section 314.27(C) you find that a listed floor box is required.*

*314.27(C) Floor Boxes. Boxes listed specifically for this application shall be used for receptacles located in the floor.*

*Exception: Where the authority having jurisdiction judges them free from likely exposure to physical damage, moisture, and dirt, boxes located in elevated floors of show windows and similar locations shall be permitted to be other than those listed for floor applications. Receptacles and covers shall be listed as an assembly for this type of location.*

*I have seen a listed floor box assembly that appears to incorporate a normal style box with the brass round floor cover plate. The exception that permits a box other than a floor box is for a specific application which is an elevated floor for area of a show window or similar location. It needs to be a listed floor box.*

### **14. Can liquidtight flexible metal conduit be installed in a suspended ceiling used for environmental air? Section 300.22(C)(1) does not show LFMC as a permitted wiring method but 350.30(A) Exception No. 4 seems to permit LFMC for wiring in an accessible ceiling.**

*This is an interesting topic to show how the NEC has changed. In the 1999 NEC 300.22(C) Exception FLMC was allowed to have single lengths up to 6 ft. The problem was if there is 100 pieces of 6 ft. lengths then we have 600 ft. in the air return, quite toxic. In the 2002 NEC the 6 ft. exception was removed.*

*In 350.30(A) EX. 4 FLMC 6FT lengths are allowed in an accessible ceiling that is not an air return for environmental air*

**15. I have plans with a large service with 50,000 ampere short-circuit current availability protected with fuses. They want to install a breaker in this system. Does it have to have a matching rating?**

*No – The fuse and breaker does not need to have matching ratings.*

*There are a couple of options:*

*1) Utilize a circuit breaker that has an Interrupting Rating equal to or greater than the available fault current*

*2) Utilize series ratings in 240.86. Review the circuit breaker enclosure / panelboard in which the circuit breakers are going to be installed for a series rating that will establish a rating using a lower rated circuit breaker and a specified fuse type.*

*Code Reference: 110.9 and 240.86*

**16. I used flexible metal conduit to connect to a sign outdoors in front of a shop and I'm being told I can't use flex outdoors. Is this correct? I'm using THWN wire, which is good for wet locations.**

*Reference: Section 348.12(1). Per 348.12(1), Flexible Metal Conduit is not acceptable for use in areas defined as a wet location. Prior to the 2008 NEC, FMC was permitted to be used in a wet location as long as the conductor was approved for wet location and that the conduit was installed so that it was unlikely that water could enter the raceway system. The installation was subjective. Other flexible raceway found in Chapter 3 such as Liquidtight Flexible Metal Conduit or Liquidtight Flexible Nonmetallic Conduit can be used as a replacement.*

**17. On a large construction site, the local utility set a 500 KVA transformer. The contractor set a temporary pole with a 100 Ampere, 240-Volt main breaker. Should I enforce the short circuit rating of this installation? If so, why?**

*(2008 NEC Reference Articles 590 and 240 and Sections 110.9 and 110.10) Article 590 addresses temporary installations of electrical power and lighting. Section 590.4 requires services, feeders, branch circuits, etc. to be installed in accordance with all the applicable Articles of the NEC. Therefore, the requirements of Article 240 and Sections 110.9 and 110.10 are applicable and temporary installations are to comply with the same provisions for overcurrent protection as is required for a permanent installation.*

**18. I installed an emergency equipment unit in the center of the passage hall to the apartments in a multifamily dwelling unit. There is one head (light) on the unit and one head mounted remote from the unit in a stairwell. I am being told this is not an acceptable installation. Any idea why not?**

*This is in violation of NEC 700.16. It is critical to have 2 heads on egress lighting so if the bulb is burnt out they still have some light.*

*700.16 Emergency Illumination.*

*Emergency illumination shall include all required means of egress lighting, illuminated exit signs, and all other lights specified as necessary to provide required illumination.*

*Emergency lighting systems shall be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency illumination.*

**19. When installing self-grounding receptacles in flush outlet boxes, is an equipment bonding jumper required from the metal box to the grounding terminal on the receptacle?**

*Response; Yes 250.146(C) for flush type and self ground screws and*

*No 250.146 (A) Surface-Mounted Box. Where the box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box or a contact yoke or device that complies with 250.146(B) shall be permitted to ground the receptacle to the box. At least one of the insulating washers shall be removed from receptacles that do not have a contact yoke or device that complies with 250.146(B) to ensure direct metal-to-metal contact. This provision shall not apply to cover-mounted receptacles unless the box and cover*

combination are listed as providing satisfactory ground continuity between the box and the receptacle. A listed exposed work cover shall be permitted to be the grounding and bonding means when (1) the device is attached to the cover with at least two fasteners that are permanent (such as a rivet) or have a thread locking or screw locking means and (2) when the cover mounting holes are located on a flat non-raised portion of the cover.

**20. I have received plans for a retail space with an open girder design. Fire alarm cable is being strung through the exposed ceiling. I have been asked if the cable can be painted. Is this allowed?**

*The NEC does not have a specific prohibition from painting exposed fire alarm cables. There are requirements in 760.30 for markings at terminal and junction locations. The only issue along the cable is the provisions for PLFA cable where there are marking required along the cable that painting would cover up.*

*760.30 Fire Alarm Circuit Identification.*

*Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems.*

**21. If you connect the grounding electrode conductor to the street side of the water meter, is it still necessary to always bond around the water meter?**

*250.50.(A)(1) The metal water pipe grounding electrode is one that is direct contact with the earth for ten feet or more and includes the first five feet of the pipe that enters the building. To be used as a grounding electrode it needs to meet the requirements of 250.53(D)(1) and (D)(2), (D)(1) states:*

*Continuity. Continuity of the grounding path or the bonding connection to interior piping shall not rely on water meters or filtering devices and similar equipment.*

*(D)(2) References a metal water piping system needs to be supplement. As we see an increase use of a non-metallic water piping systems use in all types of occupancies bonding on the other side of the water meter may not be necessary.*

**22. I have a cord-and-plug connected radon exhaust fan, can I install that in the attic space of a dwelling?**

*422.16(A) Page280 Yes, you can use a cord and plug connected exhaust fan in the attic. The product and cord must be listed or approved to be used in an attic and directly connected to a receptacle.*

**23. Can I run a 3-wire multiwire circuit using two individual single-pole circuit breakers without handle ties for two lighting circuits in a residence?**

*2005 NEC – Yes*

*Handle tie not required for this application in the 2005 NEC*

*210.4(B) Devices or Equipment. Where a multiwire branch circuit supplies more than one device or equipment on the same yoke, a means shall be provided to disconnect simultaneously all ungrounded conductors supplying those devices or equipment at the point where the branch circuit originates.*

*2008 NEC – No*

*Handle tie required for this application in the 2008 NEC*

*210.4(B) Disconnecting Means. Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.*

*Code Reference: 210.4*

**24. We have a local contractor installing NM cable inside a raceway in complete runs for exterior branch circuit locations. Is there an assigned cross section for NM to calculate the conduit's fill? How**

**would you figure the ambient temperature effect? The conduit is 1/2 inch EMT with 2-12/2 with ground NM cables installed.**

*Reference for Question # 1: Chapter 9, Table 1, Note 9. There is not an assigned cross sectional area for NM cable. Dimensions of the NM Cable are available from the NM Cable manufacturer such as Southwire. The major axis dimension is used for elliptical cross section when calculating the wire fill for the conduit per Note 9 of Table 1 in Chapter 9. The NM Cable is treated as a single circular (round) conductor where the major diameter is the diameter of the cable.*

*Reference for Question # 2: 334.80, 310.15(B)(2) and Table 310.15(B)(2). There is not an adjustment for the ambient temperature for NM Cable in a raceway. However ampacity needs to be addressed per 310.15(B)(2) and Table 310.15(B)(2). 310.15(B)(2)(c) is a new requirement for the 2008 NEC (although the concept was covered in a Fine Print Note in previous additions) where ambient temperatures are required to be adjusted for conduit on rooftops. NM Cable is permitted for Dry Locations only and is not permitted in a Wet Location such as a rooftop (See 300.9 for Raceways in Wet Locations).*

**25. If there is a raceway under the slab on the interior of a building, are the conductors in it required to be rated for a wet location?**

*(2008 NEC Reference Section 300.5) Section 300.5 specifies the requirements for underground installations. Section 300.5 (B) clearly states:*

*“Wet Locations. The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall comply with 310.8(C). Any connections or splices in an underground installation shall be approved for wet locations.”*

*See also Article 100 for definition of wet location.*

**26. I have a question in regards to new Section 406.11, which states tamper-resistant receptacles are to be installed in “all areas specified in 210.52”. Does this mean that a receptacle for a refrigerator, garage door opener, sump pump, vacuum system etc., would not be required to be tamper-resistant since they are not required in 210.52?**

*Refrigerator is included in 210.52.(B)*

*406.11 Tamper-Resistant Receptacles in Dwelling Units.*

*In all areas specified in [210.52](#), all 125-volt, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.*

*The intent of the code panel was to provide tamper-resistant receptacle outlets where kids could get at. Obviously the garage door opener would be out of reach. It was there intention (per the panel chair) that if a receptacle outlet is within reach it should be tamper-resistant.*

*210.52 Dwelling Unit Receptacle Outlets*

*Section 210.52(B) requires that all receptacle outlets in the kitchen, pantry, dining room, breakfast room, and similar areas of a dwelling unit be supplied by a 20-ampere small-appliance branch circuit required by 210.11(C)(1). This includes countertop receptacles and receptacles for refrigerators. Section 210.52(B)(1) requires that there be two or more small appliance branch circuits to supply these receptacles.*

**27. Are there any special requirements for wiring a lift pump associated with a pressure sewer in a residential setting? I have heard of inspectors requiring the wiring to comply with Article 500, Classified Locations.**

*Response; I believe there is since Methane may be present. Inside the holding tank would be Class I Div I and Article 501 should be applied.*

**28. I know that raceways installed underground are considered to be a wet location and conductors used in these raceways must be listed for use in a wet location but what about conductors used in raceways that are used above ground but are outside. Is this also considered a wet location?**

*A change in the 2008 NEC in Section 300.9 now indicates that the interior of any raceway installed in wet locations, above grade is considered a wet location and appropriately rated conductors are to be installed in these raceways.*

*300.9 Raceways in Wet Locations Above Grade.*

*Where raceways are installed in wet locations abovegrade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations abovegrade shall comply with 310.8(C).*

**29. What are the support requirements for communications cable above a suspended ceiling system?**

*Communications wiring above a suspended ceiling is required to be secured to the building structure. All though there is no specific supporting and securing interval requirements listed in the National Electrical Code, Section 800.24 and the NEIS standards may have guidelines that may provide guidance to ensure a proper installation. Section 800.24 which is Mechanical Execution of Work states:*

*Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11.*

*300.4(D) requires the cables to be protected when installed close to the edge of the framing members.*

*300.11 does not allow the ceiling support wires to support the cables. It doesn't allow cable to support other cables either.*

*There is a Fine Print Note referencing four NEIS standards dealing with the installation of communication cables that may provide guidance for proper installation.*

**30. A situation came up recently which is a puzzler...a cafe has an outdoor seating section, and scattered through the space are 120 volt receptacles. Apparently the receptacles are there for 'convenience use' (lights, P.A. etc). The boxes are mounted on "stub-ups", the devices are standard receptacles. The receptacles are not GFCI protected, and I couldn't find anything in 210.8 requiring that protection.**

