

NEC CODE QUESTIONS

Western Section IAEI 101st Annual Meeting September 19-21, 2005

The Code Panels were as follows:

CODE PANEL NO. 1 – MIKE FORISTER, MODERATOR

| | |
|------------------|-----------------------------|
| Mark Earley | - 1, 9, 17, 25, 33, 41, 49 |
| Monte Ewing | - 2, 10, 18, 26, 34, 42, 50 |
| Richard Loyd | - 3, 11, 19, 27, 35, 43, |
| Chuck Mello | - 4, 12, 20, 28, 36, 44, |
| Dick Owen | - 5, 13, 21, 29, 37, 45, |
| Jim Pauley | - 6, 14, 22, 30, 38, 46, |
| M. "Sam" Sampson | - 7, 15, 23, 31, 39, 47, |
| John Stacey | - 8, 16, 24, 32, 40, 48, |

CODE PANEL NO. 2 - O.P. POST, MODERATOR

| | |
|------------------|-------------------------------|
| Tom Lichtenstein | - 51, 59, 67, 75, 83, 91, 99 |
| Todd Lottmann | - 52, 60, 68, 76, 84, 92, 100 |
| Dave Mercier | - 53, 61, 69, 77, 85, 93, 101 |
| Tom Moore | - 54, 62, 70, 78, 86, 94, 102 |
| Don Offerdahl | - 55, 63, 71, 79, 87, 95, 103 |
| Phil Simmons | - 56, 64, 72, 80, 88, 96, 104 |
| Charlie Trout | - 57, 65, 73, 81, 89, 97, |
| Ray Weber | - 58, 66, 74, 82, 90, 98, |

The person who was assigned and answered the question supplied answers to the following questions. Highlighted names did not supply their answers and answers were derived from notes. Questions do not take into account debate at the meeting.

1. What is the definition of an "unobstructed exit" in relation to 110.26(C)?

Answer: Exit without traversing around equipment or over obstacles without entering the workspace.

2. Can metal four-square boxes be mounted to studs with nails, sheet metal, or drywall screws, using the two small holes on the sides toward the front of the box?

Answer: These holes are intended for attachment of a bracket used with metal lath. NEMA OS-3 does not recommend use of these holes for mounting. The AHJ answering this question would allow the use of these holes for mounting.

3. Is a rigid coupling with two chase nipples a suitable raceway or nipple between two panels or boxes?

Answer: No, the chase nipple is listed to attach to a box with a locknut not be screwed into a conduit coupling which depends on a wrench-tight connection also Part 5 to Article 250 requires the bonding to provide a low impedance path suitable for carrying the fault current. 250.

Mark Ode says; A chase nipple screwed into a coupling from inside a panelboard (from both sides) would certainly not be a positive bonding for either the raceway or the enclosure based on 250.92(B).

Chase nipples were intended and listed for use with a locknut and not listed with the intent to screw it into a rigid coupling, in my opinion. Could it act as a path for fault current? Yes, however, we would not have tested it for the path of current from the panel metal in contact with the chase nipple into the rigid coupling, through the coupling and into a chase nipple on the other side to a panel or box. Too many questions about acceptable grounding paths and the fault path levels. How much impedance would be introduced through arcing at each point of contact. Mark

250.96 Bonding Other Enclosures.

(A) General. Metal raceways, cable trays, cable armor, cable sheath, enclosures, frames, fittings, and other metal non-current-carrying parts that are to serve as grounding conductors, with or without the use of supplementary equipment grounding conductors, shall be effectively bonded where necessary to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings designed so as to make such removal unnecessary.

And of Course Services 250.94 and over 250 volts to ground 250.97 require bonding exceeding these requirements

4. How can you maintain a redundant ground to receptacles and switches in an MRI (magnetic resonance imaging) room?

Answer: The switches for luminaries and general use receptacles would achieve the correct grounding by having the circuit(s) installed in a listed metallic raceway as identified in Section 517.13, with the addition of an insulated green or green with one or more yellow stripes wire type equipment grounding conductor. If the question is relating to any switches or receptacles on the actual MRI unit, this depends on if the entire MRI assembly is classified or not. If the unit is classified, then the assembly has been evaluated under UL Standard 60601-1 and part of that evaluation is the suitability and reliability of the integral equipment grounding conductors and Section 90.7 indicates that further inspection of the internal wiring is not required. Where there is not an overall classification, then the assembly would be subject to Section 517.13 for the circuit wiring to the MRI unit and be installed accordingly.

5. What types of wiring methods should be used inside a walk-in cooler or freezer? Are bell boxes, compression fittings, and sealtite required, or are regular four-square boxes with set screw fittings, and flex acceptable?

