

## 2009 WESTERN SECTION CODE PANEL QUESTIONS

**1. The local inspector “red-tagged” the temporary wiring for a new store of type III construction because he said Romex wasn’t allowed to be run in the open according to Section 334.10(3). Is he correct?**

*The requirement in 334.10(3) is a general provision for installation of nonmetallic sheathed cable in non-dwelling units. For a permanent wiring installation the inspector would be correct but for a temporary installation Article 590 also applies. The arrangement of the Code is such that Chapter 5 supplements or modifies Chapters 1 through 4. For an installation that has been determined to be temporary, the requirements in 590.4 for feeders and branch circuits can be utilized. This permits Type NM and NMC cables to be used for feeder and branch circuits without concealment or construction limitations during a temporary installation.*

**2. What size ground is needed for an amateur radio tower, and how should it be grounded?**

*810.21 Grounding Conductors — Receiving Stations.*

*Grounding conductors shall comply with 810.21(A) through (K).*

*(H) Size. The grounding conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.*

*(E) Run in Straight Line. The grounding conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable from the mast or discharge unit to the grounding electrode.*

*(F) Electrode. The grounding conductor shall be connected as required in (F)(1) through (F)(3).*

*(1) In Buildings or Structures with an Intersystem Bonding Termination. If the building or structure served has an intersystem bonding termination, the grounding conductor shall be connected to the intersystem bonding termination.*

*(2) In Buildings or Structures with Grounding Means. If the building or structure served has no intersystem bonding termination, the grounding conductor shall be connected to the nearest accessible location on the following:*

*(1) The building or structure grounding electrode system as covered in 250.50*

*(2) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52*

*(3) The power service accessible means external to the building, as covered in 250.94*

*(4) The metallic power service raceway See related ROP*

*(5) The service equipment enclosure, or*

*(6) The grounding electrode conductor or the grounding electrode conductor metal enclosures*

*A bonding device intended to provide a termination point for the grounding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on non-removable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is non-removable.*

*(3) In Buildings or Structures Without Intersystem Bonding Termination or Grounding Means. If the building or structure served has no intersystem bonding termination or grounding means, as described in 810.21(F)(1). See related ROP*

*(1) To any one of the individual electrodes described in 250.52; or*

*(2) If the building or structure served has no grounding means, as described in 810.21(F)(1) or (F)(2), to an effectively grounded metal structure. See related ROP*

*(G) Inside or Outside Building. The grounding conductor shall be permitted to be run either inside or outside the building.*

**3. What is the difference between a cellular metal floor raceway and an underfloor raceway? How can you identify which wiring method and article apply when you see them installed?**

*Answer; easily before the floor is poured.*

*Article 374 Cellular Metal floor raceways = the Cell is part of the floor material the header is installed from a distribution point to the floor cell so that conductors can be installed in the floor cells*

*Article 390 Underfloor raceways are floor duct installed within the concrete floor to install receptacle pedestals etc. “Walker duct” is a brand.*

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

*The installation described would fall under NEC 411.5(D) which says that Chapter 3 wiring methods must be applied. These wiring methods would specify that any connections or splices would have to be accessible. The listing under UL Product Category Low Voltage Lighting Systems (IFDR) on page 164 in the 2009 UL White Book indicates that the manufacturer's instructions are to be followed for the installation and wiring method applied.*

**5. 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 R502.8.1 and 2308.10.4.2 state that I must stay at least 2" from the edge of that joist. Which rule do I go with?**

*The most restrictive rule. 300.4(A)(1) does require cables to be an inch and a quarter away from the edge of the framing members. When installed closer than an inch and a quarter they need to be protected with a steel plate at least a 1/16th of an inch. The IRC and IBC do require the cable to be routed two inches from the bottom of the floor joist. Since the building code is more restrictive I would suggest that you follow the most restrictive rule.*

*(A) Cables and Raceways Through Wood Members.*

*(1) Bored Holes. In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1 1/4 in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (1/16 in.) thick, and of appropriate length and width installed to cover the area of the wiring.*

*R502.8.1 Sawn Lumber. ...Holes shall not be closer than 2 inches to the top or bottom of the member or to any other hole located in the member. ...*

*2308.10.4.2 Notches and holes. ... Holes bored in rafters or ceiling joists shall not be within 2 inches of the top and bottom and their diameter shall not exceed one-third the depth of the member.*

*The most restrictive rule. NEC 300.4(A)(1) IRC R502.8.1 IBC 2308.10.4.2*

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

*Yes, Page 168 314.16 (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).*

**7. A master bedroom has a fireplace with an electronic starter. Is this electronic starter required to be AFCI protected? If so, will the AFCI sense the arcing of the electronic starter as a fault, resulting in a nuisance-trip?**

*Reference: NEC 210.12 AFCI - Outlet Location Requirement*

*The outlet in the bedroom is required to be protected by AFCI unless you live in Indiana.*

*An electronic starter is not going to use a 120V to ground arc as the starting means, generally a Class 2 Power Supply. The AFCI is not going to recognize this arc as a hazardous condition though the transformer.*

**8. Is it required to have a "bubble-style" "in-use" cover on a receptacle in an indoor car wash?**

*Reference 406.8(B)(1) and Article 100 Location, Wet*

*Assuming the receptacle being use is either a 15 or 20 amp receptacle. Yes, 406.8(B)(1) requires a cover that is listed for a wet location when the plug of the product is unattended. Location, Wet under Article 100 includes vehicle wash areas.*

*The exception in 406.8(B)(1) is intended for areas that are routinely hosed down such as in the food processing plants and is not intended for vehicle wash areas.*

**9. 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. I can't find anything in the Code to address this problem.**

*The space in front of electrical equipment is 'working space' while space above and below is the 'dedicated space'. Working space is required to allow workers to perform functions without jeopardizing their safety while working on energized equipment. Sufficient working space is required about all electrical equipment for safe operation and maintenance. Neither of these contains a specific requirement for the space to be on a level surface. An additional issue might be the handle height of any overcurrent devices within the equipment. Section 240.24(A) requires the center of the handle to be not more than six feet seven inches above the floor or working platform. The AHJ would have to determine if the equipment is being provided with space for safe operation and maintenance and what standing position would be utilized to measure the handle height.*

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

*410.10(D) Bathtub and Shower Areas. No parts of cord-connected luminaires, chain-, cable-, or cord-suspended luminaires, lighting track, pendants, or ceiling-suspended (paddle) fans shall be located within a zone measured 900 mm (3 ft) horizontally and 2.5 m (8 ft) vertically from the top of the bathtub rim or shower stall threshold.*

*680.22(C) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.*

*(1) New Outdoor Installation Clearances. In outdoor pool areas, luminaires, lighting outlets, and ceiling-suspended (paddle) fans installed above the pool or the area extending 1.5 m (5 ft) horizontally from the inside walls of the pool shall be installed at a height not less than 3.7 m (12 ft) above the maximum water level of the pool.*

*(2) Indoor Clearances. For installations in indoor pool areas, the clearances shall be the same 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 2.3 m (7 ft 6 in.) above the maximum pool water level:*

*I could find no other minimum Height requirements. Suggest reviewing the instructions that came with the Listed fan or use common sense.*

**11. How deep must the wiring be within 5 ft of an in-ground swimming pool?**

*Answer; 680.10 Table 680.10 RMC and IMC 6 inch PVC 18 inches other approved raceways 18 inches*

**12. Cables to be used with directional boring must be approved for the purpose. Can these same cables be continued as direct burial conductors within a trench where the directional boring ends?**

*NEC 300.5(K) is the only mention of directional boring as an installation method and it states that cables or conduits to be used are to be "approved for the purpose". Approval is acceptable to the Authority Having Jurisdiction. Since directional boring is in essence direct burial in the case of a cable one criteria that should be applied for "approval" is that cable be suitable for direct burial. With that rating, then the cable would be also be suitable to be laid in a trench.*

*Presently, there are no cables UL Listed for directional boring.*

**13. I neglected to connect to the rebar in the footings of a new building. Can the re-bar in the concrete basement walls be utilized for the UFER electrode instead?**

*Yes, 250.53(A)(3). The 2008 Code has increased the requirement to include the rebar in the foundation that is routed vertically to be utilized as a concrete encased electrode. The last sentence of 250.53(A)(3) was modified that when more than one concrete encased electrode is present; it is permissible to bond only one of them to the grounding electrode system.*

*250.53(A)(3) Concrete-Encased Electrode. An electrode encased by at least 50 mm (2 in.) of concrete, located horizontally near the bottom or vertically, and within that portion of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 6.0 m (20 ft) of one or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (1/2 in.) in diameter, or consisting of at least 6.0 m (20 ft) of bare copper conductor not smaller than 4 AWG. Reinforcing bars shall be permitted to be bonded together by the usual steel tie wires or other effective means. Where multiple concrete-encased electrodes are present at a building or structure, it shall be permissible to bond only one into the grounding electrode system.*

*Yes, 250.53(A)(3).*

**14. 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?**

No, it is required for multiwire branch circuits. Some weird stuff can happen when you loose the grounded conductor on a multiwire circuit. I have seen light bulbs and TVS get real bright, but not for long. Lets look at page 132 300.13 (B) titled *DEVICE REMOVAL* that states In multiwire branch circuits the continuity of a grounded shall not depend on device connections such as lamp holders receptacles and so forth, where the removal of such device would interrupt the continuity.

**15. What type of panel can I use in an indoor room where it is subject to hose-down and splashing water?**

Reference: NEC 110.20 Enclosure Types

Type 4X.

**16. Can SER aluminum cable be installed in an underground conduit from a house to feed a garage panel?**

Reference: Section 338.12(A)(2)

No, SE Style R cable, also know as SER cable is a SE cable and is not permitted to be used in an underground application whether it is, or is not, installed in a raceway per 338.12(A)(2)

**17. Which of the following circuits in a PV System require a disconnecting means? The PV output circuit? The inverter output circuit? The storage battery circuit?**

The requirements for photovoltaic (PV) system disconnecting means are covered in Article 690, Part III – Disconnecting Means and Part VIII – Storage Batteries.

For the PV output circuit - A disconnecting means is required to separate current-carrying conductors of the photovoltaic system from all other building conductors per 690.13 and 690.14.

For PV equipment in general - In accordance with 690.15, a disconnecting means is required to separate equipment such as the inverter or batteries from the ungrounded conductors of all sources.

For storage batteries - In addition to the disconnecting means from the source (690.15), battery systems operating at more than 48 volts have requirements for a maintenance disconnecting means in accordance with 690.71(E) and (F). For these systems a disconnecting means is required to break the battery string into twenty-four or less cells and to disconnect the grounded conductor.

It is possible for a disconnecting means to serve more than one function.

**18. What is the ampacity of (6) # 4 AWG THHN cu conductors that have a total length of 150', of which 12' pass through a boiler room with an ambient temperature of 125 degree F?**

310.15 Ampacities for Conductors Rated 0–2000 Volts.

(2) Selection of Ampacity. Where more than one calculated or tabulated ampacity could apply for a given circuit length, the lowest value shall be used.

Exception: Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity shall be permitted to be used beyond the point of transition, a distance equal to 3.0 m (10 ft) or 10 percent of the circuit length figured at the higher ampacity, whichever is less.

FPN: See 110.14(C) for conductor temperature limitations due to termination provisions.

(2) Adjustment Factors.

(a) More Than Three Current-Carrying Conductors in a Raceway or Cable. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

ASSUMING (6) CURRENT CARRYING CONDUCTORS IN A CONDUIT.

TABLE 310.16 #4 CU THHN = 95 AMPS

DERATE FOR MORE THAN 3 CURRENT CARRYING CONDUCTORS IN RACEWAY

= 95 AMPS x 0.8 = 76 AMPS

DERATE FOR AMBIENT TEMPERATURE THRU BOILER ROOM SEE CORRECTION FACTORS AT BOTTOM OF TABLE 125 DEGREE F = .76 FACTOR

76 AMPS X .76 = 57.76 AMPS

HOWEVER SEE EXECPTION IF 10% OF CIRCUIT LENGTH OR LESS, HIGHER VALUE CAN BE USED.