*210.8(B)(4) Page 47 Titled other Than Dwellings, has changed to require GFCI protection for receptacles located outdoors.*

**31. How do you define what the cross-sectional area is of a panelboard?**

*The requirement to drive this question is found in 312.8.*

*312.8 Enclosures for Switches or Overcurrent Devices.*

*Enclosures for switches or overcurrent devices shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices, unless adequate space for this purpose is provided. The conductors shall not fill the wiring space at any cross section to more than 40 percent of the cross-sectional area of the space, and the conductors, splices, and taps shall not fill the wiring space at any cross section to more than 75 percent of the cross-sectional area of that space.*

*How do I determine the cross-section? The dimension from the enclosure wall to the back of the circuit breaker multiplied by the depth of the enclosure.*

*Code Reference: 312.8*

**32. Does Section 352.46 require bushings or bell ends for all PVC conduits entering/exiting a concrete underground pull box? It appears that "other enclosure" can be construed to include such pull boxes used in underground runs.**

*Reference: 352.46, 300.4(G), 300.12 and 314.30. Conduit entering an enclosure, or box shall be properly terminated per 300.12. This is accomplished by using either a PVC male terminal adapter, bushing or bell end. Using these listed fittings completes the mechanical continuity and protects the conductors from abrasion per 300.4(G).*

*314.30(B) does not require the conduit mechanically connected when entering bottomless handhole enclosures. Fittings are not normally used in this application.*

**33. Section 330.104 now recognizes Nickel conductors. Where in the NEC do we look for ampacity of these nickel conductors?**

*(2008 NEC Reference Article 310 and Section 110.14(C)) Tables 310.18 and 310.19 contain the allowable ampacities of Nickel and Nickel-Coated Copper insulated conductors. NOTE: Ampacities for Nickel conductors are higher than copper or aluminum conductors in Table 310.16 and termination temperatures of nickel conductors for circuits 600 and less are still based on Table 310.16 Ampacities.*

**34. A church we are working on has lighting fixtures that were made in Italy. There does not appear to be a listing mark on the fixtures. Are lighting fixtures required to be listed?**

*Yes*

*410.6 Listing Required.*

[Changed From 2005](#)

*• 410.6: Added new listing requirement for all luminaires, and removed all individual listing requirements.*

*All luminaires and lampholders shall be listed*

*See analysis book pg 239. CMP-18 added this for the 2008 cycle*

**35. Article 330.30 in the 2008 NEC states: "Type MC Cable shall be supported and secured at intervals not exceeding 1.8m (6ft)." Is the intent of this article to individually secure each MC cable or can the cables be bundled and only the entire bundle be secured (for example tie-wrap to some unistrut)?**

*Response; There have been some testing done to support bundling. 330.30 (A) through (D) applies and securing smaller than 10AWG is required w/in 12 inches of the box. But 310.15(B)(2) Ex 5 allows bundling w/o full derating*

*Exception No. 5: Adjustment factors shall not apply to Type AC cable or to Type MC cable without an overall outer jacket under the following conditions:*

*(1) Each cable has not more than three current-carrying conductors.*

*(2) The conductors are 12 AWG copper.*

*(3) Not more than 20 current-carrying conductors are bundled, stacked, or supported on "bridle rings."*

*A 60 percent adjustment factor shall be applied where the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.*

**36. The scope of UL 1424, paragraph 1.7 specifically states: "As noted in 1.8, "Power-limited fire-alarm circuit cable" is used with protection such as raceway. Paragraph 1.8 specifically states: "Power-limited fire-alarm circuit cable" is used: a) In nonconcealed spaces in which the exposed length of cable does not exceed 10 ft. or 3.05m, and b) In raceway. My question is whether or not UL**

**1424 supersedes the NEC and implements a requirement to install power-limited fire-alarm circuit cable, types FPL and FPLR, occurring above a ceiling in conduit?**

*The NEC requirements come from 760.154(C)(2) and (3). The UL Standard and the associated guide card for CCN HNIR, found on page 144 of the 2008 UL White book, repeat the NEC language. Type FPL cable is to be installed within a raceway or to be concealed by building construction except there is an provision permitting by 760.154(C)(2) that up to 10 feet can be exposed and not be in a raceway. It should be noted that installation of types FPLR and FPLP have other requirements and allowances found in NEC 760.154(A) and (B).*

*UL 1424 3rd Edition*

*1.7 As noted in 1.8, power-limited fire-alarm circuit cable □ is used with protection such as raceway. All other cables covered in these requirements are not required by the NEC to be used in raceway and are capable of use without the physical protection of raceway but may be pulled into conduit or installed in other raceway.*

*1.8 Power-limited fire-alarm circuit cable □ is used:*

*a) In nonconcealed spaces in which the exposed length of cable does not exceed 10 ft or 3.05 m, and*

*b) In raceway.*

*760.154(C) Other Wiring Within Buildings. Cables installed in building locations other than those covered in 760.154(A) or (B) shall be as described in either (C)(1), (C)(2), (C)(3), or (C)(4). Type FPL-CI cable shall be permitted to be installed as described in either (C)(1), (C)(2), (C)(3), or (C)(4) to provide a 2-hour circuit integrity rated cable.*

*(1) General. Type FPL shall be permitted.*

*(2) In Raceways. Cables shall be permitted to be installed in raceways.*

*(3) Nonconcealed Spaces. Cables specified in Chapter 3 and meeting the requirements of 760.179(A) and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).*

**37. Can NM cable be installed outdoors in conduit when its ambient is not exceeded? Does it comply with Section 334.10(A) when it is normally dry 95% of the time in most geographic locations?**

*Section 334.10(A) Type NM. Type NM cable shall be permitted as follows:*

*(1) For both exposed and concealed work in normally dry locations except as prohibited in 334.10(3) We have a new section in the 2008 edition 300.9 for Raceways in Wet Locations Above Grade that states: 300.9 Raceways in Wet Locations Above Grade. Where raceways are installed in wet locations abovegrade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations abovegrade shall comply with 310.8(C).*

*Section 301.8(C) requires the conductors used in wet locations be of a type listed for use in wet locations.*

**38. Can non-metallic cable be secured with a wire staple that is not listed?**

*Yes, 90.4 Page 27 if the product is approved and manufactured for the purpose.*

**39. I recently inspected a panelboard with 5 AFCI breakers installed. These breakers were significantly warmer than the regular 20-amp breakers. Measured temp was 120 degrees F, while the regular breakers measured 80 degrees. Is this normal? I assume not, but wanted to see if there was a common explanation for this. I recommended an electrician take a look, but I'm not sure if the client followed through.**

*The AFCI circuit breaker has electronics that uses minimal power. A temperature difference drives a few questions:*

*What is the load on that branch circuit?*

*Is the breaker plugged-on appropriately or is the heat being generated from a bad connection?*

*Keep in mind that GFCI circuit breakers employ similar electronics as found in AFCIs and have not been an issue where panels have numerous GFCIs. The temperature rise on a loaded breaker can exceed that which is found in this example and be in compliance with the UL standard. I recommend contacting the manufacturer and asking them about your concern.*

**40. I understand that manufacturers of PVC conduit produce only 90 degree C. rated conduit and that it is a code violation to install 105 degree C. rated conductors as the temperature rating of the conductor exceeds that of the conduit. Is this correct?**

*References: 352.12(E) Exception. Not necessarily, the Exception found in 352.12(E) allows cables or conductors rated at a temperature higher than the PVC conduit rating as long as it is not operated at a temperature above the conduit rated temperature. The NEC Handbook describes an example of where Type MV Cable rated at 105 degree C has its ampacity reduced to a 75 or 90 degree C cable ampacity. This example was used as the substantiation for the code revisions and the addition of the exception for the 2005 NEC.*

**41. I was told, “When wiring transfer switches, the utility conductors must go on top and the generator conductors on the bottom”. I searched and searched but could not find anywhere in the NEC that made this statement. It would seem to me that it is a matter of personal preference and/or popular consensus but not an NEC requirement. This person made the comparison of a disconnect switch with a transfer switch and added “by the NEC, a disconnect must have its line on top and load at bottom, because the handle must be in the up position.” One cannot rely on a transfer switch as a means of disconnect. This is why there must be a disconnect on both the utilities line and the generators line before the transfer switch. Is this actually an NEC requirement?**

*(2008 NEC Reference Article 404 and Section 110.3(B)) Although, the NEC does not state an orientation of the conductors on a transfer switch, there are considerations that should be taken into account. Article 404 specifically applies to “all switches”. Section 404.6 addresses issues with switch orientation and connection such as blades must not be energized when the switch is in the open position. This also includes a requirement that switches not be capable of energizing by gravity. In addition, installation is required to be in accordance with the manufacturer’s instructions.*

**42. Can someone clarify code section 200.7(C) (2)? Does this mean that the white conductor in a 14/3 NM cable cannot be used for the return conductor to a light? I have seen this used all the time for the return conductor. It is typically not re-identified and usually at the end of the line (single gang box with a 3-way switch installed) where the feed is on the opposite end and the light feed is in the same junction box (in the middle of the run) as the 14/3 to the switch. If it can’t be used as the return, can it be used as a traveler instead and re-identified to meet code?**

*Yes*

*(C) Circuits of 50 Volts or More. The use of insulation that is white or gray or that has three continuous white stripes for other than a grounded conductor for circuits of 50 volts or more shall be permitted only as in (1) through (3).*

*(1) If part of a cable assembly and where the insulation is permanently reidentified to indicate its use as an ungrounded conductor, by painting or other effective means at its termination, and at each location where the conductor is visible and accessible. Identification shall encircle the insulation and shall be a color other than white, gray, or green.*

*(2) Where a cable assembly contains an insulated conductor for single-pole, 3-way or 4-way switch loops and the conductor with white or gray insulation or a marking of three continuous white stripes is used for the supply to the switch but not as a return conductor from the switch to the switched outlet. In these applications, the conductor with white or gray insulation or with three continuous white stripes shall be permanently reidentified to indicate its use by painting or other effective means at its terminations and at each location where the conductor is visible and accessible.*

(3) Where a flexible cord, having one conductor identified by a white or gray outer finish or three continuous white stripes or by any other means permitted by [400.22](#), is used for connecting an appliance or equipment permitted by [400.7](#). This shall apply to flexible cords connected to outlets whether or not the outlet is supplied by a circuit that has a grounded conductor.