Answer: A walk-in cooler or freezer is a high-humidity location where frost will build up over time on the equipment. During defrost cycle; this frost turns into water that runs down the equipment. Also, many health codes require regularly scheduled washing of the interiors for cleanliness. This would make the interior, in my opinion a wet location and the Code reference would be Sections 300.6 for general requirements and 314.15(A) for the boxes and fittings.

barrier. Alternatively, a switch that is listed as being acceptable for use within 1.5 m (5 ft) shall be permitted.

8. Can you use a pre-wired fixture whip to supply a chain-hung strip fixture?

Answer: Yes NEC 300-18 page 129

9. Are joints required to be accessible in low-voltage 12-volt lighting system installations (for example, puck lights for under cabinet lighting)?

Answer: No Article 725.52 does not require joints be accessible.

10. Why is Class 2 wiring a minimum for residential low voltage wiring per 725.61?

Answer: The circuit has the potential of being supplied by a Class 2 power supply. NEC 725.41(A)

11. When using sealing locknuts on rigid pipe in situations other than for service raceways, do they provide adequate connection to maintain grounding continuity?

Answer: Yes, the UL white book Page 22 does cover this type locknut and does not seem to require bonding bushings

12. What table do you use to size an equipment-grounding conductor from a transformer secondary to the first disconnect? NEC 250.66, or 250.122?

Answer: The conductor from the transformer enclosure to the enclosure containing the first disconnecting means is defined by Section 250.30(A)(2) as an equipment bonding jumper, not an equipment-grounding conductor. This is true without regard to if the system grounding and bonding is done at the source (transformer) or at the panel with the first disconnecting means. In accordance with Section 250.30(A)(2), you go to the requirements in Section 250.102(C) and that refers you to Table 250.66 to be used based the size of the largest secondary conductors to determine which size bonding jumper is required.

13. Can Allied type fiberglass boxes be used in cold air returns without being panned off?

Answer: No. Code reference is 300.22(C) (2). Nonmetallic equipment listed for the use and with fire-resistant and low-smoke producing characteristics are permitted, but to my knowledge these boxes have not been evaluated for this. Also, since the boxes are designed for use with NMC, the only allowed use of NMC in the space is a run straight through the space, not looped into a box with strapping on both sides.

14. Can you install a single 20-ampere receptacle on a 15-ampere branch circuit and comply with code?

Answer: If the circuit is supplying more than one receptacle or outlet, the answer is No. NEC 210.21(B)(3).

If this is an individual branch circuit with a single receptacle, then the rules in 210.21(B)(1) apply which states that the receptacle shall have an ampere rating not less than that of the branch circuit. The 20-ampere receptacle would have an ampere rating that is not less than the 15A circuit.

15. Sections 517.18 (A) and (B) addresses patient bed locations relating to branch circuit and receptacle requirements but states that they do not apply to clinics. Are hospital grade receptacles required in general care areas of clinics that have treatment and exam rooms?

Answer: No. The only NEC reference to ‘hospital grade receptacles’ is in 517.18 (B) and 517.19(A)(2). These subsections require that all patient bed location receptacles shall be listed as "hospital grade" and that they be so identified. A quick check of the definitions in 517.2 defines a patient bed location as “the location of an inpatient sleeping bed; or the bed or procedure table used in a critical patient care area.”

517.2 Definitions.

Patient Bed Location. The location of an inpatient sleeping bed; or the bed or procedure table used in a critical patient care area.

517.18 General Care Areas.

(B) Patient Bed Location Receptacles. Each patient bed location shall be provided with a minimum of four receptacles. They shall be permitted to be of the single or duplex types or a combination of both. All receptacles, whether four or more, shall be listed “hospital grade” and so identified. Each receptacle shall be grounded by means of an insulated copper conductor sized in accordance with Table 250.122.

517.19 Critical Care Areas.

(A)(2) Receptacle Requirements. The receptacles required in 517.19(B)(1) shall be permitted to be of the single or duplex types or a combination of both. All receptacles, whether six or more, shall be listed “hospital grade” and so identified. Each receptacle shall be grounded to the reference grounding point by means of an insulated copper equipment grounding conductor.

16. Can permanently mounted light fixtures (installed with toggle bolts or screwed to structure) be cord- and plug-connected since flexible cord may not be substituted for fixed wiring methods? 400.7 allows it for luminaires without restrictions.

Answer: No 400.7 gives places or articles where cords may be permitted. You would have to go to the appropriate article ie. cranes, elevators, welders, luminaires, etc. Luminaires with requirements are found in 410.30, 400.8 does not allow cord to be used for fixed wiring. Page 235

17. Does the NEC require space for future circuits in an electrical service panel or can it be filled with breakers?

Answer: No, the NEC does not require space for future circuits. It is a design issue.