ANSWER ONLY DERATE FOR MORE THAN 3 CURRENT CARRYING CONDUCTORS = 76 AMPS

**19. I'm working in very rocky soil and can't drive the ground rod the entire eight feet. Are there other acceptable ways for the installation other than cutting it off?**

*Answer; Yes, 250.53 (G) It can be driven at a oblique angle not to exceed 45 degrees. Or buried in a trench at least 30 inches deep.*

**20. Where can I find the smoke characteristic ratings for the different insulations of conductors listed in 310.13(A)?**

*Both UL 83 (Thermoplastic) and UL 44 (Thermoset) building wire standards permit these wires (THW, THHN, THWN, XHHW, RHW, etc) to have a "ST1" formerly "LS" marking which means the wire complies with limited smoke requirements. This smoke test is part of either the vertical-tray flame test or the FT4 flame test. So if the wire is marked with this "ST1" designation the smoke characteristics are identified as the low smoke producing type insulation. If there are no markings, then the characterization of the smoke production has not been done. The UL Guide Information for Thermoplastic Insulated Wire (ZLGR) located on page 430 in the 2009 White Book includes the information on the ST1 rating. The Guide Information for UL Product Category Thermoset Insulated Wire (ZKST), (also on page 430) is in the process of being updated to reflect the ST1 rating information.*

**21. A grounding electrode system consists of a cold water pipe, a UFER, and a ground rod. The size of the service entrance conductors is 500kcmil copper. Is it acceptable to install a 1/0 cu grounding electrode conductor to the water pipe, then a # 4 cu conductor from the water pipe to the UFER, then # 6 cu from the UFER to the ground rod?**

*250.66 Size of Alternating-Current Grounding Electrode Conductor.*

*The size of the grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system of a grounded or ungrounded ac system shall not be less than given in Table 250.66, except as permitted in 250.66(A) through (C).*

*(A) Connections to Rod, Pipe, or Plate Electrodes. Where the grounding electrode conductor is connected to rod, pipe, or plate electrodes as permitted in 250.52(A)(5) or (A)(7), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire.*

*(B) Connections to Concrete-Encased Electrodes. Where the grounding electrode conductor is connected to a concrete-encased electrode as permitted in 250.52(A)(3), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than 4 AWG copper wire.*

*Yes 250.66(A)(B)*

**22. Are the traveler conductors for three-way and four-way switches considered part of the switch loops? Can the white wire be used as a traveler conductor if it is permanently re-identified with a hot color?**

*Yes, the traveler conductors for three-way and four-way switches are considered part of the switch loops. Let's look at page 44 200.7(C)(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.*

**23. Is a main breaker required for a lighting and appliance panelboard that is fed from the secondary of a step-down transformer?**

*Assume this is not a Service and answer based on the 2008 NEC*

*Reference: NEC 408.36*

*The general requirement is to protect the panelboard with an overcurrent device. Yes*

*The permission to use the 10ft tap to a power panelboard without protection is no longer permitted.*

*The lighting and appliance designation is no longer recognized due to a change in the 2008 NEC.*

**24. What is the difference between non-homogenous PVC and homogenous PVC?**

*Reference: 352.10(G)*

*A PVC conduit becomes a non-homogenous when foaming agents are added to the PVC resin at the point of extrusion. Foaming is an acceptable method used to remove material from thick wall products such as conduits*

and enclosures. The foaming of product can actually increase the strength of the product by creating a structural formation within the wall.

Panel 8 was addressing the issue of non-homogenous PVC and homogenous PVC during the 2008 NEC process. Listed non-homogenous PVC and homogenous PVC conduit are acceptable to be used throughout the Code. The language found in 352.10(G) will be removed from the 2011 NEC per Proposal 8-68.

**25. Many jurisdictions have adopted the new energy codes. Will the NEC incorporate these requirements or leave it up to the AHJ since it is not an international requirement?**

*The purpose of the NEC is provided in 90.1. The NEC is concerned with the practical safeguarding of people and property from the hazards of the use of electricity. It addresses electrical installations and contains minimum requirements that are considered necessary for an electrical installation to be essentially free of hazards. As such it does not address energy efficiency. The NEC allows for installations beyond its requirements. For example, it does not prohibit a level of energy efficiency from being obtained by the installation of larger gauge wire than required by the NEC. An energy efficient installation is not necessarily free from electrical hazards; it is essentially free from the hazards when installed in accordance with the NEC. I will not rule out the idea of the NEC requiring energy efficiency in the future. However, at this point in time, it is not required.*

**26. Are the receptacles installed on porches and landings counted as the required receptacles for the front and back of the residence if they can't be accessed at grade level? Is a 24" elevation of the deck or landing still at grade level?**

*PART A- NO, PART B – YES LESS THAN 6 ½'*

*210.52 Dwelling Unit Receptacle Outlets.*

*(E) Outdoor Outlets. Outdoor receptacle outlets shall be installed in accordance with (E)(1) through (E)(3).*

*[See 210.8(A)(3).]*

*(1) One-Family and Two-Family Dwellings. For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet accessible while standing at grade level and located not more than 2.0 m (6½ ft) above grade shall be installed at the front and back of the dwelling.*

*(2) Multifamily Dwellings. For each dwelling unit of a multifamily dwelling where the dwelling unit is located at grade level and provided with individual exterior entrance/egress, at least one receptacle outlet accessible from grade level and not more than 2.0 m (6½ ft) above grade shall be installed.*

*(3) Balconies, Decks, and Porches. Balconies, decks, and porches that are accessible from inside the dwelling unit shall have at least one receptacle outlet installed within the perimeter of the balcony, deck, or porch. The receptacle shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch surface.*

*Exception to (3): Balconies, decks, or porches with a usable area of less than 1.86 m<sup>2</sup> (20 ft<sup>2</sup>) are not required to have a receptacle installed.*

**27. Would NEC 300.15 apply to fittings such as flexible metal to EMT fittings that are installed in a wall for a remodel job where all portions of the installation will be covered?**

*Answer; Yes or no, Would this need to be accessible Audience disagreed since they and UL CM felt this was an coupling I feel it is an adapter. Listed to 514D*

**28. What is the difference between tamper-proof and tamper-resistant receptacles?**

*The Code doesn't refer to Tamper Proof receptacles and neither does UL, TAMPER-RESISTANT RECEPTACLE is defined in UL 498 the standard for Receptacles as – A receptacle which by its construction is intended to limit improper access to its energized contacts and is intended for use in pediatric patient care areas, in accordance with 406.11 and 517.18 of the National Electrical Code, ANSI/NFPA-70.*

*Tamper proof used to be in the NEC from 1981 until the 1990 cycle and was replaced with tamper resistant and it is not a defined term in the NEC or the UL Standard, It seems some manufacturers haven't caught up with the change in terminology and promote their tamper resistant receptacles as tamperproof.*

*However, the dictionary defines tamper proof as that cannot be tampered with; impervious to tampering Tamper resistant receptacles are UL Listed under the category of Receptacles for Plugs and Attachment Plugs (RTRT) located on page 327 of the 2009 UL White Book.*

**29. I have a service on a concrete commercial building (no structural steel) with a total of 1200 kcmil cu service entrance conductors. The water service is ductile pipe with a bituminous coating, so there is no**

**metal pipe in contact with the earth. The UFER has a # 4 cu grounding electrode conductor connected to it. A ground rod has a # 6 cu grounding electrode conductor connected to it. NEC 250.66 required a 3/0 cu grounding electrode conductor but there is no place to connect it. Am I right in requiring the electrical contractor to install a 3/0 bare copper conductor, 36" deep, for a total minimum length of 20' in the earth to satisfy 250.66?**

*Since the water piping system does not meet the requirements of a metal underground water pipe electrode you would not have to include it in the grounding electrode system. The concrete encased electrode is being utilized and the conductor of a 4 AWG is properly sized. The use of a ground rod is also being used even though it is not required if you have a concrete encased electrode.*

*250.50 Grounding Electrode System.*

*All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.*

*(4) Ground ring (5) Rod or Pipe (6) Other listed electrodes (7) Plate (8) Other underground systems*

*250.50 No*

**30. The building code requires egress lighting for stairs but does not dictate if it needs to be on an emergency circuit. It is not a requirement of the NEC. Are we required to install and inspect it?**

*No the Building Code does not require an emergency circuit, it does require illumination and it does require emergency power*

*On page 205 in the 2006 INTERNATIONAL BUILDING CODE Section 1006.3 is titled Illumination Emergency Power.*

*It states, the power supply for means of egress illumination shall normally be supplied by the premises' electrical supply*

*The emergency power system shall provide power for duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702 IBC*

*In the event of power supply failure, an emergency electrical system shall automatically illuminate the following areas:*

*Aisles and unenclosed egress stairways in rooms and spaces that require two or more means of egress.*

*Corridors, exit enclosures and exit passageways in buildings required to have two or more exits.*

*Exterior egress components at other than the level of exit discharge until exit discharge is accomplished for buildings to have two or more exits.*

*Interior exit discharge elements, as permitted in section 1024.1, in buildings required to have two or more exits.*

*Exterior landings, as required by section 1008.1.5 for exit discharge doorways in buildings required to have two or more exits.*

*If you are the installing contractor yes you are required to install it.*

*If you are a Building Inspector or multi inspector yes you need to inspect for it and require it.*

*If you are an Electrical Inspector, article 700 has several requirements for you. This may be a good time for the Electrical Inspector and the Building Inspector to work together to make sure that both the Electrical Code and the Building Code are followed.*

*700.4 Tests and Maintenance.*

*(A) Conduct or Witness Test. The authority having jurisdiction shall conduct or witness a test of the complete system upon installation and periodically afterward.*

*(B) Tested Periodically. Systems shall be tested periodically on a schedule acceptable to the authority having jurisdiction to ensure the systems are maintained in proper operating condition.*

*(C) Battery Systems Maintenance. Where battery systems or unit equipments are involved, including batteries used for starting, control, or ignition in auxiliary engines, the authority having jurisdiction shall require periodic maintenance.*

*(D) Written Record. A written record shall be kept of such tests and maintenance.*

*(E) Testing Under Load. Means for testing all emergency lighting and power systems during maximum anticipated load conditions shall be provided.*

**31. What is the maximum ambient temperature allowed before de-rating is required?**

*Which part of the electrical system?*

*Equipment*

*NEC 110.3(b) ---- Example Note the “40C” marked on a circuit breaker – 105 Deg F*

*Wiring Method*

*Note the Wiring ambient Correction at the bottom of each table*

*NEC 310.15*

*86 Deg F*

**32. An underground feeder is run from the main building service which used the 6-handle rule to another building on the same property. Can I use the 6-handle rule again for the service on the second building?**

*Reference: 225.33(A) Maximum Number of Disconnects.*

*I was told to respond to this question with a resounding “Yes” and thank Mr. Owen for being the moderator.*

*First I want to clarify that this is not a “service to the second building” as indicated in the question but a “feeder”. So the question should read “Can I use the 6-handle rule for the feeder at the second building?”*

*Section 225.33(A) permits “not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard”. Yes, all the other requirements must be complied with such as 225.34 through 225.40, but I don’t see this as being difficult to meet using the customary equipment.*

*Maybe I’m missing something here, but I don’t see the problem or why the question is being asked.*

**33. Is a receptacle required in all residential garages?**

*The requirements for garage receptacles are provided in 210.52(G)(1). Receptacles are required in all garages attached to the dwelling. A detached garage is only required to have a receptacle if the garage is provided with power. Therefore, if the detached garage has power for a light it also needs a receptacle. The NEC does not require receptacles in multi-family dwelling garages.*

**34. How many # 12 AWG conductors can be installed in a 3/8” flexible metal conduit?**

*We need to know what type of wire, and is fitting inside or outside?*

*348.22 Number of Conductors.*

*The number of conductors shall not exceed that permitted by the percentage fill specified in Table 1, Chapter 9, or as permitted in Table 348.22, or for metric designator 12 (trade size).*

*Cables shall be permitted to be installed where such use is not prohibited by the respective cable articles. The number of cables shall not exceed the allowable percentage fill specified in Table 1, Chapter 9.*

*Table 348.22 Maximum Number of Insulated Conductors in Metric Designator 12 (Trade Size) Flexible Metal Conduit\**

Size (AWG)	Types RFH-2, SF-2		Types TF, XHHW, TW		Types TFN, THHN, THWN		Types FEP, FEBP, PF, PGF	
	Fittings Inside Conduit	Fittings Outside Conduit	Fittings Inside Conduit	Fittings Outside Conduit	Fittings Inside Conduit	Fittings Outside Conduit	Fittings Inside Conduit	Fittings Outside Conduit
18	2	3	3	5	5	8	5	8
16	1	2	3	4	4	6	4	6
14	1	2	2	3	3	4	3	4
12	—	—	1	2	2	3	2	3
10	—	—	1	1	1	1	1	2

*\*In addition, one insulated, covered, or bare equipment grounding conductor of the same size shall be permitted.*

**35. Is it permissible for a wireway to contain both 120 volt and 277 volt wires?**

*Yes 300.3(C) (1) they would all have to have the same voltage rating insulation equal for the 277 circuit.*