**43. An office building has painted block walls as a finish. Would it be permissible to surface mount approximately 9' of EMT feeding baseboard heaters, stubbed in to a suspended ceiling and making a transition from MC Cable by stripping the metal sheathing off and joining the cable to the EMT? Or would a junction box be required?**

*Response; 330.10 allows MC in EMT, 330.40 would require a listed fitting But stripping the cable no if you want to bring only conductors down then use a box*

**44. How do I know if a recessed luminaire can be installed in an hourly fire-rated assembly?**

*The answer to this can be found in the UL White book under the CCN CDHW found on page 82 of the 2008 UL White Book. The luminaire will be marked as suitable for the application in a fire rated assembly with a marking as follows:*

*[PRODUCT IDENTITY\*] CLASSIFIED FOR FIRE RESISTANCE  
FIRE RESISTANCE CLASSIFICATION  
DESIGN NO(S). \_\_\_\_\_*

*SEE UL FIRE RESISTANCE DIRECTORY*

*Issue No.*

*or*

*[PRODUCT IDENTITY\*] CLASSIFIED FOR FIRE RESISTANCE  
FIRE RESISTANCE CLASSIFICATION  
SEE UL FIRE RESISTANCE DIRECTORY*

*Issue No.*

**45. Does the metal faucet on a hydromassage tub need to be bonded the same as the circulating pump motor when the rest of tub has plastic water pipes?**

*No. The Section in the NEC that references hydromassage bathtub bonding is 680.74.*

*680.74 Bonding. All metal piping systems and all grounded metal parts in contact with the circulating water shall be bonded together using a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG. The bonding jumper shall be connected to the terminal on the circulating pump motor that is intended for this purpose. The bonding jumper shall not be required to be connected to a double insulated circulating pump motor. The 8 AWG or larger solid copper bonding jumper shall be required for equipotential bonding in the area of the hydromassage bathtub and shall not be required to be extended or attached to any remote panelboard, service equipment, or any electrode.*

*This section has clarified that the bonding only applies to the interconnection between metal piping systems and metal parts associated with the water recirculation system only at the hydromassage bathtub location. If there are plastic water pipes supplying the tub, the metal faucets are not required to be bonded.*

**46. Is it permissible to run non-metallic cable through kitchen cabinets at peninsulas and islands where it is not subject to damage or does it always have to be sleeved?**

*Yes, Page 186 334.15(B) where it is not subject to physical damage. It must be sleeved through the floor.*

**47. Article 409 of the 2008 NEC requires, among other things, that industrial control panels be marked with a short-circuit current rating that is based either on certified testing by UL or another Listing agency, or by use of an approved method. UL 508A-2001 Supplement SB is given as an**

**example of an approved method. My question is: If the local AHJ is obligated to enforce the 2008 NEC, what other "approved" methods are acceptable?**

*There are a number of avenues to address the rating of a control panel by the inspector:*

*For a simple control panel, review the components to understand the short circuit rating of each component and mark the highest component rating. (This method is actually recognized by UL 508A – SB*

*Utilize UL 508A supp SB to determine the rating or ask the contractor to demonstrate that he has complied with UL 508A SB.*

*When the panel gets “too complicated,” the burden of proof remains on the installer and markings on the product to ensure compliance with the NEC. Therefore the inspector is well within his prevue to require a field evaluation if the contractor can not demonstrate compliance.*

*The authority should consider establishing ground rules for when a field evaluation is necessary. Consider, “when more than 4 components are installed or a higher rating is desired than the minimum rating of components, a third party must certify the SCCR is accurate.”*

**48. I ran a 2-inch PVC feeder underground. Where it came up out of the ground I used a 2-inch rigid metal elbow and then continued with 2-inch PVC up a wall to a junction box 10 feet above the floor. I just used the rigid metal elbow for physical protection where it came out of the slab. Am I required to ground this steel elbow?**

*Reference: 250.86 Exception No.2. No, an equipment grounding conductors is not required for short sections of exposed metal conduit when used for physical protection per 250.86 Exception 2.*

*If the elbow is completely buried, then the Exception found in 250.86 Exception No.3 allows the use of an ungrounded metal elbow for feeders when used with PVC conduit. The complete metal elbow is required to be buried below 18”.*

**49. A 4-gang 400 ampere meter stack is being installed on a 4 unit multifamily building. When sizing the main grounding electrode conductor, do we use the wire size of the utility lateral feeding the 400amp meter stack or size the wire to the 400amp rating?**

*(2008 NEC Reference Table 250.66) A grounding electrode conductor is to be sized in accordance with Table 250.66 based on the size of the largest ungrounded service-entrance conductor(s) or equivalent area for parallel conductors. Table 250.66 Note 2 addresses the conductor sizing issue where there are no service-entrance conductors. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served. See also Article 100 for definition of service point, service lateral and service-entrance conductor.*

**50. Can a dishwasher be direct-wired with nonmetallic cable (romex)? Is an additional disconnect required?**

*PART 1 - YES*

*334.10 Uses Permitted.*

*Type NM, Type NMC, and Type NMS cables shall be permitted to be used in the following:*

*(1) One- and two-family dwellings.*

*PART 2- IT DEPENDS*

*It depends on the VA. Under 300va or 1/8 hp yes, over 300va or over 1/8 hp No an additional disconnect is required.*

*422.31 Disconnection of Permanently Connected Appliances.*

*(A) Rated at Not over 300 Volt-Amperes or  $\frac{1}{8}$  Horsepower. For permanently connected appliances rated at not over 300 volt-amperes or  $\frac{1}{8}$ hp, the branch-circuit overcurrent device shall be permitted to serve as the disconnecting means.*

*(B) Appliances Rated over 300 Volt-Amperes or  $\frac{1}{8}$  Horsepower. For permanently connected appliances rated over 300 volt-amperes or  $\frac{1}{8}$  hp, the branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance or is capable of being locked in the open position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.*

*FPN: For appliances employing unit switches, see [422.34](#).*

*422.34 Unit Switch(es) as Disconnecting Means.*

*A unit switch(es) with a marked-off position that is a part of an appliance and disconnects all ungrounded conductors shall be permitted as the disconnecting means required by this article where other means for disconnection are provided in occupancies specified in [422.34\(A\)](#) through (D).*

*(A) Multifamily Dwellings. In multifamily dwellings, the other disconnecting means shall be within the dwelling unit, or on the same floor as the dwelling unit in which the appliance is installed, and shall be permitted to control lamps and other appliances.*

*(B) Two-Family Dwellings. In two-family dwellings, the other disconnecting means shall be permitted either inside or outside of the dwelling unit in which the appliance is installed. In this case, an individual switch or circuit breaker for the dwelling unit shall be permitted and shall also be permitted to control lamps and other appliances.*

*(C) One-Family Dwellings. In one-family dwellings, the service disconnecting means shall be permitted to be the other disconnecting means.*

*(D) Other Occupancies. In other occupancies, the branch-circuit switch or circuit breaker, where readily accessible for servicing of the appliance, shall be permitted as the other disconnecting means.*

*Please keep in mind that some jurisdictions would not allow this unit switch as the “other disconnecting means” Check with your local AHJ.*

**51. We have a 3-foot section of EMT between two panelboards. Is additional support required on the raceway?**

*Response: Sadly yes, 358.30(C) was added to require support*

*(C) Unsupported Raceways. Where oversized, concentric or eccentric knockouts are not encountered, Type EMT shall be permitted to be unsupported where the raceway is not more than 450 mm (18 in.) and remains in unbroken lengths (without coupling). Such raceways shall terminate in an outlet box, device box, cabinet, or other termination at each end of the raceway.*

**52. In a Wal-Mart there is a nail shop and inside there they also do some sort of foot baths. I can not find anything in the code that will require them to GFCI protect them. Would the NEC require these to be GFCI protected, or is it possibly a requirement of the product listing?**

*In reviewing NEC 210.8(B) there is no provisions that would require a GFCI for this application. Also a check of article 680, specifically to therapeutic type tubs, seems to not cover this in its scope as for a product. The UL listing for these commercial units is under the CCN QMTX found on page 272 of the 2008 UL White book. The guide card does not indicate any requirements for being connected to a GFCI device. A check on a couple of the listing reports for this product found the chair aspect to be supplied through a Class 2 transformer, the water fill is via standard plumbing faucets without any electrical aspect, the pump is a listed type pump as one would see for a swimming pool and the controls are pneumatic. In summary it does not appear that there is a NEC or a listing requirement that these units be served by GFCI protection.*

**53. When installing feeders from building #1 to building #2, an equipment grounding conductor is required. Are ground rods required at building #2?**

*The requirement for a grounding electrode system at the second building is referenced in the first part of Section 250.32 in (A) which states:*

*250.32 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).*

*(A) Grounding Electrode. Building(s) or structure(s) supplied by feeder(s) or branch circuit(s) shall have a grounding electrode or grounding electrode system installed in accordance with Part III of Article 250. The grounding electrode conductor(s) shall be connected in accordance with 250.32(B) or (C). Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.*

*A grounding electrode system is required to be utilized at the second building first, in Part (A), and then 250.32(B) requires an equipment grounding conductor to be routed with the ungrounded and any grounded conductors to the second building. The grounded neutral conductors are not permitted to be connected to an equipment grounding conductor or to the grounding electrodes.*

**54. Do the requirements of 400.8(5) apply to factory-supplied cord and plug connected equipment, such as condensate pumps for air handlers, security cameras, and wireless routers install above suspended ceilings?**

*No, 422.16 page 280 the equipment must connect directly to a receptacle above the ceiling.*

**55. Now that combination-type AFCI circuit breakers are required to be used, where can Branch/Feeder AFCI circuit breakers be used?**

*The combination AFCI is required in the 2005 as of Jan. 1, 2008 and the 2008 NEC. Therefore, only those jurisdictions that are enforcing a version of the NEC older than the 2005 NEC or have amended the NEC to not require Combination AFCI.*

*Where can Branch Feeders be used? – A few examples include:*

*Nebraska (No AFCI requirement), Indiana (No AFCI requirement), local areas in MO, KS and IL on version of NEC earlier than 2005. Georgia amended out the Combination Type of AFCI to require BF.*

**56. Are connections and splices required to be accessible in low-voltage 12-volt lighting system installations (for example, puck lights for undercabinet lighting)?**

*References: (110.14(B)) 411.4(A), 411.5(D), Article 725, 300.15 and 314.29. Maybe, Sections 411.4(A) and 411.5(D) basically refer you to the wiring methods found in Chapter 3 or Article 725. Since Article 725 does not modify Chapter 3 for splices I referred to 300.15 where this section tells me a that some sort of fitting and connector shall be used for specific wiring methods or a box, conduit body or enclosure can be used or unless otherwise permitted in 300.15(A) through (M). 314.29 states that when boxes and conduit bodies are required to be accessible.*

**57. My question is on 110.26 (C)(3), & 110.33 (A)(3) about the egress door being over 25 feet away. Does this mean if it's beyond that it doesn't need panic hardware & need to open outward?**

*(2008 NEC Reference Section 110.26(C)(3) and 110.33(A)(3)) Section 110.26(C)(3) is applicable to locations with electrical equipment rated 600 Volts or less and 1200 Amps or more. Section 110.33(A)(3) is applicable to locations with electrical equipment rated over 600 Volts. Both have identical requirements (distance, hardware, open direction, etc.) for a door (intended for entrance to or egress from the working space) which is located within 25 feet of the working space. The reason for extending this requirement to a door located within 25 feet from the working space is to allow an injured worker to safely and quickly exit the work area in the event of an emergency. The requirement only applies to doors within the 25 ft. distance.*

**58. Is low voltage lighting allowed to be installed near a pool or spa?**

*YES – BUT NEED 10' HORIZONTAL CLEARANCE FROM WATER.*

*ARTICLE 411 Lighting Systems Operating at 30 Volts or Less*

*411.4 Specific Location Requirements.*

(A) Walls, Floors, and Ceilings. Conductors concealed or extended through a wall, floor, or ceiling shall be in accordance with (1) or (2):

(1) Installed using any of the wiring methods specified in Chapter 3

(2) Installed using wiring supplied by a listed Class 2 power source and installed in accordance with [725.130](#)

(B) Pools, Spas, Fountains, and Similar Locations. Lighting systems shall be installed not less than 3 m (10 ft) horizontally from the nearest edge of the water, unless permitted by Article [680](#).