18. The ungrounded conductors to parking light lighting are increased from #10 AWG to #6 AWG for voltage drop compliance. Can the #10 grounding conductor remain for this 30-amp circuit?

Answer: No, the grounding conductor must be increased in ratio to the ungrounded conductors. NEC 250.122

19. Does the outer sheath of Type MC Cable meet the requirements for equipment grounding?

Answer: These products are covered in Article 330. And since there are a number of types available I'll try to give you the whole answer.

Solid tube type could be listed as the sheath only meeting 250.118 but generally it is listed as a combination of the sheath plus enclosed Equipment grounding wire.

Spiral wrapped standard MC cable No

Circuit integrity type No

Hazardous location type no

There is a new type with a bare wire run along the inside of the sheath and that is available the answer would be yes as long as it is listed with the bare wire in continuous contact with the sheath and special connectors.

20. Under what circumstances can an assortment of equipment constructed on the jobsite, containing motors, controllers, and junction boxes be allowed to be grouped and used without carrying a listing as an assembly?

Answer: Under any circumstances the Authority Having Jurisdiction allows. I am not trying to be flippant with that answer as it is serious. There is nothing in the NEC that prohibits an enterprising contractor or electrician from taking whatever components are needed and creating an installation as long as the construction and installation complies with the adopted electrical Code. Where the contractor or electrician starts to act more like a manufacturer off site and away from true "installation, the more likely an AHJ may ask that prefabricated "products" be Listed or Evaluated by a recognized third party testing laboratory. The final authority under Section 110.2 is the AHJ and what he or she enforces for product listing or evaluation is up to them and the laws, rules, policies they operate under.

21. An office break room has range, refrigerator, sink with a disposal, and counter space. Do the receptacles require GFCI protection?

Answer: Generally, yes. Code reference is Section 210.8(B) (2) for "Commercial and Institutional Kitchens". The Code Panel indicated that the intent is to include break rooms in this section, as long as it complies with the requirements, including permanent facilities for cooking.

22. Do duct heaters that supplement a ground source heat pump system require a disconnect means within sight of the main panel?

Answer: Not necessarily a “disconnect” in sight of the main panel. However, given that these are fixed space heating, then Article 424 would apply. There is no motor and likely no supplemental protection. So 424.19(B) (1) would require that the branch circuit breaker be within sight or “capable of being locked in the open position”.

23. Where a running board is required to protect Type NMC cable within 6’ of an attic access, how close to the Type NMC is the board to be located? Does a board need to be installed on both side of the Type NMC cable?

Answer: There is no direct code reference for the safe installation of Type NM cable near an attic access. Two places in the NEC mention the undefined term “running board.” From the dictionary we find this definition:

Main Entry: **running board**

Function: *noun*: a footboard especially at the side of an automobile

The article on non-metallic cable clearly requires this type of cable to be protected from physical damage when exposed:

334.15 Exposed Work.

In exposed work, except as provided in 300.11(A), cable shall be installed as specified in 334.15(A) through (C).

(A) To Follow Surface. Cable shall closely follow the surface of the building finish **or of running boards.**

(C) In Unfinished Basements. Where cable is run at angles with joists in unfinished basements, it shall be permissible to secure cables not smaller than two 6 AWG or three 8 AWG conductors directly to the lower edges of the joists. Smaller cables shall be run either through bored holes in joists **or on running boards.**

Another resource can be found at Section 320.23, which requires Type AC cable to be protected within 6’ of an attic access. Although not a specific requirement for NMC, this could be used as a guide for the installation - and protection of - of Type NM cables.

320.23 In Accessible Attics.

Type AC cables in accessible attics or roof spaces shall be installed as specified in 320.23(A) and (B).

(A) Where Run Across the Top of Floor Joists. Where run across the top of floor joists, or within 2.1 m (7 ft) of floor or floor joists across the face of rafters or studding, in attics and roof spaces that are accessible, the cable shall be protected by substantial guard strips that are at least as high as the cable. Where this space is not accessible by permanent stairs or ladders, protection shall only be required within 1.8 m (6 ft) of the nearest edge of the scuttle hole or attic entrance.

24. Can a tree ever be used to support outdoor luminaires?

Answer: Yes, 410.16 (H) Please read the FPN 1&2, 225.26 No conductors and 300.5(D) Protection of direct buried cables. page 257

25. Can an electrical panel be installed in a normally locked manager's office of a fast food joint? Can a door that opens be in front of the dedicated panel space?

Answer: No, it does not meet the definition "readily accessible" No 110.26

26. When calculating single-family dwelling loads, is the A/C condenser unit calculated at 125% when it is the largest motor? Is the 125% already built into the nameplate rating of the unit?