*Article 376 also does not prohibit*

**36. An old house has 2-wire ungrounded circuits in some rooms. Can I replace these with new ungrounded receptacles? Do they have to be tamperproof?**

*For the first question, yes, per 406.3(D)(3)(a), an existing non-grounding type (two wire) receptacle can be replaced in kind with another non-grounding type receptacle as long as there is no equipment grounding conductor or other means for grounding in the device box. For the second question, there is no requirement that older receptacles being replaced in general would have to be the tamper resistant type. The only retroactive rule for receptacle replacement is 406.3(D)(2) where if the present Code requires a GFCI protected receptacle, then the replacement would have to be a GFCI type to afford that protection.*

**37. Is a fire suppression water sprinkler line required to be used as a grounding electrode the same as the metal water service?**

*Yes, The code requires all metal water piping to be utilized with the grounding electrode system.*

*250.50 Grounding Electrode System.*

*All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.*

*250.52 Grounding Electrodes.*

*(A) Electrodes Permitted for Grounding.*

*(1) Metal Underground Water Pipe. A metal underground water pipe in direct contact with the earth for 3.0 m (10 ft) or more (including any metal well casing bonded to the pipe) and electrically continuous (or made electrically continuous by bonding around insulating joints or insulating pipe) to the points of connection of the grounding electrode conductor and the bonding conductors. Interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building shall not be used as a part of the grounding electrode system or as a conductor to interconnect electrodes that are part of the grounding electrode system.*

*250.50, 250.52(A)(1) Yes*

**38. Are the branch circuit conductors supplying power to the baseboard heaters in a residential bedroom required to be AFCI protected?**

*Yes on page 49, 210.12 (B) if the baseboard heater is a 120 volt and on a 15 or 20 ampere circuit. It does not mention 240 volt circuits.*

**39. I installed a 150 KVA step-down transformer to supply a 120/208 volt, 400 amp main breaker panelboard. The secondary conductors are 500 kcmil cu THHN/THWN. I failed the inspection. Doesn't 240.4 (B) allow this installation?**

*NEC 240.21(c) ---- Transformer Secondary Protection for conductors*

*The conductors must be sized for the device in which it is landed to limit the load current to the ampacity permitted by 310.15. You must have a 400A conductor and no round up permitted. A 500kcmil is only a 380A conductor.*

*“The secondary conductors terminate in a single circuit breaker or set of fuses that limit the load current to not more than the conductor ampacity that is permitted by 310.15.”*

**40. Is there any additional temperature rise requirement for the conductors in metal conduits versus PVC conduits running across a roof?**

*Reference: 310.15(B)(2)(c) and Table 310.15(B)(2)(c)*

*No, per Section 310.15(B)(2)(c), a temperature adder is required to be used. Section 310.15(B)(2)(c) refers you to Table 310.15(B)(2)(c) where you find the “Temperature Adders” for conduit installed on rooftops exposed to the sun. The values found in the table are the same for metallic or nonmetallic conduits.*

*This section is new, as mandatory text, for the 2008 NEC. The 2005 NEC only referenced the possibility as a Fine Print Note.*

*Per proposal 6-66, Panel 6 accepted a proposal to change “conduit” to “circular raceways” for the 2010 which will exempt non-circular raceways such as Wireway. There were several rejected proposals to add cables to the requirement.*

**41. NEC 400.4 seems to contain a lot of information that is very seldom or never used. Why isn't it in the annex?**

*The NEC does not require all flexible cords or flexible cables to be listed. The information in Table 400.4 provides an AHJ or others with the minimum construction requirements necessary as a basis of approval of a flexible cord or cable installed in accordance with the provisions of Article 400.*

**42. When are flexible cords, not required to be equipped with attachment plugs, allowed to be energized from a receptacle outlet?**

*400.7 Uses Permitted.*

*(A) Uses. Flexible cords and cables shall be used only for the following:*

- (1) Pendants*
- (2) Wiring of luminaires*
- (3) Connection of portable luminaires, portable and mobile signs, or appliances*
- (4) Elevator cables*
- (5) Wiring of cranes and hoists*
- (6) Connection of utilization equipment to facilitate frequent interchange*
- (7) Prevention of the transmission of noise or vibration*
- (8) 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*
- (9) Connection of moving parts*
- (10) Where specifically permitted elsewhere in this Code*

*(B) Attachment Plugs. Where used as permitted in 400.7(A)(3), (A)(6), and (A)(8), each flexible cord shall be equipped with an attachment plug and shall be energized from a receptacle outlet.*

*Proposal to Change 2008 NEC*

*6-154 Log #2641 NEC-P06*

*Final Action: Accept in Principle*

*(400.7(B))*

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*Submitter: Dan Leaf, Seneca, SC*

*Recommendation: Add: "cord connector" after "receptacle outlet".*

*Substantiation: Edit. Such attachment plugs may also be energized from a cord connector body.*

*Panel Meeting Action: Accept in Principle*

*Add: "or cord connector body" after "receptacle outlet".*

**43. How many compact 1/0 AWG XHHW aluminum conductors are permitted in a 620 mm (24.4") long, 41 mm (1 1/2" trade size), IMC nipple?**

*Answer; 8 at 60% fill*

*Chapter 9 Table 1 and note (4) permits 60% fill Table 5A .1590 in<sup>2</sup> Table 4 list 60% fill to be 1.334 in<sup>2</sup>*

*Which means you could put 8 1/0 compact strand conductors in the 1 1/2 in by 24 inch nipples.*

**44. What is the difference between a 15 amp and a 20 amp receptacle?**

*5 Amps. Depending on voltage, there is a configuration difference so that a 20 Amp cord cap cannot be inserted into a 15 Amp rated receptacle, but a 15 Amp cord cap can be inserted into a 20 Amp configured receptacle.*

**45. A structure has five 200 amp services, each of which is fed with 4-3/0 THWN cu conductors. I want to run one main grounding electrode conductor to the main ground electrode and tap each 200 amp service to it. What size do my taps and main grounding electrode conductors need to be?**

*The requirement for grounding electrode conductor taps is found in 250.64(D).*

*250.64(D) Service with Multiple Disconnecting Means Enclosures. Where a service consists of more than a single enclosure as permitted in 230.71(A), grounding electrode connections shall be made in accordance with (D)(1), (D)(2), or (D)(3).*

*(1) Grounding Electrode Conductor Taps. Where the service is installed as permitted by 230.40, Exception No. 2, a common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded service-entrance conductor(s). Where the service-entrance conductors connect directly to a service drop or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, Note 1. A tap conductor shall extend to the inside of each service disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest conductor serving the individual enclosure. The tap conductors shall be connected to the common grounding electrode conductor by exothermic welding or with connectors listed as grounding and*

*bonding equipment in such a manner that the common grounding electrode conductor remains without a splice or joint.*

*We have 3/0 conductors paralleled four times that have an accumulated circular mil size of (167,800 cm times 4) 671,200 cm. If a main grounding electrode conductor were routed from the main grounding electrode to the service it would be a 2/0 AWG. The tap conductor to each 200 amp service is based on the service conductors routed to each service disconnect. If that conductor were a 3/0 copper the grounding electrode tap would be a 4 AWG. If a 4/0 were used than a 2 AWG would be required.*

*250.64(D), 250.66, Chapter 9, Table 8 2/0 4AWG if using 3/0 2 AWG if using 4/0*

**46. What is the maximum number of # 2 AWG RHH conductors that can be installed in a 590 mm (23.25") long, 53 mm (1/2" trade size) schedule 80, PVC raceway?**

*Chapter 9 Note 4 page 671 allows a 60% fill for nipples 24 inches or less.*

*(4) Where conduit or tubing nipples having a maximum length not to exceed 600 mm (24 in.) are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to 60 percent of their total cross-sectional area, and 310.15(B)(2)(a) adjustment factors need not apply to this condition.*

*Chapter 9 Table 4 page 674 shows 1/2 inch schedule 80 with 60% fill at .130 square inches allowed.*

*Chapter 9 Table 5 page 676 shows # 2 RHH as .1742 sq. in.*

**47. Can the factory-installed neutral wire on an AFCI breaker be shortened to make a neater looking panel installation?**

*Yes – the factory installed pigtail is intended to be long enough to reach from the furthest intended circuit installation location to the neutral connector in the panel.*

**48. Is it permissible to run the power cord for a ceiling-mounted, overhead projector up through the pipe supporting the projector, and to plug it into a receptacle located above the suspended ceiling?**

*Reference: 400.8(5)*

*Power cord is not permitted to be used above suspended ceilings per Section 400.8(5). Projectors below suspended ceilings utilize a mounting plate that is secured to the T-Frame and where metal outlet boxes assembled to the plate. The acceptable wiring method is used with the metal outlet box above the suspended ceiling. The projector is then plugged in the receptacle that is flushed to the tile.*

*It is acceptable to install signaling cables into the "Projector Pipe" which are usually slotted. If the suspended ceiling is used for environmental air return then the signaling cable needs to be listed for use in a plenum.*

**49. What is the minimum ventilation required for a 60 amp, 208 volt, single phase electric vehicle charging system for indoor charging?**

*The requirements for an electric vehicle charging system are in Article 625. There are three methods, in 625.29(D), by which to determine minimum ventilation requirements. The first is to obtain a value directly from Table 625.29(D)(1) or (D)(2). The second is to calculate the necessary ventilation for a specific supply voltage and current (not provided on the tables) using the equation provided in 625.29(D)(2). The third method in 625.29(D)(3) allows for an engineered system where the minimum ventilation requirement is calculated as part of that study.*

*For this question, 208 volt, 60 amp, single phase is on the tables. Using Table 625.29(D)(2), the required ventilation is 256 cfm per vehicle being charged while using Table 625.19(D)(1) for metric units requires 7.3 m<sup>3</sup>/min.*

**50. Can you explain the rationale that requires the overcurrent protective device for a fire pump on normal power to carry the locked-rotor current indefinitely while only requiring short-circuit current protection for the emergency generator OC device for the fire pump?**

*695.4 Continuity of Power.*

*(B)(1) Overcurrent Device Selection. The overcurrent protective device(s) shall be selected or set to carry indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply. The next standard overcurrent device shall be used in accordance with 240.6. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s).*

695.5(B) *Supervised Connection.* A single disconnecting means and associated overcurrent protective device(s) shall be permitted to be installed between a remote power source and one of the following:

(3) A listed combination fire pump controller and power transfer switch

*For systems installed under the provisions of 695.3(B)(2) only, such additional disconnecting means and associated overcurrent protective device(s) shall be permitted as required to comply with other provisions of this Code. Overcurrent protective devices between an on-site standby generator and a fire pump controller shall be selected and sized according to 430.62 to provide short-circuit protection only.*

*The difference is that locked rotor is not the same as short circuit. Short circuit protection keeps the arc-flash and arc-blast levels down for personnel protection.*

**51. What is the jam ratio for pulling three, 250 kcmil THW compact conductors into a 53 mm (2" trade size), HDPE conduit?**

*Answer; When the conduit I.D. is between 2.8 and 3.2 of the conductor O.D. jamming is likely to occur*

52. In NEC 250.64 (C) (2), numbers (3) & (4) have been deleted from the 2005 NEC. Does this mean that a grounding electrode conductor can be run from a grounding electrode to a grounding bar in a sub panel, with another grounding electrode conductor attached to the same ground bar in the sub panel, and then run to the main disconnect?