**59. Why is an insulating bushing required for type AC cable per Section 320.40 and not for type MC cable?**

*Response: Cause the code says so--- the conductors in AC cable are individually wrapped with paper whereas MC all to conductors are wrapped together with Mylar. Thus the extra protection of the redhead or bushing is required for AC. Reference is in the question*

**60. With the design revisions of the GFCI over the last couple of years, there is still great concern about the use of the GFCI's on a sump pump or freezer circuits. If the GFCI becomes non-functional due to lightning surge or equipment (GFCI) failure, there is not any power to the equipment in use. Any data on the life-cycle of a GFCI?**

*The present requirements for listing of GFCI require that if the GFCI function fails there is an action. Those actions can be an auditable or visual indicator that the GFCI function is no longer working or it may be a denial of power. The typical unit is using an LED indicator that is green for working and red for failure. The concern about sump pumps and freezers is understandable but the protection afforded is also much better than not being there. The best means to have reassurance that GFCI is functioning is to complete the monthly testing that is in all the manufacturer's instructions. If there is a near lightning strike, it would be a good idea to immediately check the GFCI functioning just as people do in checking out the TV, microwave or other electronic equipment. There is no history or standard on the "life expectancy" of a GFCI and they should be expected to function for many years. Again, the best assurance is doing the routine testing.*

**61. A well drilling company supplied a twisted cable containing 4-#10 conductors. The individual conductors are marked "Pump Cable". Can this cable be direct buried from the residence to the wellhead?**

*These cables are not listed or marked for direct burial. This cable has four single conductors without an overall covering. Our second favorite book the famous UL White Book includes the Wire and Cable Marking Guide. A cable that is marked "Pump Cable" or "Submersible Pump Cable" is evaluated for use in wiring of pumps and/or submersible pumps. These cables have not been evaluated for direct burial based on the marking guide.*

**62. If apartments share a common hallway, is a house panel required?**

*Page 51 210.25(B) Yes, in general where power is needed for common lighting central alarm, signal, communications or other needs for public or common areas. The lighting or other loads that are associated with each unit would apply to 210.25(A) an example would be a four family apartment with switched hallway lighting for each unit.*

**63. Is there any data on life-expectancy of an arc-fault breaker? Are they susceptible to surges caused by lightning? Any history at this time?**

*The life-expectancy of an AFCI or susceptibility to surges would not be any different than electronic trip circuit breakers that have been in the field for decades including GFCI and GFPE which are installed at the service.*

*This questions often is generated due to a concern generated over the GFCI receptacle findings and their susceptibility to surges. Although a plausible question, it is not a correct parallel to draw. Service equipment manufacturer's are familiar with surge issues at the service and had taken such issues into account even with the GFCI circuit breaker electronics long before the GFCI receptacle issue was recognized.*

*A push-to-test button exists on an AFCI similar to the GFCI receptacles and breakers for periodic testing.*

**64. Could a switch in a patient care area, located outside the patient vicinity be supplied by a switch loop consisting of type MC cable?**

*References: 250.118(10) and 517.13(A). Yes, MC Cable can be used to supply the switch per 517.13(A) and as long as the Type MC Cable is listed and identified for grounding per 250.118(10). Non-Grounding Type of MC Cable is unacceptable.*

*I made the assumption that the luminaire was supplied from the normal branch circuit. If it is on the emergency system then it must comply with 517.30(C)(3).*

*It should be noted that the 2008 NEC, Section 517.13(B)Exception No.2 was revised. Previous edition of the NEC relieved the requirement for redundant grounding. The revised exception no longer allows a wiring method that is not qualified as an equipment grounding conductor. This revision clear states that NM or Standard Type MC cable can no longer be used for switches outside the patient vicinity supplying a luminaire 7-1/2 feet above the floor.*

**65. Does the NEC allow stranded wire to be wrapped around the screws on a receptacle?**

*Yes. Section 110.14(A) allows conductors up to and including #10 AWG to be attached to "wire binding screws".*

**66. How many AC- powered residential smoke detectors are allowed to be interconnected? Most of the instructions I have read say a maximum of 12. I have a residential plan showing 18, is there an approved way to interconnect detectors fed from different circuits?**

*If the instructions state a maximum of 12 than that is all that is allowed NEC 110.3(B). Based on NFPA 72-2007. If the size of the dwelling requires more than 12 smoke alarms, then the system would have to be a supervised system that would allow up to 42 smoke alarms as per NFPA 72-2007 11.8.2.2(2)&(3).*

*The NEC does not address smoke detector evaluation or interconnection, this is addressed in NFPA 72.*

*Smoke detectors are evaluated by other agencies to determine compliance with product standards for function, use, and other requirements. Installation is to be in accordance with the manufacturer's*

*installation guide and the requirements of the detector's Listing agency. NPFPA 72 Section 11.8.2 states: Smoke and heat alarms shall not be interconnected in numbers that exceed the manufacturer's published instructions.*

*In no case shall more than 18 initiating devices be interconnected (of which 12 can be smoke alarms) where the interconnecting means is not supervised.*

*In no case shall more than 64 initiating devices be interconnected (of which 42 can be smoke alarms) where the interconnecting means is supervised.*

*Smoke or heat alarms shall not be interconnected with alarms from another manufacturer unless listed as being compatible with the specific model.*

*2008UL White Book page 311 SINGLE- AND MULTIPLE-STATION SMOKE ALARMS (UTGT)*

*The installation instructions (manual) indicate the maximum number of units that can be interconnected.*

*IRC-2006 R313.1 Smoke detection and notification.*

*All smoke alarms shall be listed in accordance with UL 217 and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.*

NFPA 72-2007 11.8.2.2

*Not to exceed the manufacturer's published instructions*

*In no case more than 18 devices, 12 of which may be smoke alarms, where the system is not supervised*

*In no case more than 64 devices, 42 of which may be smoke alarms, where the system is supervised*

*May not be interconnected with different manufacturer's unless listed as compatible with specific model*

NFPA 72-2007 11.8.1

*Smoke alarms must be installed in accordance with manufacturer's published instructions and any applicable electrical standards.*

**67. The plans for a new coffee shop show there is skeleton-tube neon installed inside. Is this neon required to be listed?**

*No, it is not required to be listed where installed in conformance with the Code, provided the skeleton tubing is field installed. Otherwise, if the neon lighting meets the definition of outline lighting and is not field installed, then it is required to be listed.*

*600.3 Listing. (A) Field-Installed Skeleton Tubing. Field-installed skeleton tubing shall not be required to be listed where installed in conformance with this Code.*

*Code References: 600.3 & 600.3(A)*

**68. I am reviewing plans for an apartment building. The disconnects for the A/C units are shown behind the outside condensers. Are these disconnects required to meet 110.26? Does it make a difference if they are fused or non-fused?**

*Yes 110.26 does apply (Reference 440.14, 110.26 (A) and 90.3). As for the second part of the question, does 110.26 apply for both fused and non-fused and the answer is yes referencing the same sections. Also see CMP 11 panel statement on proposal 11-94.*

*11-94 Log #3600 NEC-P11 Final Action:  
(440.14)*

*Reject*

---

*Submitter: Douglas Hansen, Code Check*

*Recommendation: Add the following sentence to the end of the first paragraph in 440.14:*

*Working space about the disconnecting means shall comply with 110.26.*

*Substantiation: There is inconsistency in interpretation and enforcement for working space about the disconnecting means for air conditioning equipment, yet it is clearly a type of equipment that is frequently worked on while energized, and it should fall under the scope of 110.26. The wording here is the same that was added to article 480 in the 1999 cycle, clarifying the need for working space about a battery rack. This proposal is consistent with many other recent changes that promote worker safety.*

*Panel Meeting Action: Reject*

*Panel Statement: Section 110.26 already applies per 90.3.*

*Number Eligible to Vote: 15*

*Ballot Results: Affirmative: 15*

**69. I have a medical building fed with a 480 volt service. I now have plans for an addition to install a CAT scan machine. The transformer for the CAT scan machine is fed from the main service but is pad-mounted outside. What is the proper way to ground the separately-derived system?**

*I have to make some assumptions, here. The Mike Forister Memorial Medical Center has a 480-volt service and the computed axial tomography machine needs approximately twice that voltage to operate. CAT scans use an autotransformer and the grounding of this transformer, also known as a separately derived system, is*

*the issue. While the 3-phase equipment may not need a grounded circuit conductor, the system requires grounding and an effective ground-fault current path must be established.*

*Grounding of Separately Derived Systems is covered in Section 250.30.*

*Using the requirements of 250.30(A)(1) you would size the system bonding jumper using the size of the derived phase conductors (per the table 250.66) or use 250.30(A)(2) if the bonding jumper is run with the circuit conductors. The grounding electrode conductor requirements are in 250.30(A)(3), installation requirements in 250.30(A)(5) and bonding requirements in (A)(6).*

*250.30(A)(7) requires the grounding electrode be as near as possible to the connection to the SDS, and be either a metal underground water pipe, as per 250.52(A)(1) or grounded structural steel per 250.52(A)(2) or any of the other electrodes if a water pipe or grounded steel are not available.*

**70. I have plans for a commercial building where the engineer has specified a concrete-encased electrode to be #4 bare copper installed in the footing. Is there a possibility of the concrete adversely affecting the copper conductor?**

*None that I am aware of. The NEC in 250.52(A)(4) has recognized bare copper wire for use in concrete as a grounding electrode for many years.*

**71. Can NM-B cable be installed in exposed locations, especially in unfinished basements?**

*Yes, read NEC 334.15(C) – Exposed Work in Unfinished Basements and Crawl Spaces which shows the requirements necessary and if you have an NEC Handbook (and you should have one) read the commentary after 334.15(C).*

**72. In convenience stores there are many countertop appliances (hot dog machines, sandwich and pizza warmers) that are cord connected. Could this area be considered a “commercial kitchen”? Any receptacles within 6’ of the sink are required to be GFCI protected. What about the others?**

*A. YES & YES, POSSIBLY, in 210.8 (B) (2) & (5), page # 47, (B) talks about other than dwelling units, which I believe is referred to in the above question. Article 100 defines Kitchen as “An area with a sink and permanent facilities for food preparation and cooking” this was relocated from the 2005 Code section (2) and the same language was used; now being article 100 it applies generally throughout the code. The question has to be asked if there are permanent facilities for cooking, meaning a stove or in counter top range unit and not just an appliance that sits on the counter top. If that is the case then the answer is yes all 125 volt 15 & 20 ampere receptacles shall have GFCI protection. If the answer is no then (5) sinks states that where receptacles are installed within (6ft.) of the outside edge of the sink must be GFCI protected.*

**73. When running #4 AWG copper service entrance conductors between a service panel and a meter socket for a 100 ampere residential service, can you strip the insulation off of the grounded (neutral) conductor and install it into the lug of a bonding bushing?**

*Yes 230.41 Insulation of Service-Entrance Conductors.*

*Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated.*

*Exception: A grounded conductor shall be permitted to be uninsulated as follows:*

*(1) Bare copper used in a raceway or part of a service cable assembly.*

*250.142 Use of Grounded Circuit Conductor for Grounding Equipment.*

*(A) Supply-Side Equipment. A grounded circuit conductor shall be permitted to ground non-current-carrying metal parts of equipment, raceways, and other enclosures at any of the following locations:*