Answer: No, the Air Conditioner nameplate is 125%.

27. A meter socket is mounted on a remote pedestal adjacent to a pad-mounted transformer. The underground service lateral from the meter socket to the residence is 50 ft. A ground rod is driven at the meter pedestal location and connected to the terminal in the socket. Is an additional ground rod required to be connected at the main service panel?

Answer: Yes grounding electrode system is required , 250.24 and 250.32, 250.24(D) which states; Grounding Electrode Conductor. A grounding electrode conductor shall be used to connect the equipment grounding conductors, the service-equipment enclosures, and, where the system is grounded, the grounded service conductor to the grounding electrode(s) required by Part III of this article.

High-impedance grounded neutral system connections shall be made as covered in 250.36.

FPN: See 250.24(A) for ac system grounding connections.

28. I have a detached garage served by a common service from a dwelling. I have a phone wire installed between the two buildings. Am I required an equipment grounding wire to be installed with the feeder from the dwelling to the accessory building?

Answer: Yes. It is being assumed that the telephone cable has a metallic shield which would be the norm. Please note that in the 2005 NEC the concept of the "common service" was deleted and replaced by buildings served by feeders or branch circuits without regard to where the service is physically located. In the telephone wire, the shield is required to be bonded to the service panel and to the main disconnecting means for the additional building per Sections 800.93 and 250.94. In this case as stated, Section 250.32(B)(1) would apply because the requirements in 250.32(B)(2) can not be met since re-bonding of the neutral in the detached garage panel would create a parallel path for normal neutral current. Therefore an equipment-grounding conductor is required to be installed along with the feeder and bonding of the neutral bus in the feeder panel prohibited.

29. What column of Table 300.5 is used for the direct burial of EMT?

Answer: First of all, start on page 32 of the UL White Book under Electrical Metallic Tubing (FJMX). The text says "In general, galvanized steel electrical metallic tubing in contact with soil requires supplementary corrosion protection." In the next paragraph, under "Unevaluated Factors", it is noted that "Supplementary nonmetallic coatings presently used have not been investigated for resistance to corrosion." So basically, I would say under Section 110.3 that EMT is not suitable for direct burial since there is no recognized, acceptable corrosion protection for it. However, if the AHJ is willing to approve some method, even though it is not evaluated by a testing laboratory, then Column #3 of Table 300.5 (Other Approved Raceways) would apply.

30. Can 725.61 be applied for residential fire pumps? Are motors connected to fire suppression systems considered fire pumps?

Answer: Not sure what the reference to 725.61 is after. 725.61 applies to Class 2, 3 and PLTC cables and would not appear to relate to a fire pump circuit.

Motors connected to a simply suppression system may not be a fire pump. Fire pump systems are complete systems with specific requirements from NFPA 20.

31. An extended stay motel has small apartment type suites with a kitchen, living room, bathroom and one or two bedrooms. Are these units required to be wired as dwelling units?

Answer: Yes, they do not have to be “wired as dwelling units” but they must meet some of the provisions, that is, the branch circuits and outlets shall be installed to meet the requirements for dwelling units, except that receptacle outlets shall be permitted to be located conveniently for permanent furniture layout.

210.18 Guest Rooms and Guest Suites.

Guest rooms and guest suites that are provided with permanent provisions for cooking shall have branch circuits and outlets installed to meet the rules for dwelling units.

210.11 Branch Circuits Required.

In addition to the number of branch circuits required by other parts of this section...

(C) Dwelling Units.

- (1) Small-Appliance Branch Circuits.
- (2) Laundry Branch Circuits.
- (3) Bathroom Branch Circuits.

210.12 Arc-Fault Circuit-Interrupter Protection.

(B) Dwelling Unit Bedrooms. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit bedrooms shall be protected by a listed arc-fault circuit interrupter, combination type installed to provide protection of the branch circuit.

210.52 Dwelling Unit Receptacle Outlets.

(A) General Provisions.

(1) Spacing. (2) Wall Space. (3) Floor Receptacles.

(B) Small Appliances.

(C) Countertops.

(D) Bathrooms.

(E) Outdoor Outlets.

(F) Laundry Areas.

(G) Basements and Garages.

(H) Hallways.

210.60 Guest Rooms or Guest Suites.

(A) General. Guest rooms or guest suites in hotels, motels, and similar occupancies shall have receptacle outlets installed in accordance with 210.52(A) and 210.52(D). Guest rooms or guest suites

provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52.