*These two subparts were relocated to 250.64(F) in the 2008 NEC. This was done to better align the allowance for the busbar to show connections of grounding electrodes together with bonding jumpers and not to confuse these bonding jumpers with the grounding electrode conductor. The grounding electrode conductor, now defined as going from the equipment to a grounding electrode or the grounding electrode system, is to be unspliced and 250.64(F) now makes it clear that one of the points of termination of the unspliced GEC is on this busbar used to bond together two or more electrodes to form the grounding electrode system.*

*With respect to the question as posed, no, it is not permissible to install the grounding electrode conductors to a panelboard equipment ground bus and then continue the grounding electrode conductor to the main service equipment, that is a splice since both conductors are being termed a "grounding electrode conductor".*

**53. Is it permissible to install a circuit breaker panelboard in a toilet room when it has the required working clearances if it can only be accessed through the bathroom?**

*Yes, if the building is anything other than a dwelling unit. Section 240.24(E) does not permit overcurrent devices in dwelling unit bathrooms.*

*240.24(E) Not Located in Bathrooms. In dwelling units and guest rooms or guest suites of hotels and motels, overcurrent devices, other than supplementary overcurrent protection, shall not be located in bathrooms.*

*The working clearances of 110.26 would of course need to be met.*

*240.24(E) and 110.16*

**54. What size neutral conductor is required for a three-phase, 4-wire, wye-connected service that feeds electric discharge lighting with ungrounded conductors of 250 kcmil THW copper?**

*If we look at 250.66 a # 2 could be used if the loads are balanced. Larger depending on the unbalanced load. Not larger than 250 kcmil.*

*Page 98 250.24 (C) (1) Routing and Sizing. This conductor shall be routed with the phase conductors and shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service-entrance phase conductor.*

**55. The residential furnace room is not listed as a required room that needs AFCI protection. Can this room be on a standard circuit?**

*Is it a furnace room or a closet?*

*Reference: NEC 210.12 – "Closet" is in the list of rooms requiring AFCI protection*

**56. What is the ampacity of (4) # 8 THHN cu conductors in EMT exposed to direct sunlight in an ambient temperature of 100 degrees F, and located 3" above a roof?**

*Reference: 300.9, Section and Table 310.15(B)(2)(c), 310.15(B)(2), Table 310.16*

*First, per section 300.9, THHN is an unacceptable conductor to be used since it is not listed for a wet location.*

Assuming that THWN-2 is used, Per Table 310.15(B)(2)(c) and since the EMT is supported 3" above the roof a Temperature Adder of 40 degrees F needs to be added to the ambient temperature of 100 degrees F, which equals 140 degrees F.

Since we have 4 #8 in the raceway, Section 310.15(B)(2) applies and an adjustment of 80% from Table 310.15(B)(2)(a) needs to be used on the values from Table 310.16.

Looking at Table 310.16 we see an ampacity of 55 amps is assigned for copper THWN-2 with a temperature rating 90 degrees C.

80% of 55 amps is 44 amps.

The correction factors for the 140 degree F ambient temperature indicate that we need to further reduce the ampacity by multiple the allowable ampacity by a correction factor of 0.71 for the 90 degree C conductor. Therefore the maximum capacity of the #8 THWN-2 Copper conductor is 31.2 amps for the 90 degree C conductor.

**57. A sprinkler pipe has been installed above the meter stack in an eight-unit multi-family dwelling. A 100-Ampere breaker is located beneath each meter. Does the pipe violate the dedicated equipment space requirement of NEC Section 110.26 (F)? What if there were no breakers in the meter stack?**

The dedicated space required in 110.26(F) applies specifically to switchboards, panelboards, distribution boards, and motor control centers. The intent is to provide space for cables, conduits, etc. to enter these types of equipment. A breaker installed beneath a meter stack is not typically in a switchboard or panelboard.

**58. Can the bonding for other systems such as telephone & CATV be accomplished by the use of a # 6 pigtail out of the electric panel and the use of split bolts?**

NO -

250.94 Bonding for Other Systems

An intersystem bonding termination for connecting intersystem bonding and grounding conductors required for other systems shall be provided external to enclosures at the service equipment and at the disconnecting means for any additional buildings or structures. The intersystem bonding termination shall be accessible for connection and inspection. The intersystem bonding termination shall have the capacity for connection of not less than three intersystem bonding conductors. The intersystem bonding termination device shall not interfere with opening a service or metering equipment enclosure. The intersystem bonding termination shall be one of the following:

(1) A set of terminals securely mounted to the meter enclosure and electrically connected to the meter enclosure. The terminals shall be listed as grounding and bonding equipment. See related

(2) A bonding bar near the service equipment enclosure, meter enclosure, or raceway for service conductors. The bonding bar shall be connected with a minimum 6 AWG copper conductor to an equipment grounding conductor(s) in the service equipment enclosure, meter enclosure, or exposed nonflexible metallic raceway.

(3) A bonding bar near the grounding electrode conductor. The bonding bar shall be connected to the grounding electrode conductor with a minimum 6 AWG copper conductor.

**59. Is it necessary to install caution tape above a service lateral installed in GRC?**

Answer; No, 300.5(D) and Pren (3) does require a marking tapes be placed above the direct buried cables or conductors it does not require conductors in raceways to be marked. However, Pren (4) requires GRC, IMC or schedule 80 PVC for protection where physical damage is likely to occur.

**60. There is an ongoing investigation concerning metal, casement window frames that are deteriorating because they are in contact with re-bar which is being utilized as a UFER grounding electrode. Is there any new information concerning this situation?**

I am not familiar with this study, neither is the UL research dept. To get to a resolution of the question, anyone with direct knowledge of this study, please contact UL.

**61. Are grounding electrode conductors permitted to be paralleled? Could two No. 1/0 copper conductors be used in place of a 3/0 for the grounding electrode conductor of a service over 1100 kcmil?**

No, Paralleled conductors are covered in 310.4 and they do not reference that the grounding electrode conductor can be installed in parallel.

310.4(A). Aluminum, copper-clad aluminum, or copper conductors of size 1/0 AWG and larger, comprising each phase, polarity, neutral, or grounded circuit conductor shall be permitted to be connected in parallel (electrically joined at both ends).

Section 250.64 covers the installation of the grounding electrode conductors and again routing a grounding electrode in paralleled is not addressed.

310.4(A), 250.64 No

**62. The 6-disconnect rule for services requires that the disconnects be grouped. Is there any maximum distance between disconnects?**

230.72 No, Gathered together in one location to form a group in a workmanship manner. Look at 3 chairs to your right and 2 to your left. They are 6 grouped together. Use common sense.

**63. Are meter sockets required to have a fault current withstand rating in accordance with section 110.10 of the NEC? Our utility says inspectors have no jurisdiction over the metering equipment, and it is not an issue.**

Reference: UL 414 Meter Sockets - Yes

The service point establishes who has jurisdiction. If that service point is the line side of the meter socket terminals then the AHJ is well within the parameters of NEC to ensure appropriate ratings.

**64. Can a PVC conduit be installed in a slab-on-grade dentist's office for an exam room if it contains a grounding conductor?**

Reference 517.2, 517.10 and 517.13(A).

No, the definition for Health Care Facilities tells us that a dental exam room is included per 517.2. 517.10 tells us that the exam area of the dentist office is covered by 517 Part II. 517.13(A) requires all branch circuits serving the patient care area shall be provided with an effective ground fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly. The metallic system is required to be an equipment grounding conductor (250.118).

**65. When installing wiring methods in ducts or plenums used for environmental air, which wiring methods are permitted?**

Section 300.22(B) contains the wiring methods permitted in a duct or plenum used for environmental air. The only wiring methods permitted in these ducts are: Smooth or corrugated Type MC cable, Type MI cable, electrical metallic tubing (EMT), flexible metallic tubing (FMT), intermediate metallic conduit (IMC), and rigid metallic conduit (RMC). These must not have a nonmetallic covering. Additionally, a four foot length of flexible metal conduit (FMC) is permitted to connect to a piece of equipment which is allowed to be installed in the duct.

**66. How far away from the diesel fuel-dispensing tank must the non-explosion-proof equipment be located?**

514.3 Classification of Locations.

(A) Unclassified Locations. Where the authority having jurisdiction can satisfactorily determine that flammable liquids having a flash point below 38°C (100°F), such as gasoline, will not be handled, such location shall not be required to be classified.

Otherwise see Table 514.3(B)(1) Class I Locations — Motor Fuel Dispensing Facilities

Beyond a 20' circle around fuel-dispensing tank to a height over 18" above grade would be the non-classified locations.

**67. Can I secure signal or communications cables to ceiling-support wires or ceiling grid?**

Answer Maybe 725.24, 8000.21 & 24, they cannot obstruct the removal of ceiling panels. But you may be able to tie them up out of the way with cable ties attached to the ceiling wires.

**68. If I increase the size of my feeder conductors from #1/0 to #3/0 due to voltage drop, do I have to increase the size of the equipment-grounding conductor?**

Yes, the equipment grounding conductor must be increased in size. Section 250.122(B) is very clear that whenever the ungrounded conductors are increased in size for any reason, the equipment grounding conductor must also be increase proportionately. In this case the 1/0 copper would typically require a 6 AWG copper EGC. The increase from 1/0 to 3/0 would then proportionately require a 4 AWG copper EGC.

**69. When running feeders in parallel, for example a 2000 ampere motor control center, how do you size the ground in the raceway?**

*Equipment grounding conductors installed in parallel are covered in Section 250.122(F). The code requires a full size equipment grounding conductor in each raceway based on the overcurrent device rating protecting the feeder. If there is a ground fault condition in one of the raceways the equipment grounding conductor would need to be sized properly to activate the overcurrent device.*

*250.122(F) Conductors in Parallel. Where conductors are run in parallel in multiple raceways or cables as permitted in 310.4, the equipment grounding conductors, where used, shall be run in parallel in each raceway or cable.*

*Each parallel equipment grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit conductors in the raceway or cable in accordance with Table 250.122. 250.122(F) and 310.4*

**70. With a 90 degree cable, what table column should we start with for derating ampacity with a 75 degree termination?**

*Let's look at page 34 110.14(C) Temperature Limitations. The temperature rating associated with the ampacity of a conductor shall be selected and coordinated so as not to exceed the lowest temperature rating of any connected termination, conductor, or device.*

*Conductors with temperature ratings higher than specified for terminations shall be permitted to be used for ampacity adjustment, correction, or both.*

*The word derating is going away in the 2011 NEC and the word ampacity adjustment and correction factors are being used. Additionally we will be counting the spare conductors in a raceway in the 2011 NEC. The title will change to Adjustment factors for more than 3 conductors in a raceway or cable; this will include spares since they take up space and may be used in the future.*

**71. Can a circuit breaker be used to switch fluorescent lighting?**

*Reference: NEC 240.83 ---- Yes*

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

**72. Can Romex be installed in outdoor conduit? Does it comply with 334.10(A) when it is normally dry 95% of the time in most geographic locations?**

*Reference: 300.9, 310.8(C)(3), Article 100 Location, Wet, and 334.12(B)(4)*

*No, under Article 100 a wet location includes areas exposed to the weather. Section 300.9 tells us that the inside of the raceway needs to be treated as wet location and refers the user to 310.8. 310.8(C)(3) tells us that the cable needs to be listed for a wet location. Section 334.12(B)(4) tells us that NM Cable is not permitted to be used in a wet location.*

*334.10(A) tells us that NM Cable is permitted to be used exposed and concealed in dry locations.*

**73. 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).*

*2009 UL White Book page 344 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.*

**74. Assuming that a furnace and an air conditioner have exactly the same circuit requirements; can they both be on the same circuit?**

*Yes, because central heating equipment and air-conditioning equipment are considered to be noncoincident loads, or two loads that are unlikely to operate at the same time. However, 422.3 require compliance with Article 430 & 440 respectively. Accordingly, per 430.24 & 440.34, the circuit must be sized for the combined load or must be interlocked to prevent simultaneous operation in accordance with the exceptions. Code Reference: 422.12 Exception 2, 430.24 Exception 3, & 440.34 Exception*

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

*YES REF. 110.3(B) & 400.7 These type of fans are listed under Electric Fans (GPWV) located on page 151 of the UL White Book. These fan types are not specifically evaluated for radon, nor is the whole system Listed. These are just fans Listed under this category and then assembled into a system. The fans are not evaluated for any radon claims, only that they can safely move air. These in-line duct fans and crawl space fans are permitted to be cord and plug connected because of vibration and that they have to be removed to be cleaned as permitted in 400.7(A)(7) & (8). Some confusion exists with 400.8(5) as rather or not the attic is considered to be a concealed space or not, most feel this is true and some read the definition of “concealed” in Article 100 as not. See proposal 6-157 for the 2011 NEC.*

**76. The local inspector keeps getting complaints that the refrigerators being used by vendors at the County Fair keep tripping the GFCI-protected receptacles. Is it a requirement that these refrigerators be on a ground-fault? Don't they keep “nuisance tripping” the GFCI?**

*Answer: Yes. No.*

*525.23 Ground-Fault Circuit-Interrupter (GFCI) Protection.*

*A Where GFCI Protection Is Required. The ground-fault circuit interrupter shall be permitted to be an integral part of the attachment plug or located in the power-supply cord, within 300 mm (12 in.) of the attachment plug. Listed cord sets incorporating ground-fault circuit interrupter for personnel shall be permitted.*

*(1)125-volt, single-phase, 15- and 20-ampere non-locking-type receptacles used for disassembly and reassembly or readily accessible to the general public*

*(2)Equipment that is readily accessible to the general public and supplied from a 125-volt, single-phase, 15- or 20-ampere branch circuit*

*210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.*

*B Other Than Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (5) shall have ground-fault circuit-interrupter protection for personnel:*