*(1) On the supply side or within the enclosure of the ac service-disconnecting means*

*250.92 Services.(A) Bonding of Services. The non-current-carrying metal parts of equipment indicated in 250.92(A)(1) and (A)(2) shall be bonded together.*

*(2) All service enclosures containing service conductors, including meter fittings, boxes, or the like, interposed in the service raceway or armor*

**74. In a department store the plans show using a UPS system for powering emergency and backup lights. Additional egress lights have been added to meet the building code. How do I verify the UPS is rated for the additional load?**

*The UPS that is used in accordance with the requirements of 700.12, 700.5 states that it shall have adequate capacity for all loads operated simultaneously. UL Listed Emergency Equipment is identified by the 08 UL White Book page 134 EMERGENCY LIGHTING AND POWER EQUIPMENT (FTBR) and identifies that this equipment is listed to UL 924 which requires the equipment to be marked with a maximum total and remote load output when provisions for connecting to remote loads exists. Since additional loads have been added, I would suggest that the AHJ require the Design Professional to provide an accurate emergency load calculation and compare it to the marked output loads on the UPS.*

*FTBR UL White Book*

*The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and the product name "Emergency Lighting Equipment" (or "Emer. Light Eq."), "Emergency Power Equipment" (or "Emer. Power Eq.") or "Emergency Lighting and Power Equipment" (or "Emer. Light & Power Eq.").*

*Product identity is extremely important. If this equipment is identified as "Auxiliary Lighting Equipment," "Auxiliary Power Equipment" then it is listed under OUST UL White Book-2008 page 232 and has not been evaluated for compliance with the performance criteria of Article 700 of the National Electrical Code (ANSI/NFPA 70), the Life Safety Code (ANSI/NFPA 101) or the Uniform Fire Code.*

**75. Is a "cold sequence" disconnect required on the line side of a utility company meter for a 480Y/277 V 3-phase, 4-wire service? I recently worked in an area where this disconnect was required to be installed in addition to a "service disconnect" on the load side of the meter. Where in the NEC is this requirement found? Are there Code rules that apply when this "cold sequence" disconnect is a requirement of utility regulations in a given area?**

*No, a cold sequence disconnect is not required per the NEC (although it does permit them) on the line side of the utility company meter for 480 Y/277 Volt 3-phase, 4-wire service. However this would not preclude a local utility company from requiring it as a condition of their service. Consequently, if the local utility company requires a disconnect, then NEC Section 230.82(3), which addresses equipment "permitted" on the line side of the service disconnecting means.*

*A change in the 2008 NEC also reflects that this "disconnect" must be grounded in accordance with Article 250 and must also be cable of interrupting the load served.*

*Code References: 230.82(3)*

**76. I recently installed a disconnect in an accessible ceiling space for a duct strip heater and the inspector required a minimum of 36 inches clearance in front of the disconnect. Is working space required for this disconnect even in tight ceiling spaces such as the one described?**

*Yes 110.26(A) & 424.19 See my same analogy in question # 68 in regards to 110.26(A) & 90.3*

**77. I am inspecting a doctor's office where they are planning to have a permanent generator. The plans show that the disconnect is integrated into the generator as allowed in Section 702.11. How does this affect the overcurrent coordination required in 701.18?**

*Legally required stand-by systems are covered by Article 701, and section 701.18 requires selective coordination of the system. Selective coordination is not defined in Article 100, but "Coordination (Selective)" is there – and is defined as "localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings."*

*It is the "coordination" of the ratings or settings of each overcurrent device that should prevent a small-scale problem from becoming larger—e.g., a fault on a single circuit expanding and taking out a panelboard*

or even the entire service. This is especially important in emergency system design. In an emergency situation, all kinds of things are going haywire and reliability is essential.

*“This system has a “disconnect” at the generator. Perhaps this is also an OC device? Selective coordination can be achieved with either fuses or circuit breakers.*

*If fuses are used for this system, chose fuse types and ampere rating ratios that are equal to or greater than the published ratios to achieve selective coordination. You do not have to plot fuse time current curves or analyze fuse systems for selective coordination. Just use the ratio guide from the fuse manufacturer.*

*However, if fuses are used, then full system coordination requires fusible branch-circuit panelboards.*

*Knowledge of circuit breaker characteristics and settings is necessary to use breakers for selective coordination. Molded case circuit breakers have instantaneous trip characteristics, which can be problematic. You should perform short-circuit current and coordination study and look to circuit breakers with short-time delay settings to achieve selective coordination.*

**78. When wiring a submersible well pump motor at a single-family residence I was instructed to bond the well casing to the equipment-grounding conductor. This seems odd to me. You would think a 100-foot metal well casing is pretty well grounded. Is this correct?**

*Bonding the equipment grounding conductor to the metal well casing is required in 250.112(M). The equipment grounding conductor run with the branch circuit is connected to the submersible pump motor. Connecting the equipment grounding conductor to the metal well casing keeps the casing and pump motor (bonded) at the same potential.*

**79. I have been given a landscape design where they want to install receptacles around a swimming pool. The contractor has installed the receptacle boxes a few inches above the ground. Is there any rule against this?**

*There is no rule against this but there are several requirements that must be followed to do it properly. NEC 314.15 covers installation of boxes in damp or wet locations, 314.23(F) relates to raceway supported boxes and 680.22(A) contains the requirement for receptacles installed around swimming pools.*

**80. In a multiwire branch circuit, the breakers that feed these circuits must be interlocked so that they simultaneously disconnect all ungrounded conductors. The most common method in supplying power to these circuits is using a two-pole breaker. That would mean that the multiwire branch circuit is fed with two different phase legs and I can read 220 volts across a split-wired duplex receptacle (with the tab on yoke removed). My question is, can the split-wired receptacle be fed from the same phase but off two separate breakers? And how can they be interlocked on the same phase? Do they make an interlocking device for use on a piggyback breaker, which would then be on the same phase to feed this multiwire circuit?**

*A. Consider 210.7 (B) on page 47 where tow or more branch circuits supply devices or equipment on the same yoke then they shall have a simultaneous disconnect at the panel board. Your question is, can the split-wired receptacle be fed from the same phase but off two separate breakers? A. YES provided once again you have a tow pole breaker or two single pole breakers with a listed handle bar tie means. Now regarding the interlock concept on the same phase some manufactures make a handle bar tie mechanism the can accomplish that end ; I have seen Westinghouse/Bryant panaelboards that can do it. Next question, do they make an interlocking device for use on a piggyback breaker, (mini-breakers) which would then be on the same phase to feed this multiwire circuit?*

*My answer: to have a multiwire BC you need by definition a BC that consists of two or more ungrounded conductors that have a have a voltage between them and a grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system. In the first sentence it is correct that the OCP must be interlocked via a two pole breaker or two single pole breakers with an approved handle bar tie means. Regarding the use of a*

*(piggyback, tandem or mini-breaker) it may be connected but since it is on the same phase leg it is not a multiwire BC by definition's you also introduce the problem of double lining the neutral current in making a connection as described and sharing the one neutral (grounded conductor) for the two circuits. You may possibly take two adjacent tandem breakers which would then have one side of the multiwire branch circuit taken off of two halves and be on separate phases. Some manufacturers do make a handle bar tie for that type breaker. One could choose to do as asked and then have the BC be connected up to the circuit device and on the same yoke with a tab broken off to perhaps have one receptacle energized all of the time and then the other on the same yoke on a switched circuit. If that is the case then the circuit would have to be simultaneously disconnected.*

**81. Is it legal to use a two-gang plastic device box with push clamps identified for use up to 10 gauge NM cable and 37 cubic inches of volume for the installation of a range receptacle and 8/3 with ground NM cable?**

*314.16(4) Device or Equipment Fill. For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with Table 314.16(B) shall be made for each yoke or strap based on the largest conductor connected to a device(s) or equipment supported by that yoke or strap. A device or utilization equipment wider than a single 50 mm (2 in.) device box as described in Table 314.16(A) shall have double volume allowances provided for each gang required for mounting.*

*The 2008 Code changes for 314.16 included two editorial clarifications and one additional requirement. The additional requirement was added as a new last sentence to 314.16(B)(4), requiring devices wider than a single 2 in. device box to be counted twice or to have a "double volume allowance."*

**82. I have seen products advertised for enhancing grounding electrodes. Are these products and materials required to be listed?**

*There is nothing in the NEC that I could locate that requires Ground Enhancing Material to be listed. There is only one place that I am aware of that even requires a grounding electrode to have a minimum ground resistance. 250.52(A) identifies grounding electrodes permitted to be used. A rod, pipe or plate electrode, are several types that are permitted. 250.56 then requires that when a single rod, pipe or plate are used, shall have a ground resistance of 25 ohms or less, otherwise it requires it to be augmented with an additional electrode identified in 250.52(A)(4) through (A)(8).*

*2008 UL White Book page 180 GROUNDING AND BONDING EQUIPMENT (KDER).*

**83. If you have an existing soffit-mounted sign with the ballast inside the accessible soffit, and you replace the existing sign with a new one would you have to add the newly required switched lighting outlet per 600.21(E) in the 2008 NEC?**

*I would say no, it is not required. I believe this would be an AHJ call and would consider this a replacement, as opposed to a new installation. Another example would be the replacement of an outside AC unit and the requirement to install a receptacle within 25 ft of the unit in accordance with 210.63. I would interpret this as an attempt to retroactively apply the code to an existing building.*

*Code References: 90.4*

**84. We are finding air-conditioners installed that do not have the maximum rating of the branch-circuit short-circuit and ground-fault protective device on the nameplate. What should we do with these units?**

*Determine the maximum rating of the branch-circuit short-circuit and ground-fault protective device in accordance with 440.22(A) & (B) Reference 440.22(C).*

**85. I have plans for a health care facility. They have specified hospital grade Type AC cable. Is there a special fitting listed for hospital grade use?**

*The UL White Book, in Section (AWSX) ARMORED CABLE CONNECTORS, TYPE AC page 64 GENERAL*

*This category covers armored cable connectors suitable for use with armored cable (Type AC) for installation in accordance with ANSI/NFPA 70, "National Electrical Code" (NEC).*

*Grounding — Armored cable connectors (Type AC) are considered suitable for grounding for use in circuits over and under 250 V and where installed in accordance with the NEC.*

**REQUIREMENTS**

*The basic standard used to investigate products in this category is ANSI/UL 514B, "Conduit, Tubing, and Cable Fittings."*

*The UL White Book, in Section (PJOX) METAL-CLAD CABLE CONNECTORS, TYPE MC, page 241, states "Use with Armored Cable — Metal-clad cable connectors also suitable for use with armored cable, Type AC, are so marked on the device or carton."*

**86. If a 100-ampere service is grounded using only a concrete-encased electrode, and the size of the largest ungrounded service-entrance conductor is 1 AWG copper, what is the largest size copper grounding electrode conductor required for the service? I was recently told it had to be at least a 4 AWG copper and could not be smaller. Is this correct?**

*Let's separate the rules for the grounding electrode from the rules for the grounding electrode conductor. 250.52(A)(4) requires the grounding electrode to be 20 ft or longer of a copper conductor not smaller than 4 AWG. 20 ft of ½ in. or larger steel reinforcing rod that is properly encased is acceptable as well. (Other requirements are in the section.)*