(B) Receptacle Placement. In applying the provisions of 210.52(A), the total number of receptacle outlets shall not be less than the minimum number that would comply with the provisions of that section. These receptacle outlets shall be permitted to be located conveniently for permanent furniture layout. At least two receptacle outlets shall be readily accessible. Where receptacles are installed behind the bed, the receptacle shall be located to prevent the bed from contacting any attachment plug that may be installed or the receptacle shall be provided with a suitable guard.

32. Can non-metallic conduit be used to wire a gasoline-dispensing pump? Are there any special requirements to using it this way?

Answer: Yes RMC may be used under 2 ft. of earth with the last 2 ft. being rigid or imc, and then 90 degree up with a seal-off to the pump. Must also have an equipment ground. 514.8 page 394

33. Does the NEC have a definition for a bedroom? Many times a room has a closet and is designated as an office on the drawings but can be easily converted to a bedroom. This so called office is not required to have AFCI protection?

Answer: No

34. Why can cable entering the back of a box in a 2 X 4 wall not come under the 1-1/4" spacing rule for protection?

Answer: The box is providing the protection and sheet rockers can see the box. NEC 300.4(D)

35. Section 250.12 includes "shall be removed from the threads & other contact surfaces". How does this rule apply to the installation of an equipment ground bar in a panel? Are machine thread screws adequate or does the paint need to be removed behind the grounding bar?

Answer: look at 250.4(A)(3) Yes we want a low impedance path.

36. If the secondary side of a transformer is correctly grounded to a grounding electrode system, is a grounding conductor required to the first disconnecting means?

Answer: If the grounding electrode conductor is installed to the transformer as the question implies then the proper installation would also require the system bonding jumper to be installed in the transformer also. Given the above, a "grounding conductor" as defined in Article 100 is not required and in fact if installed would be a violation of Section 250.30(A)(3). What is required though, is a bonding conductor between the transformer enclosure as provided in Section 250.102(C) and the enclosure containing the first disconnecting means by Section 250.30(A)(2). This use of the "grounding conductor" terminology brings up one more instance of the need to clarify all the terminology around this topic. If the term "grounding conductor" is meant to include all conductors (grounding electrode conductor, equipment-grounding conductor, and all bonding conductors) then

the answer to the above question would be yes because the required “equipment bonding conductor” would be included under the umbrella term “grounding conductors”.

Grounding Conductor. A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

37. Can a refrigerator receptacle be on the kitchen small-appliance circuit?

Answer: Yes. Reference is Section 210.52(B)(1). Actually, the section requires that “...receptacle outlets for refrigeration equipment.” be on the small appliance branch circuit. Exception 2 to this section does allow the refrigerator to be on an individual branch circuit 15 amperes or greater.

38. Are the breakers that can be used for lighting system switching marked for this application or are all breakers now approved for this usage?

Answer: 240.83(D) - where used as a switch

SWD marking – 120V or 277V fluorescent lighting

HID marking – HID lighting

If it isn't marked, then it isn't acceptable to be used as the switch to control the lighting.

39. I have a Romex cable in a wall that got nicked. Only the outer sheathing was slightly damaged. Can I repair that damage with electrical tape and not replace that Romex cable?

Answer: Although the purpose of the sheath of Type NM cable is to protect the inner conductors and Article 334 has requirements for the outer covering, there is no specific requirement to replace a cable assembly with a damaged outer sheath. Article 334 has requirements for protecting the cable from physical damage after it has been installed, and it is reasonable to assume that some minor damage will occur during installation. This raises other related questions, such as: Must metal conduit that is kinked be replaced? Must ENT that has split be replaced? How about flexible metal conduit or Type AC and MC cable that has been damaged?

Whether a length of Type NM cable must be replaced if the outer sheath is nicked will be a judgment call based on the extent of the visible damage.

ARTICLE 334 Nonmetallic-Sheathed Cable: Types NM, NMC, and NMS

334.1 Scope.

This article covers the use, installation, and construction specifications of nonmetallic-sheathed cable.

334.15 Exposed Work.

In exposed work, except as provided in 300.11(A), cable shall be installed as specified in 334.15(A) through (C).

(A) To Follow Surface. Cable shall closely follow the surface of the building finish or of running boards.

(B) Protection from Physical Damage. Cable shall be protected from physical damage where necessary by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means.

334.17 Through or Parallel to Framing Members.

Types NM, NMC, or NMS cable shall be protected in accordance with 300.4 where installed through or parallel to framing members. Grommets used as required in 300.4(B)(1) shall remain in place and be listed for the purpose of cable protection.

334.116 Sheath.

The outer sheath of nonmetallic-sheathed cable shall comply with 334.116(A), (B), and (C).

(A) Type NM. The overall covering shall be flame retardant and moisture resistant.

(B) Type NMC. The overall covering shall be flame retardant, moisture resistant, fungus resistant, and corrosion resistant.