*(1)Bathrooms*

*(2)Kitchens*

*As far as “nuisance-tripping” the GFCI, UL Standard # 101 or the specific standard for an appliance requires that at the time the unit is manufactured the total leakage current be more than .5 ma. GFCI devices trip somewhere between 3 and 7 milliamps – where there is a real danger of electric shock and or electrocution.*

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

*No. See 600.3(A) Field-Installed Skeleton Tubing. Field-installed skeleton tubing shall not be required to be listed where installed in conformance with this Code.*

**78. 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?**

*NEC 410.6 in the 2008 edition has added a new requirement for listing all luminaires.*

**79. 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?**

*A. YES, given certain conditions, Table 4000.4 pg. 244 indicates SO cord can be used as a pendant or portable. NEC 400.7 (A) (1) allows it as a pendant. NEC 400.10 states cords shall be connected to devices and to fittings so that tension is not transmitted to joints or terminals Second part of the question NO, NEC 400.14, 2nd paragraph states in industrial establishments, cord can be installed in aboveground raceways.*

**80. 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?**

*700.12(A) Storage Battery. Storage batteries used as a source of power for emergency systems shall be of suitable rating and capacity to supply and maintain the total load for a minimum period of 1 1/2 hours, without the voltage applied to the load falling below 87 1/2 percent of normal.*

*Functional load testing You can break functional load testing down into six distinct operations, including steady-state load test, harmonic analysis, filter integrity, transient response test, module fault test, and battery rundown.*

*For systems with multiple modules, you should also perform a module fault test and restoration.*

*Steady-state load test*

*Under a steady-state test, you should check all input and output conditions at 0%, 50%, and 100% load. Make sure to test the following parameters: input voltage, output voltage, input current, output current, output frequency, input current balance, and output voltage regulation. The analysis will reveal if input currents match across all phases of a module as well as determine if all modules equally share the load. Because power is equal to voltage times current, a degraded voltage from a single module or phase means other modules or phases must produce more current to accommodate the voltage drop.*

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

*More than likely, one would be required to comply with 210.25(A) & (B).*

*210.25 Branch Circuits in Buildings with More Than One Occupancy.*

*(A) Dwelling Unit Branch Circuits. Branch circuits in each dwelling unit shall supply only loads within that dwelling unit or loads associated only with that dwelling unit.*

*(B) Common Area Branch Circuits. Branch circuits required for the purpose of lighting, central alarm, signal, communications, or other needs for public or common areas of a two-family dwelling, a multifamily dwelling, or a multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.*

**82. 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, they are required to meet the clearances prescribed by 110.26. There was a proposal to the 2008 via Proposal 11-94 to add a sentence to the end of the first paragraph in 440.14 to require disconnecting means to comply with 110.26. The Panel rejected with a Panel statement: Section 110.26 already applies per 90.3.*

*A similar proposal was included in the 2011 ROP, which was to add a FPN to 440.14 to remind code users that 110.26 apply. The Panel accepted, however the TCC has directed the Panel to reconsider, since there is no need to duplicate 110.26 in accordance with 4.1 of the NEC Style Manual, i.e., 90.3.*

*In response to the second question fused vs. nonfused, 110.26 (A) requires adequate working space for equipment operating at 600 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized. Accordingly, whether fuses are installed or not, service personnel will check for the presence of voltage on the line and load side of the disconnect. Yes, the requirements of 110.26 would be applicable, regardless of fused or nonfused disconnect.*

*Code Reference: 110.26 & 90.3*

**83. In a five-story building, can I run a new emergency circuit up through the elevator shaft from the basement to the top level?**

*NO Ref. IBC 707.8.1, NEC 620.37, 700.9(D) & (D)(1)*

*IBC 707.8.1 Prohibited penetrations.*

*Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.*

700.9(D)(1)(4) Was revised for the 2008 Code and clarifies the requirement for emergency feeder installation in a fire-rated assembly. The requirement is the fire-rated assembly be a minimum 1-hour and only contain emergency wiring circuits.

620.37(A) Wiring in Hoistways, Machine Rooms, Control Rooms, Machinery Spaces, and Control Spaces permits only such electrical wiring, raceways, and cables used directly in connection with the elevator or dumbwaiter, including wiring for signals, for communication with the car, for lighting, heating, air conditioning, and ventilating the elevator car, for fire detecting systems, for pit sump pumps, and for heating, lighting, and ventilating the hoistway, inside the hoistway, machine rooms, control rooms, machinery spaces, and control spaces.

**84. Do the live parts of residential battery systems need isolation protection for accidental contact regardless of battery type or voltage?**

*Answer: Yes. Although the question does not specify this, I think this may refer to the storage batteries associated with a residential PV system.*

*Article 690 Part III. Storage Batteries*

*690.71 Installation.*

*A General. Storage batteries in a solar photovoltaic system shall be installed in accordance with the provisions of Article 480. The interconnected battery cells shall be considered grounded where the photovoltaic power source is installed in accordance with 690.41.*

*B Dwellings. (2) Guarding of Live Parts. Live parts of battery systems for dwellings shall be guarded to prevent accidental contact by persons or objects, regardless of voltage or battery type.*

**85. In a residence we have a sub-panel being fed with a feeder from the main panel. The water line coming into the house is plastic then turns to copper after the meter. There are no copper water lines in contact with the earth for more than 3.0 m (10 ft). Is it acceptable to bond the copper water line in the residence from the feeder panel since we are only bonding the copper lines and not grounding?**

*No. 250.104(A)(1) General. Metal water piping system(s) installed in or attached to a building or structure shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used. The bonding jumper(s) shall be sized in accordance with Table 250.66 except as permitted in 250.104(A)(2) and (A)(3).*

**86. Does the bare aluminum conductor of AC cable need to be wrapped back around the cable before it is inserted in the AC connector?**

*No. The bare aluminum strip is not a recognized electrical conductor. It is an internal bonding strip, which can be cut off at the termination of the cable. Its purpose is to reduce the inductive reactance of the spiral armor and increases the armors effectiveness as an equipment grounding conductor.*

*87. Is it legal to put a sign disconnecting means by the panel in the mechanical room?*

*A. NO, 600.5 (A) (1) & (2), pg. 505, the disconnecting means shall be within sight of the sign or when not in sight, it shall be capable of being locked in the open position and must remain in place weather the lock is installed or not.*

**88. 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?**

*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.*

*314.3 Exception No. 1 applies to nonmetallic boxes without threaded entries and permits the use of metal raceways and metal-armored cables with nonmetallic boxes. Internal bonding means must be installed to ensure ground continuity between the metal raceways or metal-armored cables. For the purposes of Exception No. 1, the term metal-armored cable includes cables with a metal covering such as mineral-insulated, metal-sheathed cable (Type MI), metal-clad cable (Type MC), and armored cable (Type AC).*

**89. 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?**

*Probably it will not be allowed.*

*760.176 Listing and Marking of NPLFA Cables.*

*Non-power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.*

*760.179 Listing and Marking of PLFA Cables and Insulated Continuous Line-Type Fire Detectors.*

*Type FPL cables installed as wiring within buildings shall be listed as being resistant to the spread of fire and other criteria in accordance with 760.179(A) through (H) and shall be marked in accordance with 760.179(I). Insulated continuous line-type fire detectors shall be listed in accordance with 760.179(J). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.*

*2009 UL White Book, NONPOWER-LIMITED FIRE ALARM CABLE (HNHT) and POWER-LIMITED FIRE ALARM CABLE (HNIR) both include flame testing to name one or the numerous tests. Painting the cable would be considered a field modification of this product and UL has no way to determine if the product continues to comply with the safety requirements used to certify the product without investigating the modified product. UL can neither indicate that such modifications "void" the UL Mark, nor that the product continues to meet UL's safety requirements, unless the field modifications have been specifically investigated by UL. Some concerns would be, does the painted cable still comply with the flame testing, and has the paint had a deteriorating effect on the cables integrity? It is the responsibility of the AHJ to determine the acceptability of the modification or if the modifications are significant enough to not approve the installation and require one of UL's Field Engineering Services staff members to evaluate the modified product.*

*Painting would also cover the required cable markings of 760.176(G) and 760.179(I) in addition to the required markings of UL 1424 and UL 1425.*

**90. What is the ampacity of seven, 8 AWG, type FEPB conductors. The seven conductors are energized simultaneously. The equipment in question is a DC crane motor, operating at an ambient of 37 degrees C, and with a thirty-minute rating?**

*Table 610.14(A) provides the ampacity for conductors to cranes. Before any correction factors are applied, Table 610.14(A) allows an ampacity for type # 8 AWG FEPB conductors of 69 amperes for 90 degree C and 80 amperes for 125 degree C rated wire at the 30 minute rating.*

*The question specifies that the operating temperature is 37 degrees C and there are 8 conductors. Accordingly, at the bottom of Table 610.14(A), we have a multiplier of .91 for the 90 degree C conductor and .95 for the 125 degree C conductor. In addition, note 1 to the Table requires an additional correction of 80 percent where you 4-8 conductors.*

*Therefore to determine the ampacity of both the 90 & 125 C conductors we perform the following calculation:*

*90 degree C: 69 amps X .91 = 62.79 amps X .80 = 50.232 or 50 amps*

*125 degree C: 80 amps X .95 = 76 amps X .80 = 60.8 amps*

*Code Reference: Table 610.14(A)*

**91. Does the NEC require work space in front of the storage batteries for a PV system?**

*YES Ref. 690.71 – 480.9*

*690.71(A) Requires storage batteries in a solar photovoltaic system be installed in accordance with the provisions of Article 480.*

*480.9(C) States working space about the battery systems shall comply with 110.26 and working clearance shall be measured from the edge of the battery rack.*

**92. NEC 334.80 requires de-rating for NM, NMC & NMS cables when more than 2 cables are run through wood framing and foamed or caulked in place. Does this requirement also need to be enforced when multiple conductors are run into the back of a panel in a 2" nipple and sealed with duct-seal or foam used for a thermal seal from an outside wall panel?**

*Answer: No*

*This is an unusual question. The opening statement refers to cable assemblies, but the question asks about conductors installed in a nipple. While the NEC has specific ampacity adjustment requirements for cables installed within thermal insulation, there is no corresponding requirement for individual conductors installed in a raceway when the installation is exposed to different temperatures. Many installers will pack duct seal or similar compound around the conductors in a conduit body or other accessible point, but the language of 300.7 is misleading. It states "the raceway or sleeve shall be filled" with an approved material to prevent condensation.*

334.80 Ampacity. The ampacity of Types NM, NMC, and NMS cable shall be determined in accordance with 310.15. The ampacity shall be in accordance with the 60°C (140°F) conductor temperature rating. The 90°C (194°F) rating shall be permitted to be used for ampacity derating purposes, provided the final derated ampacity does not exceed that for a 60°C (140°F) rated conductor. The ampacity of Types NM, NMC, and NMS cable installed in cable tray shall be determined in accordance with 392.11.

Where more than two NM cables containing two or more current-carrying conductors are installed, without maintaining spacing between the cables, through the same opening in wood framing that is to be fire- or draft-stopped using thermal insulation, caulk, or sealing foam, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(2)(a) and the provisions of 310.15(A)(2), Exception, shall not apply.

Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining spacing between cables, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(2)(a).

310.15 (B)(2) Adjustment Factors.

(a) More Than Three Current-Carrying Conductors in a Raceway or Cable. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

**Table 310.15(B)(2)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable**

Number of Current-Carrying Conductors	Percent of Values in Tables 310.16 through 310.19 as Adjusted for Ambient Temperature if Necessary
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41 and above	35

**93. 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? Would it be required to be marked "suitable for use as service equipment" and to contain the service overcurrent device?**

No mention of transfer switches in 230.82.

Yes, if located on the supply side of the service disconnecting means.

Yes, so far as the marking requirements are concerned. Overcurrent protection is required or permitted to be located per 230.91 Location. "The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto."

**94. Can SER cable be installed as a feeder for a sub-panel serving a residential swimming pool?**

No. NEC 680.25(A) requires feeders to be installed in rigid metal conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, rigid vinyl chloride conduit, or reinforced thermosetting resin conduit. Electrical metallic tubing is permitted where installed on or within a building and electrical nonmetallic tubing is permitted where installed within a building.