*Sizing of the grounding electrode conductor comes from 260.66, both the table and sections. Using Table 250.66, the minimum size copper grounding electrode conductor for a 1 AWG copper service entrance conductor is 6 AWG. The 6 AWG grounding electrode conductor is permitted to be connected to the concrete encased electrode using a suitable connector. 250.70 requires ground clamps to be listed for the materials of the grounding electrode and the grounding electrode conductor.*

*Be sure to follow the protection rules from 250.64(B) for the grounding electrode conductor.*

**87. A contractor upgraded and relocated the service panel of a residence into a crawl space. The height of the workspace from the clay crawl floor was about four and a half feet. The contractor was told to provide the proper headroom. I went there today and the contractor had dug down two feet in front of the panel four feet by four feet. The problem now is you have about a foot of water in the hole. In order to examine or work on the panel you have to have your waders on. What code sections can I use to prohibit this?**

*I believe your best bet here is to use 230.70(A)(1) where the location must be readily accessible. In using the definition of readily accessible note that you must resort to a portable ladder to gain entrance into the "service pit" and in addition the definition also says "and so forth" which can only be defined by the authority having jurisdiction. This permits a world of reasons such as "unsafe conditions", "violation of 110.12 – neat and workmanlike manner", etc.*

**88. I have a residential kitchen plan; they show a new UL-listed floor box that is listed for damp and wet locations. The receptacle pops up. The contractor wants to mount it in an island counter top. It is not a face-up receptacle. Is this installation approved?**

*A. YES per 110.3 (B) page 32, is that floor box listed as being approved for counter top installation. The answer is NO. In 406.5 (E) the receptacle shall not be mounted in the face up position in countertops or similar work surfaces. With the pop up referred to is the receptacle the perpendicular to the counter top surface? Y/N if the answer is no it can not be used in that location or type of use. In 314.27 (C) page # 173*

*indicates that when used in a floor installation it must be listed for that purpose and as a complete assembly and is normally an adjustable box to match different surfaces it may be installed in ; with box and cover as components of that assembly. This said in the 2007-UL White Book page # 343, Cat. (XBYS) Relocatable Power Taps,*

**89. An inspector said we couldn't use MC Cable in a non-metallic box even if we drilled out a 1/2 in hole & used a locknut. Is this correct?**

*UL White book Cat. QCMZ*

*330.40 Boxes and Fittings.*

*Fittings used for connecting Type MC cable to boxes, cabinets, or other equipment shall be listed and identified for such use.*

*250.148(D) Nonmetallic Boxes. One or more equipment grounding conductors brought into a nonmetallic outlet box shall be arranged such that a connection can be made to any fitting or device in that box requiring grounding.*

*314.3 Nonmetallic Boxes.*

*Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob-and-tube wiring, cabled wiring methods with entirely nonmetallic sheaths, flexible cords, and nonmetallic raceways.*

*Exception No. 1: Where internal bonding means are provided between all entries, nonmetallic boxes shall be permitted to be used with metal raceways or metal-armored cables.*

**90. Can you look at 682.33 in the '08 NEC and give me your thoughts? I guess I find this section rather vague when it talks about the equipotential plane. Questions:**

**A) What would constitute a code-compliant plane?**

*682.2 Equipotential Plane. An area where wire mesh or other conductive elements are on, embedded in, or placed under the walk surface within 75 mm (3 in.), bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to prevent a difference in voltage from developing within the plane.*

*See 2008 UL White Book page 181 GROUNDING AND BONDING EQUIPMENT (KDER) Ground Mesh.*

**B) Would you only need this plane if the area around the control equipment were paved?**

*No. The definition in 682.2 or the requirements of 682.33 does not limit this to only paved areas. There was a proposal to delete 682.33 stating that this type of equipment is usually installed in areas of soil and vegetation and it was rejected unanimously stating lack of substantiation and that this would reduce the level of safety provided by the current Code.*

**C) What if the area was brick pavers or asphalt?**

*Yes it would be required. Depending on the thickness of the asphalt or pavers remember 682.2 identifies the equipotential plane to be on, embedded in or placed under the walk surface within 3 inches.*

**D) What if the equipment were mounted on a large pad that one would stand on to operate the equipment?**

*Yes, same situation as with pavers or asphalt.*

*Substantiation: 2005 ROP*

*This proposal is the result of the NEC CMP-17 Task Group on Other Bodies of Water. The addition of equipotential plane requirements is based on IEEE standards 80 and 142 to mitigate step and touch voltages for persons coming in contact with electrical equipment likely to become energized. A typical outdoor 120/240V, 200A service with 3,200A line-ground fault current and 100 ohm-meters moist soil conditions can have step and touch voltages exceeding tolerable levels as per IEEE 80. The likeliness of energization results from the proximity of controlling equipment located near a water body's shoreline.*

**91. The plumbers installed a small water heater above the lay-in ceiling in the bathrooms of a strip mall. The heaters are UL listed and are cord connected. Can they be plugged in above the ceiling?**

*Yes, NEC Section 400.7 provides a list of applications and locations flexible cords are permitted. Section 400.7(A)(8) permits appliances where the fastening means and mechanical connections are specifically*

*designed to permit ready removal for maintenance and repair, and the appliance is intended or identified for flexible cord connection.*

*Concealed. Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.*

*Code References: 400.7(A)(8) & Article 100 definitions*

**92. A building has 277-volt lighting and 120 volt receptacles. None of the circuits share the same raceways or junction boxes. Do the neutrals have to be identified by different colors, stripes, etc.?**

*The color scheme noted on each branch circuit panel would require consistency of the identification. As long as there are no other branch circuits out of that panel that are contained in the same raceway, cable, auxiliary gutter, or other type of enclosure than different color schemes would not be required.*

**93. When installing isolated-ground receptacles in areas used for patient care in health care facilities, how many equipment grounding conductors should be provided with the circuit? I was told that 3 separate equipment grounding conductor paths are required.**

*517.16 allows receptacles with isolated grounding terminals, but a fine print note stresses that caution must be used when specifying this for especially sensitive electronic equipment. This section, 517.16, then refers you back to 250.146(D)*

*With this type of installation, 250.146(D) states that the grounding terminal of the receptacle is required to be directly connected to “an insulated equipment grounding conductor run with the circuit conductors” but it is permitted to pass through one or more panelboards without connection to the equipment grounding terminal.*

*What is required in 517.13(A) is that all branch circuits in patient care areas be provided with an effective ground-fault current path by installation in a metal raceway or cable and that the cable or raceway that itself qualify as an equipment grounding conductor as described in 250.118.*

*517.13(B) requires that equipment and the grounding terminals of all receptacles be directly connected to a copper equipment grounding conductor.*

*Neither section specifies where the other end of the EGC should be connected. I believe that an isolated ground could qualify as the EGC required by 517.13(B) and the installation of a third EGC could be avoided.*

**94. Sect. 250.66(B) says the grounding electrode conductor for a UFER ground shall not be required to be larger than a #4 copper wire. We often see design engineers spec larger than #4 copper. Does this additional sizing improve the grounding capabilities or is this just wasted copper?**

*The consulting engineer may specify a larger conductor to exceed the minimum requirements of the NEC for various reasons such as physical protection.*

**95. I am currently designing an electrical system for a funeral home that also contains living quarters for the manager. The chapel is designed to hold more than 100 people, and is not divided from the rest of the building by fire-rated walls; the construction material is wooden studs. The NEC prohibits the use of NM cable, but I am unclear as to whether I can install non-metallic flexible conduit. It is also unclear if the entire building will need to be run in conduit or just the chapel area. What is allowed by the NEC?**

*Your building is covered under 518.2(A) – Assembly Occupancies. NEC 518.2(B) tells us that for buildings of multiple occupancy these rules apply only to that portion of the building considered an assembly occupancy. The residential portion can be wired with Type NM cable. You mention nonmetallic flexible conduit which is liquidtight flexible nonmetallic conduit and the requirements are shown in Article 356. The wiring methods for assembly occupancies are shown in 518.4*

**96. I am drilling holes in a ceiling joist. It is my understanding that 300.4.A.1 in the NEC says I must stay 1- 1/4" from the edge of that joist but I also understand that the IRC and the IBC rules E3702.1 and R502.8.1 says I must stay at least 2" from the edge of that joist. Which rule do I go with?**

*A. Both statements are true but the old adage "when in Rome do as the Romans do" applies, but in most cases the most strigent rule applies o or the 2" inch set back. And this is usually measured from the face of what wall finish material or exterior sheathing or boards or finish exterior materials are applied to and the edge of the bored hole and not just the center of the hole whatever size it may be. Section 300.4 (A) (1) is found on page 127 and indicates that if that dimension can not be maintained then the cable must be protected by a (1/16 "in) steel plate or be sleeved out with an approved means. A nominal width for a approved 2" X4" is now 3 1/2" inches so in that type of framing the code can not be complied with unless other protective means is available.*

**97. I am inspecting a building addition. They have a 150 KVA transformer with two 220 amp panels being fed from it, but now have more circuits than these two panelboards can handle. Can they tap an additional 100 amp panel off of this transformer? The 100 ampere panel would be 15 feet away.**

*Table 450.3(B) Notes 2. Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device.*

**98. I'm sure you are aware of the controversy going on about GFCI end-of-life protection. Is this found in the NEC or is it a requirement of the product listing?**

*This is a requirement of the product standard UL 943. See the 2008UL White Book page 179 GROUND-FAULT CIRCUIT INTERRUPTERS (KCXS) and under requirements it identifies the basic standard to investigate this category is ANSI/UL 943. Both in part 5, Construction, and part 6, Tests, have a requirement that a ground-fault circuit-interrupter receptacle that has reached its end of life shall either indicate by visual means, audible means, or both, that the device must be replaced or render itself incapable of delivering power.*

*406.2(A) requires that receptacles are listed.*

**99. Is there a minimum height for mounting a ceiling fan?**

*Ordinary locations No; certain applications Yes:*

*410.10(D) Luminaires in Specific Locations, which states is part, (D) Bathtub and Shower Areas. No parts of ceiling-suspended (paddle) fans shall be located within a zone measured 3 ft horizontally and 8 ft vertically from the top of the bathtub rim or shower stall threshold.*

*680.22(C) Area Lighting, Receptacles, and Equipment,*

*680.22(C)(1) New Outdoor Clearances. ceiling-suspended (paddle) fans installed above the pool or the area extending 5 ft horizontally from the inside walls of the pool shall be installed at a height not less than 12 ft above the maximum water level of the pool.*

*680.22(C)(2) Indoor Clearances. For installations in indoor pool areas, the clearances shall be the same (12 ft) as for outdoor areas unless modified as provided in this paragraph. If the branch circuit supplying the equipment is protected by a ground-fault circuit interrupter, the following equipment shall be permitted at a height not less than 7 ft 6 in. above the maximum pool water level:*

*(1) Applies to luminaries*

*(2) Ceiling-suspended (paddle) fans identified for use beneath ceiling structures such as provided on porches or patios*

*(4) GFCI Protection in Adjacent Areas. Requires ceiling-suspended (paddle) fans installed in the area extending between 5 ft and 10 ft horizontally from the inside walls of a pool to have GFCI unless installed not less than 1.5 m (5 ft) above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool.*

*Spas and Hot Tubs*

680.42 Outdoor Installations requires complying with the rules for pools installed outdoors.

680.43(B) Indoor installations

680.43(B)(1) Elevation. Ceiling-suspended (paddle) fans located over the spa or hot tub or within 5 ft from the inside walls of the spa or hot tub shall comply with the clearances specified in (B)(1)(a), (B)(1)(b), and (B)(1)(c) above the maximum water level.