(C) Type NMS. The overall covering shall be flame retardant and moisture resistant. The sheath shall be applied so as to separate the power conductors from the communications and signaling conductors. The signaling conductors shall be permitted to be shielded. An optional outer jacket shall be permitted.

40. I have a Romex cable running from my panel through my crawl space. I plan to run this cable through the floor on the surface of the wall to my ceiling and into my attic. I plan to use Schedule 40 PVC to protect my Romex from a chance of physical damage. Does this meet the rules of the NEC?

Answer: Yes, schedule 80 pvc, ridgid, imc or emt may be used 334.15 (B). Page 179

41. Can a meter main panel be used for an existing dwelling service change upgrade to feed more than one existing load without a main breaker protecting each load as long as there are less than 6 throws to de-energize? The service equipment is a 200-ampere combination meter and panel suitable for outdoor locations, with 200-ampere rated service-entrance conductors supplying the meter. There is a 50-ampere breaker installed for the range, and a 70-ampere breaker supplying the existing panelboard with a properly rated feeder.

Answer: Yes. Provided it is not a lighting and appliance panelboard. 408.34(A) and 408.36(A), 230.71 and 230.72

42. What is the equipotential plane defined in 682.2 likely to look like at an agricultural irrigation well service?

Answer: Look at the scope of this article you will generally not have a equal potential plane 682.32(A).

43. Can I jump a grounding electrode conductor from the metal water pipe to a metal beam and go to the other end of the building and then go from the metal beam to the service and call this my continuous grounding electrode? Are there restrictions on how small a beam or bar joist that can be used?

Answer: Yes, Lets look at 250.50 It does not stipulate how it is done only that you meet the performance requirements.

250.50 Grounding Electrode System.

All grounding electrodes as described in 250.52(A)(1) through (A)(6) 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)(7) shall be installed and used.

250.58 Two or more grounding electrodes that are effectively bonded together shall be considered as a single grounding electrode system in this sense.

250.64(F) To Electrode(s). A grounding electrode conductor shall be permitted to be run to any convenient grounding electrode available in the grounding electrode system, or to one or more grounding electrode(s) individually, or to the aluminum or copper busbar as permitted in 250.64(C). The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all the electrodes connected to it.

44. Are all listed and labeled metallic cable trays suitable as an equipment ground path? What type of connection and fastening means can be made for an equipment ground wire if it is not listed as a ground path?

Answer: Cable trays are not listed but are “Classified” under category CYNW found on page 12 of the 2005 UL General Information Directory (White Book). Classification of a product means that it was specifically evaluated for one or more items as described in the classification, in the case of cable trays this classification is for the use as an equipment grounding conductor under NEC Sections 392.3(C) and 392.7(B). To be used in this manner, the cable tray must be installed, either by direct assembly and/or by the use of bonding jumpers, in accordance with the instructions provided with the product and with the hardware provided or specified. If there is no mark or if the tray is not installed as specified, then it is not suitable as an equipment grounding conductor and an alternate means must be used. Installing a wire type equipment grounding conductor and using listed connectors would be one way of installing an equipment grounding conductor, where the cable tray is not suitable, and for bonding the various sections of the tray together.

45. In a remodel or retrofit of an existing dwelling, is AFCI protection required in all existing bedrooms?

Answer: No. Code reference is Section 210.12(B). The NEC in general applies to new installations, and if new outlets are installed in an existing bedroom, they must be AFCI-protected. Existing outlets in a bedroom are not required to be retrofitted with AFCI protection. It is probably a good idea, but is not required.

46. A receptacle is installed at an outdoor monument structure. Would the NEC require GFCI protection?

Answer: Yes. 210.8(B)(4). The installation described would appear to be an area that is accessible to the public.

47. We recently remodeled the Operating Room in a hospital and were required to put all receptacles on GFCI Breakers. The Fire Marshall claimed this is a wet location. Is this accurate? The hospital staff has complained that they are tripping breakers and would like us to do something.

Answer: Unfortunately, the AHJ does not have the authority to classify locations, but yes, operating rooms are definitely wet locations. GFCI is one allowance for operating rooms that are classified as wet locations, but an isolated power system would prevent nuisance tripping, per NEC 517.20. It is quite possible, however, that this is NOT nuisance tripping, but GFCI devices functioning properly and opening the circuit at dangerous fault levels. Listed appliances must have leakage current of less than one half a milliamp at manufacture, so if the equipment trips GFCI (with a trip setting of 5 milliamps) it is obviously damaged.

517.20 Wet Locations.

(A) Receptacles and Fixed Equipment. All receptacles and fixed equipment within the area of the wet location shall have ground-fault circuit-interrupter protection for personnel if interruption of power under fault conditions can be tolerated, or be served by an isolated power system if such interruption cannot be tolerated.