**95. A hydro-massage tub has its own individual branch circuit. Is it considered a continuous-duty circuit? A., Lets analyze the question; NEC 680.71 pg. 71, requires an Individual BC which is defined as one that supplies only one utilization equipment. This is a common listing and labeling requirement for hydro-tubs. Next**

*a continuous load is where the maximum current is expected to continue for 3 hours or more. The normal answer is NO, unless you stay in the tub most of the day and come out shriveled like a dried prune. Note also the requirement for protection to be a readily accessible GFCI*

**96. A residence is located in a rural area surrounded by fields that are plowed and left as raw dirt which can blow and get into the panel & disconnects for the A/C & other outside equipment. Do I need to use type S rated equipment?**

*In most cases no*

*110.3 Examination, Identification, Installation, and Use of Equipment.*

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

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

*FPN: Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Suitability of equipment may be evidenced by listing or labeling.*

**ELECTRICAL EQUIPMENT FOR USE**

**IN ORDINARY LOCATIONS (AALZ)**

*3 Same as 3R plus windblown dust*

*3S Same as 3R plus windblown dust, external mechanisms remain operable while ice laden*

**97. Is it permissible to daisy-chain one power strip from another power strip? Are power strips addressed in the NEC?**

*No, they are not permitted to be “Daisy-Chained”. No, however one could use 110.3(B) since the product is not being installed in accordance with the manufacturers installation instructions.*

*2009 UL White Book RELOCATABLE POWER TAPS (XBYS)*

**USE AND INSTALLATION**

*This category covers relocatable power taps rated 250 V ac or less, 20 A or less. They are intended for indoor use as relocatable multiple outlet extensions of a single branch circuit to supply laboratory equipment, home workshops, home movie lighting controls, musical instrumentation, and to provide outlet receptacles for computers, audio and video equipment, and other equipment.*

*Relocatable power taps are intended to be directly connected to a permanently installed branch circuit receptacle. Relocatable power taps are not intended to be series connected (daisy chained) to other relocatable power taps or to extension cords.*

**98. Section 511.2 defines an auto body repair shop as a major repair garage. There are acetylene/oxygen torch cutting, MIG, -arc welding, and grinding operations routinely occurring daily. What is gained by classifying the lower floors and upper ceilings of the building as Class I, Division 2 locations?**

*The scope of Hazardous (classified) locations is found in 500.1. This covers the requirements for electrical installations in locations classified as hazardous locations due to the materials handled, processed, or stored in those locations. Furthermore, 500.4 require all areas designated as hazardous (classified) locations to be properly documented. Documented area classification in accordance with this section is for electrical equipment and installations covered by the NEC and have no other defined purpose.*

*While the NEC’s purpose is to control the hazards associated with electrical equipment, there are other sources of ignition such as what is described in the question, like welding, grinding, mechanical sparks, and open flames. These sources too, must be controlled in a hazardous environment.*

*Despite the fact that the NEC is aimed at only controlling ignition sources for electrical equipment, I have found that OSHA regulates additional ignition sources for those located outside the purview of the NEC. For example, OSHA would define arc welding and grinding as “Hot Work.” Accordingly, OSHA includes specific requirements to mitigate any hazards associated with “Hot Work” in areas of a building where a fire or explosion hazards exists. NFPA 51B, the Standard for Fire Prevention During Welding, Cutting, And Other Hot Work, is utilized as the baseline requirements for OSHA as it relates to Hot Work and is incorporated therein by reference.*

*Consequently, the NEC regulates electrical installations and electrical ignition sources in hazardous (classified) locations, whereas OSHA and NFPA 51B regulates other ignition sources such as welding and grinding.*

*Additional requirements can also be found in NFPA 30A, Code for Motor Fuel Dispensing Facilities & Repair Garages. Chapter 9 includes Operational Requirements with Section 9.7 addressing Repair Areas. Section 9.7.2 includes requirements for welding and open flame operations. Those requirements restrict welding and open flame activities to areas specifically provided for that purpose.*

*Code Reference: 500.1, 500.4, OSHA 1910.252 and NFPA 51B Standard for Fire Prevention During Welding, Cutting, And Other Hot Work & NFPA 30A, Code for Motor Fuel Dispensing Facilities & Repair Garages.*

**99. Can a sump pump located in an elevator pit use a cord-and-cap plugged into a receptacle as its disconnecting means?**

*YES Ref. 620.21(A)(1)(e), 110.3(B) & 430.109(F), 620.55*

*620.21(A)(1)(e) specifically allows cord-and-plug connected sumps. For disconnecting means of the sump pump motor they must be installed in accordance with manufacture instructions as required by 110.3(B) and as required in 430.109(F), however if the question is refereeing to the required disconnecting means for the branch circuit feeding utilization equipment as covered in 620.55 the answer would be no. Since this disconnecting means is required to be located in the machine room or control room/machine space or control space.*

**100. Does flexible metal conduit fulfill the requirements for a metal raceway in 517.13 (B)?**

*Answer: Sometimes*

*517.13 Grounding of Receptacles and Fixed Electrical Equipment in Patient Care Areas. Wiring in patient care areas shall comply with 517.13(A) and (B).*

*A. Wiring Methods. All branch circuits serving patient care areas shall be provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly. The metal raceway system, or metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.*

*250.118 Types of Equipment Grounding Conductors. The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:*

*(5) Listed flexible metal conduit meeting all the following conditions:*

*a. The conduit is terminated in listed fittings.*

*b. The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.*

*c. The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground return path does not exceed 1.8 m (6 ft).*

**101. Can I use table 310.15 (B) (6) for a #2 SER aluminum cable for my 100 amp sub-panel in the basement?**

*Only if it is the "main power feeder as defined in 310.15(A)(6).*

*(6) 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For individual dwelling units of one-family, two-family, and multifamily dwellings, conductors, as listed in Table 310.15(B)(6), shall be permitted as 120/240-volt, 3-wire, single-phase service-entrance conductors, service-lateral conductors, and feeder conductors that serve as the main power feeder to each dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder shall be the feeder between the main disconnect and the panelboard that supplies, either by branch circuits or by feeders, or both, all loads that are part or associated with the dwelling unit. The feeder conductors to a dwelling unit shall not be required to have an allowable ampacity rating greater than their service-entrance conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided the requirements of 215.2, 220.61, and 230.42 are met.*

*See Panel Proposal 6-83a for CMP-6's fairly major change to this section.*

**102. Conductors within outdoor conduits are considered in a wet location. Are the conductors within a rain tight gutter located on the outside of a building considered to be located in a wet location?**

*According to NEC 300.9 the inside of a raceway is considered to be a wet location where the raceway is installed in a wet location and a raceway installed outdoors is considered to be in a wet location. The conductors installed therein must be suitable for use in a wet location.*

**103. Does the NEC require a GFCI receptacle in the unfinished furnace room located within a finished basement?**

A. YES, 210.52 (G) (2) pg. 54, each basement must have at least one receptacle, and 210.8 (A) (5) pg. 47, for unfinished basements. Note per 210.63, pg. 55, a receptacle outlet is required to be located in an accessible location on the same level and within 25' Ft. of the unit.

**104. In rural areas large structures called “barns” are to be used for storage of tractors, recreation vehicles, and all-terrain vehicles. If they are called “barns”, do they need to meet the requirements for an agricultural building if no animals are going to be housed inside them?**

*no*

*547.1 Scope.*

*The provisions of this article shall apply to the following agricultural buildings or that part of a building or adjacent areas of similar or like nature as specified in 547.1(A) and (B).*

*(A) Excessive Dust and Dust with Water. Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.*

*(B) Corrosive Atmosphere. Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:*

*(1) Poultry and animal excrement may cause corrosive vapors.*

*(2) Corrosive particles may combine with water.*

*(3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.*

*(4) Similar conditions exist.*

**105. What is the difference between a standard receptacle and a weather-resistant receptacle besides the cost?**

*This is the commentary in the 08 NEC Handbook 406.8(A). The requirement for listed weather-resistant type 15- and 20-ampere receptacles for both damp and wet locations was added to the 2008 Code. Studies indicated that normal receptacles were inadequate because covers were either broken off or not closed properly. The major differences between WR and non-WR receptacles are that the WR has additional corrosion protection, UV resistance, and cold impact resistance.*

*In the 09 UL White Book under category RTRT;*

*Weather-resistant Receptacles — Receptacles for use in wet and damp locations in accordance with Article 406 of the NEC. Weather-resistant receptacles are identified by the words "Weather Resistant" or the letters "WR" where they will be visible after installation with the cover plate secured as intended.*

*Covered by UL Standard UL 498 Supplement SE:*

*SE2 General*

*SE2.1 In addition to the general performance and construction requirements for receptacles, weather-resistant receptacles shall also comply with requirements for corrosion resistance, cold impact, accelerated aging, and resistance to ultraviolet light and water exposure, as specified in this supplement.*

*SE3 Insulating Materials*

*SE3.1 An insulating material used in the construction of the face of a weather-resistant receptacle shall comply with the Ultraviolet Light and Water Exposure Test in Section SE8.*

*SE4 Corrosion Resistance*

*SE4.1 Except as noted in SE4.2, all current-carrying parts shall be copper alloy.*

*Exception: Insulating materials used in the construction of components other than the face of a weather-resistant receptacle, such as the body, shutters, and indicator lights, are not required to comply with this requirement. This exception does not apply to external shutters located on the outer face of the device.*

*SE4.2 All wire-binding screws and terminal pressure plates shall be copper alloy or stainless steel having a minimum of 16 percent chromium content. An internal backwire nut may be steel protected with nickel as described in SE4.4(a) (3) or (4). Protection is required on all sheared or cut edges but not required for punched holes with screw threads.*

*SE4.3 Metals used in combinations shall be galvanically compatible.*

*SE4.4 Noncurrent-carrying metal parts, such as metal mounting yoke, and mounting screws shall be:*

*a) Steel protected by one of the following coatings:*

*1) Hot-dipped mill-galvanized sheet steel conforming with the coating Designation A60, G60 or G90 in the Weight (Mass) of Coating Requirements table in the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653, with not less than 40 percent of the zinc on any side, based on the minimum single-spot test requirement in this ASTM*

designation. The weight of the zinc coating may be determined by any acceptable method; however, in case of question the weight of coating shall be established in accordance with the Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles With Zinc or Zinc-Alloy Coatings, ASTM A90. Sheared, cut edges, punched holes and screw threads are not required to be additionally protected;

2) A zinc coating, other than that provided on hot-dipped mill-galvanized steel, having an average thickness not less than 0.0005 in (0.013 mm) and a minimum thickness of not less than 0.0004 in (0.0102 mm). Sheared, cut edges punched holes, and screw threads are not required to be additionally protected;

3) A nickel coating having a thickness not less than 0.00015 in (0.0038 mm); or

4) A tin over nickel coating having an overall thickness of not less than 0.00015 in (0.0038 mm).

b) Stainless steel having a minimum of 16 percent chromium content; or

c) Copper, bronze or brass alloys.

d) Aluminum or aluminum alloys.

SE5 General

SE5.1 A weather-resistant receptacle shall be subjected to the Cold Impact Test, Section SE6, the Accelerated Aging Test, Section SE7, and the Ultraviolet Light and Water Exposure Test, Section SE8.

**106. Would ground-fault protection be required for a 3-phase, 4-wire, 277/480 volt, 1200 rated service disconnect switch with 800 amp fuses installed?**

Yes. 230.95 requires ground-fault protection of equipment for solidly grounded wye electric services of more than 150 volts to ground but not exceeding 600 volts phase-to-phase for each service disconnect rated 1000 amperes or more. The rating of the disconnect is what dictates the ground fault protection; not the rating of the fuses.

Code Reference: 230.95

**107. A neon sign transformer is located above a suspended ceiling on the interior of an outside wall. The transformer housing has an external switch to disconnect the supply conductors. The sign is on the exterior of the same wall but does not have an additional disconnect switch. Does this installation satisfy the NEC?**

YES Ref. 600.6 & 6(A)

Sign disconnecting means requirements & location are covered in 600.6 & 6(A). We need to look at the first sentence of 600.6 which states in part "or feeder circuit or branch circuit supplying a sign or outline lighting system." The question states a disconnect is installed in the branch circuit within sight of the transformer therefore meeting the requirements of 600.6. A disconnect installed as stated would provide the intended means for maintenance.

**108. NEC 600.8 (B): "Sign and outline lighting system enclosures shall be constructed of metal or shall be listed". Does this imply that non-metal signs do not need to be listed?**

Answer: No.

Generally, the enclosures for signs, channel letters, transformers, etc shall be of adequate strength and rigidity and are often mad of metal. The requirements for the minimum thickness of the metal can be found in UL standard 48. This section says that if the enclosure is not made of metal, it shall be listed, which means it will have to prove that it is of "adequate strength and rigidity."

Manufacturers of non-metallic enclosures, such as Allied Molded Products and Carlon do make listed non-metallic enclosures, however keep in mind that Section 600.3 requires electric signs, section signs and outline lighting (fixed, mobile or transportable) to be listed.