680.43(B)(1)(a) Without GFCI. Where no GFCI protection is provided, the mounting height shall be not less than 12 ft.

680.43(B)(1)(b) With GFCI. Where GFCI protection is provided, the mounting height shall be permitted to be not less than 7 ft 6 in.

680.43(B)(1)(c) not applicable since it applies to luminaries

Code References: 410.10(D), 680.22(C)(1), 680.22(C)(2), 680.42, 680.42(B)(1)

**100. Can a motor-operated gate disconnect be locked in the on position? At a factory, the entrance gate for traffic is motor-operated and the gate disconnect is locked in the on position. There is no way to turn it off with the lock in place. Is this legal?**

*The motor disconnect is not permitted to be locked in the on (closed) position for the first part of the question reference would be 430.101.*

*As for the second part of the question, the disconnect is not permitted to be locked in on position therefore would not be in compliance.*

**101. Does Section 210.4(B) apply to Article 517? For example a multiwire branch circuit feeding a minimum of six receptacles for a patient bed location in a critical care area as required by 517.19(B). Would it be required to disconnect all ungrounded conductors of a multiwire branch circuit permitted from the normal system?**

*210.4(B) Devices or Equipment. Where a multiwire branch circuit supplies more than one device or equipment on the same yoke, a means shall be provided to disconnect simultaneously all ungrounded conductors supplying those devices or equipment at the point where the branch circuit originates.*

*I see no exceptions, or need for an exception. The answer is yes.*

**102. When installing a feeder to an outbuilding, ground rods will be installed, and 4-wire feeder cable will be used to keep a floating neutral at the outbuilding panel isolated from the ground bus. What is to be done if there also is a copper water line to this outbuilding that is common to the first building where the service disconnect is located? Does that need to be bonded to the feeder ground bus also?**

*The answer is found in 250.104(A)(3) Multiple Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s). This section requires the metal water piping system to be bonded in or at the building supplied by one or more feeders or branch circuits. The size of the bonding jumper conductor is determined from Table 250.66 based upon the size of the supply conductor.*

**103. We installed a separately derived system (transformer) at the far end of a large warehouse. We proposed to use a primary equipment grounding conductor that would be sized based on the required grounding electrode for the derived system. This way one conductor acts as both the equipment grounding conductor and grounding electrode conductor. Is this installation prohibited?**

*Yes, it is not acceptable by the NEC. Attempting to use the equipment-grounding conductor on the primary side of the transformer as the grounding electrode conductor for the secondary side of the transformer is not permitted by 250.30(A)(7) which requires the grounding electrode to be – as near as practicable to and preferably in the same area as the grounding electrode conductor connection to the system.*

**104. I ran a 2-wire w/ground NM cable to feed the four receptacles in a bedroom. I'm being told that I have to splice the neutral and pigtail to the receptacle to prevent opening the neutral if the receptacle is removed. Is this correct?**

*A. No for this type of installation as indicated above. But per 300.13 (B) on page 132 and the device removal would interrupt the continuity of the grounded conductor, then the answer would be yes if it were a Multiwire branch circuit*

**105. Where I pull a conductor through a box without a splice, is this conductor counted only once when calculating box fill?**

*314.16(B) (1) Conductor Fill. Each conductor that originates outside the box and terminates or is spliced within the box shall be counted once, and each conductor that passes through the box without splice or termination shall be counted once. Each loop or coil of unbroken conductor not less than twice the minimum length required for free conductors in 300.14 shall be counted twice. The conductor fill shall be calculated using Table 314.16(B). A conductor, no part of which leaves the box, shall not be counted.*

**106. If someone installs 24 inch concrete sidewalk around pool perimeter and it has steel installed in it, are they required to add additional 12 inch equal potential bonding grid in the dirt outside of it to complete their 36 inch bonding requirement per 680.26 (B) (2)? Keep in mind that if no concrete is used, one can use the alternate method per 680.26 (B) (2) (b) and this is only one #8 solid copper wire, 18 inches to 24 inches from the pool. So wouldn't you think that since the steel was installed in this same area, that it would provide the same protection?**

*The NEC does not include language as to whether the bonded structural reinforcing in the concrete can be used to extend the bonding to the unpaved portion; the AHJ will have to make a determination on whether the intent of 680.26(A) is complied with.*

*It could be debated that since the concrete only extends 2 feet and not the entire 3 feet of the required parameter surface the structural reinforcing could not be used since the language in 680.26(B)(2) states that the parameter shall extend 3 feet from the inside walls of the pool and shall include unpaved as well as poured concrete and other types of paving and bonding to perimeter surfaces shall be provided as specified in 680.26(B)(2)(a) or (2)(b). The word OR gives an option depending on the construction method but does not require that both have to be met.*

*680.26(B)(2)(b) is only applicable as an alternative method if structural reinforcing is not available. Structural reinforcing is available for the concrete 680.26(B)(2)(a), but this only extends 2 feet out from the pool. So now we have 12 inches of the 3-foot required parameter surface area of 680.26(B)(2) that does not have structural reinforcing. The AHJ will have to decide, is it the intent of 680.26(B)(2) to identify the 1 foot of unpaved surface area without steel reinforcement to require a bare #8 solid copper conductor buried below the concrete slab so that the equipotential bonding grid is extended out the additional 12 inches to cover the entire required area of 3 feet?*

*Keep in mind that if the contractor did not install structural reinforcing in the 2 foot area of concrete, 680.26(B)(2)(b) would be allowed to be the equipotential bonding grid for both the paved and unpaved surface simultaneously, and 680.26(B)(2)(b)(5) would allow it to be installed in or under the parameter surface. Therefore a single #8 solid copper conductor installed within the 2-foot concrete walkway or under the 2 foot concrete walkway would meet the requirements of 680.26(B)(2).*

*So I guess the AHJ will have to decide if the structural reinforcing embedded in the 2 feet of concrete walkway is equal to or better than a #8 solid copper conductor installed in or under the concrete as allowed by 680.26(B)(2)(b)(5). Remember 680.26(B)(2)(a) has no prescriptive requirements for the structural steel but 680.26(B)(2)(b) has very prescriptive requirements when structural steel is considered not available.*

**107. A new commercial kitchen has a piece of kitchen equipment with a 20 amp, 125 volt twist lock connector, is GFCI protection required?**

*Yes, 210.8(B)(2) requires all 125-volt, single-phase, 15- and 20-ampere receptacles installed in kitchens to have ground-fault circuit-interrupter protection for personnel. There are no exceptions for a twist lock connector.*

*Code References: 210.8(B)(2)*

**108. The requirements in Art. 300.14 state 6” of free conductor in each outlet, junction, and switch point for splices or the connection of luminaries or devices. When someone is installing a heat/vent, light the junction box is very small and it is difficult to meet the 6” requirement. Does the NEC give us any leeway for this type of installation?**

*300.14 There are no exceptions for the min. 6” free conductor requirements (also see Exhibit 300.13 commentary in the handbook).*

**109. I have a 79,000 sq. ft school being constructed in our city. All of the footings are over-dug and then rock is brought in and compacted. All of the exterior footings are poured on a rock base. Does the concrete-encased electrode function in this situation? Do we need to bond the rebar?**

*This is not a code question. Seriously, whether “the concrete-encased electrode function” I do not know. I do know that the “magic” of the CEE is that the steel electrode (rebar) bonds to the concrete and the concrete leaches into and, in essence, “dopes” the soil it contacts. In this situation, the concrete connection to the soil, rock or earth may not be as good as it would be in clay, but the NEC would require that – if it’s there - a 20-foot length of the rebar be bonded.*

*If there were concerns over the effectiveness of this as an electrode, there is no NEC prohibition to the installation of a ground ring or other made electrode.*

**110. A meter and service disconnect are being installed on the outside of the home and the panelboard is 15 feet inside the basement. Can the main grounding conductor from the exterior service disconnect be installed inside the EMT conduit along with the feeders, through the panelboard and to the water pipe in one continuous length or should it remain outside of the conduit?**

*This grounding electrode conductor is permitted to be installed inside or outside the EMT. If installed inside, look at the rules in 250.64(E) which requires the grounding electrode conductor to be bonded to the ferrous metal raceways and enclosures it passes through.*

**111. Nm-B cable requires physical protection when passing through floors. Is ENT allowed to be used for this physical protection in Article 334?**

*NEC 334.15(B) does not show Electrical Nonmetallic Tubing as being permitted for protection from physical damage for Type NM cable where passing through a floor but it does permit or “other approved means” which is subject to approval by the authority having jurisdiction.*

**112. Section 210.12(B) lists dining rooms as requiring AFCI protection but a kitchen is not required. 210.52(B)(1) lists both dining and kitchen in the small appliance circuit required rooms. The dinette isn't on either list. . So does a dinette require AFCI?**

*A. YES, 210.12 (B) on page # 49, and 210.52 (B) (1) is on page 53 and the words “dinette” is not indicated specifically but both references indicate “ OR SIMILAR AREA” so that a laundry list of possibilities was not required. The panel in its discussions on AFCI initially took a whole house AFCI protection requirement position in the ROP phase and then in the ROC phase of the code process came back and for what I believe to be one code cycle exempted those areas where GFCI protection is installed for a guarded approach to making that complete step to what I believe is a far safer electrical installation for the public good. We will see what the 2011 code change proposal bring to light for the Panel.*

**113. The local sheet metal shop fabricates pull and junction boxes as well as wireways for us. Can we use a non-listed J-box, wireway or auxiliary gutter for equipment grounding? Are wireways listed for grounding?**

*376.100 Construction.*

*(A) Electrical and Mechanical Continuity. Wireways shall be constructed and installed so that adequate electrical and mechanical continuity of the complete system is secured.*

*(B) Substantial Construction. Wireways shall be of substantial construction and shall provide a complete enclosure for the contained conductors. All surfaces, both interior and exterior, shall be suitably protected from corrosion. Corner joints shall be made tight, and where the assembly is held together by rivets, bolts, or screws, such fasteners shall be spaced not more than 300 mm (12 in.) apart.*

*(C) Smooth Rounded Edges. Suitable bushings, shields, or fittings having smooth, rounded edges shall be provided where conductors pass between wireways, through partitions, around bends, between wireways and cabinets or junction boxes, and at other locations where necessary to prevent abrasion of the insulation of the conductors.*

*(D) Covers. Covers shall be securely fastened to the wireway.*

**114. What is the difference between "wet locations", "watertight", "liquidtight", "waterproof", and "raintight", and how do these terms apply to different products?**

*Article 100*

*Location, Wet. Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.*

*Raintight. Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions.*

*Watertight. Constructed so that moisture will not enter the enclosure under specified test conditions.*

*Weatherproof. Constructed or protected so that exposure to the weather will not interfere with successful operation.*

*FPN: Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.*

*Table 110.20 Enclosures Types*

*FPN: The term raintight is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 6, and 6P. The term rainproof is typically used in conjunction with Enclosure Types 3R, and 3RX. The term watertight is typically used in conjunction with Enclosure Types 4, 4X, 6, 6P. The term driptight is typically used in conjunction with Enclosure Types 2, 5, 12, 12K, and 13. The term dusttight is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 5, 12, 12K, and 13.*