Exception: Branch circuits supplying only listed, fixed, therapeutic and diagnostic equipment shall be permitted to be supplied from a normal grounded service, single- or 3-phase system, provided that

- (a) Wiring for grounded and isolated circuits does not occupy the same raceway, and
- (b) All conductive surfaces of the equipment are grounded.

(B) Isolated Power Systems. Where an isolated power system is utilized, the isolated power equipment shall be listed as isolated power equipment, and the isolated power system shall be designed and installed in accordance with 517.160.

48. When using 2-wire with ground or 3-wire with ground Type NM cable in a 3-way or 4-way switch setup, and the white wire is re-identified as required by 200.7, can you use the “white “ wire as traveler between switches?

Answer: 200.7 C (2) yes switch loops or power to a switch may be re-identified however the return to the outlet may not. Page 44.

49. How are we to accomplish the disconnection of the service required in the last sentence of 682.11? Where do we interrupt the power? At the weatherhead? Ahead of the meter? At the service disconnect?

Answer: The language in 682.11 says that the service equipment shall disconnect. I read that to mean that the service disconnect shall open. Easiest way would be to use a shunt trip on the service disconnect and use a level switch or similar sensor.

50. Is 547.1(A) to be applied to the entire area within the four walls of a horse barn or only animal confinement areas where litter dust and feed dust may accumulate?

Answer: The entire area would be covered.

51. Is a 15- or 20-ampere, 120-volt branch circuit permitted to be added to the upper section of an existing split-bus panel where we only have three other handles?

Answer: It depends! If the panelboard is supplied by a feeder, then yes, the feeder overcurrent protection device which is protecting the feeder will serve as the disconnect for the panelboard in accordance with 408.36(A). If not, the additional breaker is required to be installed in the protected portion of the split buss panelboard.

52. What is the maximum overcurrent device rating allowed for 8 AWG aluminum, and Type SER cable installed as a branch circuit for an electric dryer?

Answer: According to Table 310.16, the maximum overcurrent would be 40-amps.

53. A commercial garage has a swinging door between the office and shop area. All of the wiring is located above 18 inches. Can I use Type MC cable to wire the office area?

Answer: Yes

ARTICLE 511 Commercial Garages, Repair and Storage

Areas adjacent to classified locations in which flammable vapors are not likely to be released, such as stock rooms, switchboard rooms, and other similar locations, shall not be classified where mechanically ventilated at a rate of four or more air changes per hour, or designed with positive air pressure, or where effectively cut off by walls or partitions.

511.3(A) (7) Within 450 mm (18 in.) of the Ceiling In major repair garages, where lighter-than-air gaseous fuels (such as natural gas or hydrogen) vehicles are repaired or stored, the area within 450 mm (18 in.) of the ceiling shall be considered unclassified where ventilation of at least 1 cfm/sq ft of ceiling area taken from a point within 450 mm (18 in.) of the highest point in the ceiling is provided.

511.7 (A) Wiring in Spaces Above Class I Locations

(1) Fixed Wiring Above Class I Locations All fixed wiring above Class I locations shall be in metal raceways, rigid nonmetallic conduit, electrical nonmetallic tubing, flexible metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit, or shall be Type MC, AC, MI, manufactured wiring systems, or PLTC cable in accordance with Article 725, or Type TC cable or Type ITC cable in accordance with Article 727. Cellular metal floor raceways or cellular concrete floor raceways shall be permitted to be used only for supplying ceiling outlets or extensions to the area below the floor, but such raceways shall have no connections leading into or through any Class I location above the floor.

54. A gas station has a diesel island installed separate from the gas pumps (more than 25 feet away). Is this required to be wired Class I, Division 2? The station will be an unattended fill station. Is an emergency shut off required as per 514.11?

Answer: The diesel flashpoint is above 100 degrees and therefore not covered but 514.3(A) emergency shut off rule still applies however, Article 510 seems to omit diesel pumps entirely from Article 514.

55. Is cable splicing permitted within the cable tray?

Answer: Yes, 392.8

56. In the event a foundation is poured today without providing a means of connecting to the footing steel, what is the most desirable remedy?

Answer: This question no doubt relates to the change in 250.50 which requires the connection of concrete encased electrodes if they are present. An exception excludes the connection requirement for “existing” buildings. A building is considered “existing” after a certificate of occupancy is issued by the Building Department.

Most desirable remedy: connect all the other grounding electrodes in 250.52(A)(1), (A)(2) and (A)(4) that are present. If these are not “present,” install one or more grounding electrodes from 250.52(A)(5), (A)(6) or (A)(7).

Caution the builder to schedule better in the future.