**109. The foundation of a building was poured without an inspection of the re-bar for the installation of the UFER connection. The superintendent chipped out the concrete to expose the lower horizontal re-bar of the foundation so I could connect my grounding electrode conductor. Would this be sufficient to satisfy the NEC?**

At this point it seems like the question is. "Is this enough to satisfy the electrical inspector." The NEC contains the installation requirement. Enforcement is up to the AHJ.

**110. Can flexible cables be used for interconnection between batteries and cells? Do they need be the hard-usage type?**

No, Article 400 Flexible Cords and Cables is not applicable to this use. The cables used to interconnect battery cells are not covered by the NEC.

**111. What is the minimum branch required for a single electric range of over 8 ¾ KW?**

*A. See section 422.10 (A), pg. 279, 4th paragraph which sends you to Table 220.55 and sized in accordance with 210.19 (A) (4) pg. 51 and 210.23 which states in no case shall the load exceed the BC ampere rating. An individual BC shall be permitted to supply any load for which it is rated. Per the question, first follow nameplate information if a minimum circuit ampacity is listed on it; if not BC calculations are found 220.14 (A), pg. 59. Ranges and dryers are covered in 220.14(C). This section permits electric range loads to be calculated per section 220.55, Table 220.55 and the Notes to the Table. Note 4 indicates that Branch Circuit loads for one range can be calculated per the Table. For example, take a range rated 10kW. Column C gives a maximum demand of 8kW for ranges not over 12KW. Dividing 8 kW by 240-volts gives 33-amperes. The 10 kW range could be supplied by a 35-ampere branch circuit. It is more likely that a 40 ampere branch circuit will actually be used due to the standard attachment plug and receptacle sizes that are typically used.*

**112. A pool contractor installed non-metal fiber mesh around the deck of a pool. He claims that it does not need bonding because it is not metal. The inspector is requiring a # 8 bare copper wire to be run around the perimeter of the pool before the concrete can be poured. Is the inspector correct?**

*Yes*

*680.26(B)(2): Revised to require bonding of paved and unpaved perimeter surfaces extending 3 ft horizontally from edge of pool, and provided new means for bonding the perimeter surfaces and required connection points to bonding element of a conductive pool shell.*

**113. How are receptacles incorporating an isolated grounding conductor connection identified?**

*Per NEC 406.2(D) and 09 UL White Book RTRT, Isolated Ground Receptacles shall be identified by an orange triangle located on the face of the receptacle.*

*Isolated Ground Receptacles — Grounding-type receptacles in which the grounding terminals are purposely insulated from the mounting means of receptacles and associated metal cover plates as permitted by Section 250.146(D) (formerly Exception No. 4 to Section 250-74) of the NEC are so identified by an orange triangle marked on the face of the receptacle.*

**114. Is it permissible to install a circuit breaker panelboard in a toilet room when it has the required working clearances if it can only be accessed through the bathroom?**

*That depends. If the circuit breaker is located in a panelboard that contains the service disconnect, then 230.70(A)(2) prohibits it. It is also prohibited in dwelling units and guest rooms or guest suites of hotels and motels per 240.24(E) and is also prohibited in manufactured homes per 550.11(A). Otherwise, a panelboard would be permitted in bathroom.*

*Code Reference: 230.70(A), 240.24(E) and 550.11(A)*

**115. Are the conductors for a roof-top PV system that run from the solar cell modules to the DC combiner box required to be de-rated?**

*YES Ref. 90.3 and 690.8*

*In accordance with Section 90.3 Chapters 1 through 4 apply except as amended by Chapters 5, 6, and 7 for the particular conditions.*

*690.8(A) Calculation of Maximum Circuit Current: The maximum current for the specific circuit shall be calculated in accordance with 690.8(A)(1) through (A)(4).*

**116. What is the spacing requirement, for a nonmetallic conduit containing a neon secondary circuit conductor operating at more than 100 Hz, to a grounded surface?**

*Answer: 45 mm*

*600.32 Neon Secondary-Circuit Wiring, over 1000 Volts, Nominal.*

*(A)(4) Spacing from Grounded Parts. Other than at the location of connection to a metal enclosure or sign body, nonmetallic conduit or flexible nonmetallic conduit shall be spaced no less than 38 mm (1 1/2 in.) from grounded or bonded parts when the conduit contains a conductor operating at 100 Hz or less, and shall be spaced no less than 45 mm (1 3/4 in.) from grounded or bonded parts when the conduit contains a conductor operating at more than 100 Hz.*

**117. PVC conduit is installed underground with a PVC 90 riser that transitions to rigid metal conduit. Is the GRC required to be bonded? How is this accomplished?**

*If the run contains service conductors, bonding of metal raceways is required per 250.92. Specific requirements for “grounding” metal raceways is covered in 250.80 for service raceways and 250.86 for other than service raceways.*

**118. The luminaries in a restroom of a commercial building are 277 volts. Can I use a 2-pole switch to control both the lights and the 120 volt exhaust fan?**

*No. Double pole switches are not listed for this use.*

**119. A new house has an unfinished basement with a finished stairway from the main level to the unfinished basement. The light for the stairway is on the circuit for the unfinished basement which does not require AFCI protection until it is finished. Does the stairway require AFCI protection or is it considered part of the unfinished basement?**

*A. YES, NEC 210.12 (B) pg. 49, does not mention finished or unfinished space nor give a definition as to there meaning. And what may or not be finished to different individual varies, my friend Larry says a concrete floor chair or sofa and a refrigerator for beer is a finished space. Therefore since hallways or similar rooms or area shall be protected applies. Remember at one time the whole house was considered and it may come back up again.*

**120. The NEC now requires a disconnecting means in fluorescent fixtures for safety in the changing of ballasts. Why does it not require the same disconnecting means for recessed cans?**

*410.130 (G) Disconnecting Means.*

*(1) General. In indoor locations other than dwellings and associated accessory structures, fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire. The line side terminals of the disconnecting means shall be guarded.*

**121. Why do the appliance manufactures install a 50 amp rated cord on an appliance that draws only 30 amps?**

*This is not a cord requirement, it is a plug and receptacle requirement based on NEC Section 210.23. So if the appliance is cord and plug connected and rated at more then 24 amps, it will be required to be installed using a 50 amp rated plug and receptacle. Based on the NEMA plug and receptacle standard configurations of 15, 20, 30 and 50 amp ratings.*

*210.23 Permissible Loads.*

*(B) 30-Ampere Branch Circuits. A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. A rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.*

*(C) 40- and 50-Ampere Branch Circuits. A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.*

*Additional information is available in the 09 UL White Book Category RTRT.*

**122. How many 3/0 THW cu conductors are allowed in a 6” wide ladder-type cable tray?**

*A total of nine are permitted in a 6 inch wide ladder type cable tray. 392.10(A)(1) thru (4) covers the requirements for sizing single conductors in a cable tray. (4) States that where any of the single conductor cables are 1/0 through 4/0 AWG, the sum of the diameters of all single conductor cables shall not exceed the cable tray width. To find the diameter of single conductors, we go to Chapter 9, Table 5, which is the Dimensions of Insulated Conductors and Fixture Wires. The diameter for a 3/0 THW copper conductor is .63. The sum of nine 3/0 THW conductors is 5.67 inches.*

*Code Reference: 392.10(A)(4) and Chapter 9, Table 5*

**123. The EMT across a rooftop is installed on 1 ½” unistrut secured to the roof. What size conductors and ground are needed for a 100 amp load?**

*Ref. 310.15(B)(2)(c) 2/0 copper conductors & 250.122(B) #8 AWG copper.*

*We first need to know the location in order to obtain the City outdoor Design Temperature. Since this was not stated in the question we will use Minneapolis Mn.*

*Adjusting conduits exposed to sunlight on rooftops 310.15(B)(2)(c)*

**STEP 1**

*Determine the ambient temperature (compensated for proximity of conduit to the rooftop exposure to sunlight).*

- a. *Ambient temperature (compensated for proximity of conduit to the rooftop exposure to sunlight) = design temperature + value from Table 310.15(B)(2)(c).*
- b. *Design temperature for Minneapolis area = 90° F.*
- c. *Temperature adder from Table 310.15(B)(2)(c) for raceway elevated 1.5 in. above rooftop = 40°F.*
- d. *Compensated ambient temperature = 90°F + 60° F = 150°F.*

**STEP 2**

*Determine the temperature correction factor for this application.*

*From Table 310.16 for aluminum 90°C XHHW-2 insulated conductors, select the proper temperature correction factor. Using the aluminum 90°C column and the temperature correction factor row for 150°F, the temperature correction factor is 0.58.*

**STEP 3**

*Using copper 90°C XHHW-2 insulated conductors, determine the proper conductor size to be used in the EMT to supply the 100-ampere load.*

- a. *Assuming the load is calculated at 100 amperes noncontinuous, and the neutral conductor is not considered to be a current-carrying conductor, the conductor ampacity is calculated as follows: 100 amperes ÷ .58 = 172 amps*
- b. *Now, moving back to the 90°C column of Table 310.16, select a conductor not less than 172 amperes, or a minimum size conductor of # 2/0 AWG XHHW-2:*
- c. *Verify that the conductor ampacity at 75°C is sufficient for the calculated load to comply with terminal temperature requirements of 110.14(C): The 75°C copper column of Table 310.16 ampacity equals 175 amperes, which is greater than the 100-ampere calculated load.*

*Increased in size EGC*

**STEP 1.**

*Calculate the size ratio of the new conductors to the existing conductors: (Conductors are increased in size from #3 AWG to 2/0 AWG).*

$$133100\text{cm} (2/0) \div 16510\text{cm} (\#3) = 2.5$$

**STEP 2**

*Calculate the cross-sectional area of the new equipment grounding conductor:*

$$16510 \times 2.5 = 41275\text{cm}$$

*According to Chapter 9, Table 8, 8 AWG, the size of the existing grounding conductor, has a cross-sectional area of 16,510 circular mils.*

**STEP 3**

*Determine the size of the new equipment grounding conductor. Again, referring to Chapter 9 Table 8 we find the next larger size is 41,740 circular mils, which converts to a 4 AWG copper equipment grounding conductor.*

**124. I'm using 4/0 URD for an underground lateral 200 amp service for a distance of 185'. Can I use a reduced-neutral conductor?**

*Answer: Maybe*

*Let's assume this service lateral is on the load side of the service point and that the installation would be covered by the NEC. Well, in that case, you can't use URD (URD stands for underground residential distribution) because URD is not a NEC-recognized conductor type.*

*Of course, if this cable has a dual rating, such as URD/USE or URD/USE-2 or XHHW then it could be used on the load side of the service point.*

*So, does the length of the run (185-feet) have anything to do with the question of the size of the neutral conductor? I would say not. The size of the grounded service conductor depends on the load and is calculated per 220.61 but in no case can it be smaller than the required grounding electrode conductor. Per 250.24(C)(1) the grounded circuit conductor could be no smaller than the grounding electrode conductor specified in table 250.66 (#4 copper or #2 aluminum.)*

*220.61 Feeder or Service Neutral Load.*

*A Basic Calculation. The feeder or service neutral load shall be the maximum unbalance of the load determined by this article. The maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor.*

*250.24 Grounding Service-Supplied Alternating-Current Systems.*

*C. Grounded Conductor Brought to Service Equipment.*

*1. Routing and Sizing. This conductor shall be routed with the phase conductors and shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service-entrance phase conductor.*

**125. A small maintenance building was built on a concrete foundation 500' away from the main building. The foundation was poured without allowing for a UFER connection. The building has a 150 amp service fed underground from the main building. This feeder contains a grounding conductor. The electrical inspector wanted a grounding electrode at the maintenance building. He wanted me to chip into the foundation for a UFER connection or drill a 20' deep, 6" wide hole with concrete-encased # 4 re-bar for a grounding electrode. Is he correct?**

*Mostly! 250.50 requires a grounding electrode system for the building supplied by the feeder. Connection to the equipment grounding conductor at the building disconnecting means is required as provided in 250.32. The exception to 250.50 reads, "Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete." Note that this exception applies to an existing building. Buildings that are under construction are often not considered to be "existing" until the certificate of occupancy is issued. The inspector determines how they will enforce the rule for a concrete encased electrode.*

**126. Is an in-use receptacle cover required under a porch with a roof?**

*No. The receptacle is in a damp location protected from the weather. NEC 406.8)(A) contains the requirements for receptacle installations in damp areas. The enclosure for the receptacle must be weatherproof when the receptacle is covered. This means when the attachment plug cap is not inserted and the receptacle covers are closed.*