*2008 UL White Book page 46 Electrical Equipment for Use in Ordinary Locations (AALZ)*

*“Raintight,” testing designed to simulate exposure to a beating rain will not result in entrance of water.*

*“Rainproof,” testing designed to simulate exposure to a beating rain will not interfere with the operation of the apparatus or result in wetting of live parts and wiring within the enclosure.*

*“Watertight” equipment is so constructed that water does not enter the enclosure when subjected to a stream of water.*

*2008 UL White Book page 103 Conduit Fittings (DWTT), Fittings identified with an enclosure type designation or as rain-tight or liquid-tight on the carton are intended for use as indicated in Electrical Equipment for Use in Ordinary Locations (AALZ).*

*“Liquid-Tight” on the carton indicates suitability for use where directly exposed to oil spray or to rain.*

**115. Is an "Airtight" recessed "can" fixture allowed to be placed in a joist space used as a return air plenum within a dwelling?**

*Yes, in accordance with 300.22(C)(2); provided the fixture is a metal enclosure, or if the fixture has nonmetallic enclosure, it must be listed for the use. Although the fixture is permitted, compliance with 300.22(C)(1) must be adhered to with respect to the wiring methods.*

*Code References: 300.22(C)(1) & 300.22(C)(2)*

**116. Is a switch with an internal neon pilot light still considered a "Device" under the definition in Article 100, even though it does utilize a small amount of power?**

*Yes, reference Article 100 definition "device" which reads:*

*"Device: A unit of an electrical system that carries or controls electric energy as its principal function."*

**117. In Healthcare facilities, do the emergency panel and normal power panel feeding the same area have to be bonded together?**

*Yes, 517.14 requires that when the panels of the emergency and normal power systems serve the same individual patient care vicinity, they be bonded. This is to assure that there is no difference of potential between grounded surfaces in each patient care vicinity.*

**118. May the building steel be used as the equipment grounding conductor from the disconnect of an optional standby generator to the transfer switch ground bus, when the only grounding electrode available is the building steel?**

*The building steel is not permitted to be used as an equipment grounding conductor. However, the building steel is permitted to be used as the grounding electrode or grounding electrode conductor. It is important that the equipment grounding conductor be run with or enclose the circuit conductors to keep the impedance as low as possible. See 250.134 and 300.3(B) and 250.52(A)(2).*

**119. A new home has a large shelf for a television set mounted near the ceiling over the hydromassage bathtub. There is no shower on this tub. Is it permissible to have a receptacle by the shelf for the TV? Must it be GFCI-protected? If the shelf is metal, must it be bonded to the bathtub?**

*Yes, 680.71 permits a ground-fault protected receptacle by the shelf. No, it is not necessary to bond the metal shelf to the bathtub.*

**120. In an industrial facility, where is GFCI protection required?**

*A. in a number of areas per 210.8 (B) on page 47, (1) bathrooms, (2) kitchens if they meet the definition, (3) rooftops, and (4) outdoors where the exception # 2, to (4) for industrials where written documentation is on file and that the 590.6 (B) (2) AEGCP assured equipment conductor program and documentations is on hand.. Also in (5) for sinks except for Exception (1) where the removal of power via a GFCI tripping incident would introduce a greater hazard; but given the requirement of NFPA 70E Electrical Safety in the Work Place, there had better be the documented need to invoke that exception.*

**121. Can the volume of extension rings be used for box fill calculations?**

*Yes 314.16(A) Box Volume Calculations. The volume of a wiring enclosure (box) shall be the total volume of the assembled sections and, where used, the space provided by plaster rings, domed covers, extension rings, and so forth, that are marked with their volume or are made from boxes the dimensions of which are listed in Table 314.16(A).*

**122. Section 680.71 states that “hydromassage bathtubs and their associated electrical components shall be on an individual branch circuit(s) and protected by a readily accessible GFCI”. Does this mean that the GFCI protection cannot be in the electrical panel or under the tub when an access panel is provided? Should it be on the bathroom wall?**

*No, that is not what this means. See the definition of Readily Accessible in Article 100 of the NEC. Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to who ready access is requisite to climb over or remove obstacles or to resort to portable ladders, and so forth.*

*240.24(A) requires overcurrent devices to be readily accessible so if you were complying with this requirement then the GFCI breaker protecting a hydromassage bathtub would also comply. As for under the hydromassage bathtub, if the access panel could be removed without the use of a portable ladder, obstacles (requires tools to remove) and so forth, I would say it complies with the definition of readily accessible.*

**123. A contractor installed a panelboard on the outside wall of the house for in-ground swimming pool equipment. To feed the panel, he used 6/3 NMB with the ground coming into the back of the sub-panel. The inspector turned down this installation for not having an insulated ground as required for outside pools. The Contractor argued that the code allows NMB to be used for the interior portions on a single-family residence. The wording in the code seems to be very vague on this issue. Could you please give us your interpretation of the code on this matter?**

*Section 680.20(A)(4) permits for the interior of dwelling units, any of the wiring methods recognized in Chapter 3 of the Code that comply with the provisions of this section shall be permitted. Where run in a cable assembly, the equipment grounding conductor shall be permitted to be uninsulated, but it shall be enclosed within the outer sheath of the cable assembly. The inspector probably rejected the installation under the premise of the word “interior” as contained in this section (680.20(A)(4)). Consequently, the NMB cable IS installed in the interior of the dwelling; the terminations of the cable are installed outside in the sub-panel. The inspector is apparently citing a violation of 680.20(A)(1), however I would disagree with this interpretation and would interpret the installation as meeting Code.*

*Code References: 680.20(A)(1) & 680.20(A)(4)*

**124. Does Section 230.82 allow transfer switches to be connected to the supply side of the service disconnecting means? If so, would a transfer switch then become the service disconnecting means, and be required to be marked "suitable for use as service equipment", and also be required to contain the service overcurrent device?**

*Reference Article 100 Definition of Service Equipment. If in fact a transfer switch is located on the supply side of the service disconnecting means it would be the main control and cut off of the system therefore considered the service disconnecting means referencing 230.91 answer to the first part of the question would be yes.*

**Is the transfer switch required to suitable for use as service equipment? Yes, 230.70(C).**

**125. I am designing a power distribution system for a health care facility. I was told that I have to coordinate the ground fault protection for the service and the feeders. What does that mean?**

*Section 517.17 requires that where ground-fault protection is provided for the service or feeder disconnecting means, an additional step of ground-fault protection shall be provided for all next level on the load side of the essential system transfer switch, between an on-site generator and the essential system transfer switch, and on systems that are not solidly grounded wye systems with greater than 150-volts to ground but not exceeding 600-volts phase-to-phase.*

*This requirement is not without controversy. The language the specifically prohibits GFP on the load side of the essential system transfer switch may actually reduce reliability of some systems. For further information on this, see Jim Pauley or Alan Manche*

**126. Is type EF Liquidtight Flexible Metal Conduit listed by a Nationally Recognized Testing Laboratory?**

*“EF represents “Extra Flexible.” This type LFMC is not listed, at least so far as I can find. It may be a recognized component and thus manufacturers are permitted to use the product in the manufacturing of equipment or machinery. Since it is not listed, it is not permitted to be used as a general wiring method.*

**127. Does the dedicated space in front of a panelboard need to be a flat surface? I have run into outdoor installations where the grade sometimes exceeds 45°degrees and I can't find anything in the Code to address this problem.**

*I believe your best bet here is to use 230.70(A)(1) where the location must be readily accessible. In using the definition of readily accessible note that you must resort to a portable means to support yourself while trying to access the panel and in addition the definition also says “and so forth” which can only be defined by the authority having jurisdiction. This permits a world of reasons such as “unsafe conditions”, “violation of 110.12 – neat and workmanlike manner”, etc.*

**128. Does the GFCI protection for receptacles in commercial kitchens extend to the preparation area or waitress station area?**

*A. it could with given certain conditions. First consider 210.8 (B) (5) on page # 48, sinks where present requires all receptacles within 6' feet of the outside edge of the sink to have GFCI protection. This means up, down and around. Or what I refer to as the 6' foot string radius measurement. Then (B) (2) kitchens which by definition must have permanent facilities for food preparation and cooking then all of the receptacles in that area require GFCI protection.*

**129. Where is the code or manufacturer requirement indicating that antioxidant compound shall be applied to the terminations of aluminum conductors?**

*There is no antioxidant compound requirement in the NEC. The general rule is that electrical connectors are tested by UL without antioxidant, however you will find antioxidant already installed in lugs from the factory or lug manufacturer, that is likely because it is necessary to pass the UL testing with it. A couple of thoughts on antioxidants:*

- 1) The use of it is not mandatory and generally manufacturer's don't have any recommendations, however it might be classed as a good work practice if done correctly, it will enhance the performance of the connection over time. You might check with Southwire to see if the conductor manufacturer's have recommendations.*
- 2) Make sure you use a Silicone based antioxidant, NOT a Petroleum based version. The petroleum based version, when dripped on plastic insulators, can impact the characteristics of the insulation, thermal and mechanical properties of the barrier material.*
- 3) There are coastal areas that enforce antioxidants due to salt spray and the unique environment that impacts the integrity of the electrical system.*

**130. With all of the flooding this past spring, what recommendations can you give on dealing with NM cable that has been submerged by flooding? Does it need to be replaced? Can it be dried out? Do we worry about it?**

*In a flooding situation, there is no way of knowing how long the cables were immersed in water, or what types of potentially corrosive substances may have been in the water that flooded the cables. As was widely reported after Hurricane Katrina, raw sewage and chemicals were known to be in the floodwaters afflicting the Gulf Coast region of the United States. Nonmetallic-sheathed cable has not been investigated by UL for*

*this type of exposure. Therefore, it is not possible for UL to state that cable in a particular installation is acceptable for continued use after having been subjected to the flooding.*

*The safest approach is to replace any nonmetallic-sheathed cable that was immersed in water for any period of time during the flooding.*

*UL and IAEI have a pamphlet and offer the following recommendation:*

*Some items may be reconditioned, while others will need to be completely replaced to protect your family. It is recommended that you allow an electrician or electrical inspector to guide the restoration or replacement of any electrical wiring or equipment.*

*Corrosion and insulation damage can occur when water and silt get inside electrical devices and products.*

*Water can also damage the motors in electrical appliances. Therefore, you should be prepared to replace:*

*Circuit breakers and fuses*

*All electrical wiring systems*

*Light switches, thermostats, outlets, light fixtures, electric heaters, and ceiling fans*

*Furnace burner and blower motors, ignition transformers, elements, relays (for furnaces and hot water tanks)*

*Hot water tanks*

*Washing machines, dryers, furnaces, heat pumps, freezers, refrigerators, dehumidifiers, vacuums, power tools, exercise equipment and similar appliances*

*Electronic equipment, including computers and home entertainment systems*

*This information is also available at: [www.ul.com/katrinafloodwaters/](http://www.ul.com/katrinafloodwaters/)*

*UL also published a Q&A on this topic in the November-December 2005 IAEI News.*

*NEMA has a document on Evaluation of Water Damaged Equipment that can be downloaded free from:*

*[www.nema.org/stds/water-damaged.cfm](http://www.nema.org/stds/water-damaged.cfm)*