**127. The receptacle enclosed in appliance garages on a kitchen counter does not count as the required receptacle for spacing requirements. If the receptacle above a bathroom counter top is enclosed within a cabinet, does another receptacle need to be installed?**

*A YES, 210.52 (D), pg.54 located on a wall or partition that is adjacent to the basin countertop or on the side or face of a cabinet not more than 12' in. below the countertop...*

**128. An unfinished basement has a GFCI duplex receptacle which serves the sump pump. Can this GFCI receptacle also serve as my required receptacle for the unfinished basement since I am only using 1/2 of it for the sump pump?**

*NO 210.52(G) Basements and Garages. For a one-family dwelling, the following provisions shall apply:*

*(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage with electric power.*

*Art. 100 defines a Outlet. A point on the wiring system at which current is taken to supply utilization equipment.*

**129. An installation is for a dust collector for cardboard chipper bailer. The bag/filters have been moved outside. Is the hopper area considered to be any kind of hazardous classified location? This machine consists of three blowers to retrieve scrap, which drops through a hopper to a bailer. Dust is vented directly outside until a new filter system is purchased. What do I do with this installation?**

*First we need to determine if we have a hazardous location.*

*500.5 Classifications of Locations.*

*Classifications of Locations. Locations shall be classified depending on the properties of the flammable gas, flammable liquid-produced vapor, combustible-liquid produced vapors, combustible dusts, or fibers/flyings that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Where pyrophoric materials are the only materials used or handled, these locations shall not be classified. Each room, section, or area shall be considered individually in determining its classification.*

*Class II Locations. Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations shall include those specified in 500.5(C)(1) and (C)(2).*

*NEC Section 500.6(B)(3) and FPN #1, which references NPFA 499 this, would be considered a Class II Group G product. The combustible dust would be Cellulose. As defined for industrial use, cellulose is mainly obtained from wood pulp and cotton. It is mainly used to produce cardboard and paper.*

*Now that we know this is a Class II location, we need to comply with the applicable requirements of Article 502.*

*Keep in mind that NFPA 499 Section 5.2.2 states that where a dust layer greater than 1/8 inch is present under normal conditions, the location shall be classified as Division 1.*

*However 5.4.1(5) would permit the area to be unclassified where dust removal systems prevent the following:*

*Visual dust clouds*

*Layers of accumulation that makes surface colors indistinguishable*

*5.4.2 Dust removal systems that are provided to allow an unclassified location should have adequate safeguards and warnings against failure.*

*5.7 Details the procedure for classifying areas.*

*Since in the question it is stated that the dust is vented directly outside, I would think that there are visible dust clouds and layers of dust accumulation so any electrical installations within this area would have to comply with the requirements of Article 502.*

**130. Section 690.4(B) on Solar Photovoltaic Systems, talks about “other systems” not being allowed in the same raceway. The question is whether or not a 120VAC feed from the house for the “tracking motor” of the array can be in the same raceway as the 360VDC from the panels to the house? Is this part of the “system”?**

*Some thought the system to be only the DC voltage side and the others thought anything to do with the project would apply.*

*No. NEC 690.4(B) states: Photovoltaic source circuits and photovoltaic output circuits shall not be contained in the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as feeders, or branch circuits of other systems, unless the conductors of the different systems are separated by partitions or are connected together. The photovoltaic source circuit is the circuits between the modules and from modules to the common connection point(s) of the dc system. The photovoltaic output circuit is the circuit conductors between the photovoltaic source circuit(s) and the inverter or dc utilization equipment. Neither of these circuits would have anything to do with the 120v AC feed for the tracking motor.*

*Photovoltaic Output Circuit. Circuit conductors between the photovoltaic source circuit(s) and the inverter or dc utilization equipment.*

*Photovoltaic Source Circuit. Circuits between modules and from modules to the common connection point(s) of the dc system.*

*Code Reference: 690.4(B)*

**131. I was told that a back-fed breaker needs to be bolted into the panel. Is this correct?**

*Ref. 408.36(D) An additional fastening means is required.*

*408.36 (D) Back-Fed Devices: Requires back-fed plug-in-type overcurrent protection devices or plug-in type main lug assemblies used to terminate field-installed ungrounded supply conductors be secured in place by an additional fastener that requires other than a pull to release the device from the mounting means on the panel. The additional fastening means would need to be in compliance with 110.3(B) as a listed method, this could be by other than bolt in type breakers such as listed retaining clips.*

**132. We use a portable generator to provide power to a construction site trailer that is moved every few days. The generator feeds a panel in the trailer. Do we have to connect the generator to earth even though it is portable and is going to be disconnected every couple days?**

*Answer: Maybe*

*Section 550.4 addresses mobile homes not intended to be used as dwelling units and would specifically allow a feeder assembly consisting of not more than one listed 50-ampere mobile home power-supply cord with an integrally molded or securely attached plug cap. Section 250.34 permits the frame of a portable generator to be “un-grounded”*

*550.4 General Requirements.*

*A Mobile Home Not Intended as a Dwelling Unit. A mobile home not intended as a dwelling unit — for example, those equipped for sleeping purposes only, contractor’s on-site offices, construction job dormitories, mobile studio dressing rooms, banks, clinics, mobile stores, or intended for the display or demonstration of merchandise or machinery — shall not be required to meet the provisions of this article pertaining to the number or capacity of circuits required. It shall, however, meet all other applicable requirements of this article if provided with an electrical installation intended to be energized from a 120-volt or 120/240-volt ac power supply system.*

## *II. Mobile and Manufactured Homes*

### *550.10 Power Supply.*

*A. Feeder. The power supply to the mobile home shall be a feeder assembly consisting of not more than one listed 50-ampere mobile home power-supply cord with an integrally molded or securely attached plug cap or a permanently installed feeder.*

### *250.34 Portable and Vehicle-Mounted Generators.*

*A Portable Generators. The frame of a portable generator shall not be required to be connected to a grounding electrode as defined in 250.52 for a system supplied by the generator under the following conditions:*

- (1) The generator supplies only equipment mounted on the generator, cord-and-plug-connected equipment through receptacles mounted on the generator, or both, and*
- (2) The normally non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame.*

### **133. Do the overcurrent devices in the DC portion of a PV power system have to be DC-rated?**

*Yes. See 690.9(D) which reads, “(D) Direct-Current Rating. Overcurrent devices, either fuses or circuit breakers, used in any dc portion of a photovoltaic power system shall be listed for use in dc circuits and shall have the appropriate voltage, current, and interrupt ratings.”*

### **134. Is there anything in the Code that would prevent you from putting a panelboard in a bedroom?**

*There are no requirements in the NEC that would prevent you from putting a panelboard in a bedroom.*

### **135. Does a receptacle installed on a second floor balcony (6’x12’) off the master bedroom need GFCI protection if it is already AFCI-protected?**

*A. YES, AFCI and GFCI protection function differently and address different safety concerns. NEC 210.52 pg. 54(E) Outdoor outlets (3), shall have at least one receptacle and not be located more than (6 ½’ ft.) above the surface. NEC 210.8 (3) pg. 47, outdoors requires GFCI protection be provided. Note: AFCI protection is not an issue since it only applies to interior receptacles per 210.12 (B), pg. 49.*

*136. An installation consists of ¾ inch conduit containing 13 conductors, a 4-gang, switch box, and four 3-way switches. Question is how many of these conductors are considered current-carrying? Contractor stated there is only one current carrying wire in this box and raceway!*

*9 only 2 conductors at a time will have current on the switches plus the conductor that feeds the switches  
8 310.15(2) Adjustment Factors.*

*(a) More Than Three Current-Carrying Conductors in a Raceway or Cable. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.*

### **136. I have parallel 4/0 AWG XHHW-2 aluminum conductors, using 2 conduits with no more than 3 conductors in each raceway. My position is that the ampacity equals 360 amperes and that I can use a 400 ampere breaker as per 240.6. Am I reading this wrong?**

*No, you are not reading this wrong; however the NEC section that permits this application is 240.4(B). For circuits rated 600 volts and under, the allowable ampacity of branch circuit, feeder, or service conductors must be capable of supplying the calculated load in accordance with the requirements of 210.19(A)(1), 215.2(A)(1), and 230.42(A). As in your example, these conductors can supply a load not exceeding 360 amperes and, in accordance with 240.4(B), can be protected by a 400-ampere overcurrent protective device.*

*240.4(B) and has several conditions that must be complied with;*

*(B) Devices Rated 800 Amperes or Less. The next higher standard overcurrent device rating (above the ampacity of the conductors being protected) shall be permitted to be used, provided all of the following conditions are met:*

- (1) The conductors being protected are not part of a multioutlet branch circuit supplying receptacles for cord-and-plug-connected portable loads.*
- (2) The ampacity of the conductors does not correspond with the standard ampere rating of a fuse or a circuit breaker without overload trip adjustments above its rating (but that shall be permitted to have other trip or rating adjustments).*
- (3) The next higher standard rating selected does not exceed 800 amperes.*

**137. Can I install conductors from different panels in the same raceway?**

*Yes, as long as you are not mixing specific systems that prohibit them from sharing a raceway with another system such as an Article 700 system or if it is part of a multiwire branch circuit (210.4(A)) which requires the conductors originate from the same panelboard or similar distribution equipment. Grounded conductors of different systems must also be identified by system 200.6(D). See also 210.5 for identification of ungrounded conductors of different systems if supplied by different voltages. 300.3(C)(1) also permits conductors of different systems, provided all conductors have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.*

*Code Reference: 300.3(C)(1), 200.6(D) and 210.5*

**138. Can a disconnect switch be located next to equipment installed above an accessible suspended ceiling, or must the switch be installed at a readily-accessible location?**

*Depends on type of equipment. Ref. Chapter 4 Articles and 240.24(A)(4)*

*240.24(A) (4) Overcurrent devices adjacent to utilization equipment that they supply, are permitted to be by portable means and not readily accessible.*

*Each Chapter 4 Article reads different for the location of the disconnecting means and would need to be reviewed.*

**139. I have a lay-in ceiling in a family room in a residential basement. The space above the ceiling is used for environmental air. Can I use non-metallic cable above this ceiling?**

*Answer: Yes, as long as it is all installed perpendicular to the long dimension.*

*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.*

*A. Type NM. Type NM cable shall be permitted as follows:*

*(1) For both exposed and concealed work in normally dry locations*

*334.12 Uses Not Permitted.*

*A Types NM, NMC, and NMS. Types NM, NMC, and NMS cables shall not be permitted as follows:*

*(1) In any dwelling or structure not specifically permitted in 334.10(1), (2), and (3)*

*Exception: Type NM, NMC, and NMS cable shall be permitted in Type I and II construction when installed within raceways permitted to be installed in Type I and II construction.*

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

*300.22 Wiring in Ducts, Plenums, and Other Air-Handling Spaces. The provisions of this section apply to the installation and uses of electrical wiring and equipment in ducts, plenums, and other air-handling spaces.*

*C. Other Space Used for Environmental Air. This section applies to space used for environmental air-handling purposes other than ducts and plenums as specified in 300.22(A) and (B). It does not include habitable rooms or areas of buildings, the prime purpose of which is not air handling.*

*FPN: The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which this section applies.*

*Exception: This section shall not apply to the joist or stud spaces of dwelling units where the wiring passes through such spaces perpendicular to the long dimension of such spaces.*

**140. Can I install a range hood in a dwelling unit kitchen to the small appliance circuit?**

*. No. NEC 210.52(B)(2) requires that the two or more small-appliance branch circuits specified in 210.52(B)(1) shall have no other outlets. There are two exceptions but a range hood is not one of them*

**141. I'm in discussion with an electrician who says that he heard that a remote control with mounting bracket located adjacent to the wall switch satisfies the requirement of having a switch control for 210.70(A)(1). I was under the impression that if the switch operates the light regardless of the state of the remote then that is ok, but the remote could not act as the sole lighting control. What is acceptable?**

*A. Section 210.70 (A) (1) pg. 55, Exception No. 2, states lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to the wall switch or (2) located at a customary wall switch location and equipped with a manual override that will allow the sensor to function as a wall switch. Per above the unit indicated would also need a manual override feature as part of the unit.*

**Panel 1**

**Dick Owen, Moderator**

**Mark Early**

**Ron Janikowski**

**Richard Loyd**

**Chuck Mello**

**Dave Williams**

**John Stacy**

**Alan Manche**

**Dave Kendall**

**Panel 2**

**OP Post, Moderator**

**Jeff Fecteau**

**Tim McClintock**

**Tom Moore**

**Sam Sampson**

**Phil Simmons**

**Charlie Trout**

**Ray Weber**

**Don Offerdahl**