57. Can a 200-amp MLO power panel be fed with a 9’ tap from a 200-amp OCP device using a #2 copper Type THHN and a heating load of 80 amps?

Answer: No, according to 240.21(B)(1)(1)(b) – Feeder Taps – Not Over Ten Feet Long -- The ampacity of the tap conductors must be “not less than the rating of the device being supplied (200A MLO Panel) by the tap conductors.”

58. Why does the NEC not allow a 125-volt receptacle for refrigeration equipment in a commercial kitchen not to be GFCI protected if it is located normally behind the appliance and not readily accessible?

Answer: Wrong, 210.8 (B) all must be GFCI protected.

59. A utility feed is fed into the bottom of a circuit breaker used for the service disconnect. The switched portion of the power is on the top of the breaker. Is this a violation?

Answer: NO it is not a violation, if the breaker is not marked line and load on the breaker then it is suitable for reverse connections. This information can be found on page 11 of the Circuit Breaker Marking guide. However, if the breaker is labeled as “Line and Load” for the supply conductors the breaker is not suitable for reverse connection and supply connections must be made appropriately. The handle shall be orientated so that “Up is On” when mounted vertically in accordance with NEC Section 240.81.

60. Do 24-volt damper motors require a disconnect in sight?

Answer: No. 430.102

61. Can Type NM cable be stapled to the bottom of the floor joist in a four-foot crawl space underneath a home?

Answer: No because in the question this is referred to as a crawl space we cannot use the rules for unfinished basements 334.15(C) where only 2/#6 or 3/#8 conductors can be secured directly to the lower edges of the joist. We now need to determine if protection from physical protection is needed. If so then 334.15(B) requires specific means for protection. If physical damage is not a concern then 334.15 (A) requires the cable to follow surface of the finish or of running boards.

334.15 Exposed Work

In exposed work, except as provided in 300.11(A), cable shall be installed as specified in 334.15(A) through (C).

(A) To Follow Surface - Cable shall closely follow the surface of the building finish or of running boards.

(B) Protection from Physical Damage - Cable shall be protected from physical damage where necessary by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means. Where passing through a floor, the cable shall be enclosed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means extending at least 150 mm (6 in.) above the floor.

Where Type NMC cable is installed in shallow chases in masonry, concrete, or adobe, the cable shall be protected against nails or screws by a steel plate at least 1.59 mm (1/ 16 in.) thick and covered with plaster, adobe, or similar finish.

(C) In Unfinished Basements - Where cable is run at angles with joists in unfinished basements, it shall be permissible to secure cables not smaller than two 6 AWG or three 8 AWG conductors directly to the lower edges of the joists. Smaller cables shall be run either through bored holes in joists or on running boards. NM cable used on a wall of an unfinished basement shall be permitted to be installed in a listed conduit or tubing. Conduit or tubing shall utilize a nonmetallic bushing or adapter at the point the cable enters the raceway. Metal conduit and tubings and metal outlet boxes shall be grounded.

320.15 Exposed Work (AC Cable)

Exposed runs of cable, except as provided in 300.11(A), shall closely follow the surface of the building finish or of running boards. Exposed runs shall also be permitted to be installed on the underside of joists where supported at each joist and located so as not to be subject to physical damage.

62. Can heater or a/c thermostat wire be run in the same raceway as power conductors if rated to highest voltage?

Answer: No, this is prohibited by Article 725.54.

63. Is a disconnect required when conductors from an outside generator come up into a room in the building? Does the new requirement in 702.11 apply if a generator is within 50 feet from any portion of the building?

Answer: In Article 225.30, 31, and 32, it covers disconnecting means to buildings but upon looking further, Article 90.3 states Chapters 1-4 applied generally, Chapters 5-7 applied to special occupancies, these ladder chapters supplement or modify the general rules of Chapter 1-4. So, Article 702.11 now does not require a disconnect at the building under the provisions described in the question.

64. If a service-rated non-fused transfer switch is installed on the line side and adjacent to a main breaker service panel, where is the neutral to be bonded at?

Answer: The neutral (grounded conductor) is required to be routed to the service disconnecting means and be bonded to each service disconnecting means. 250.24(C).

The neutral can be used to ground and bond equipment on the supply side of the service equipment. See 250.92(B)(1) and 250.142

65. The home I wired called for a 10-kW electric furnace and I installed the proper size feeder. The mechanical contractor installed a 15-kW furnace and said to disconnect as many elements as I needed to get down to 10 kW. Am I changing the listing on the electric furnace?

Answer: You change the listing, but you probably will void the listing and violate 110.3(B), which requires equipment to be installed and used in accordance with any instructions included in the listing or labeling. You will end up with a problem relating to marking of equipment in accordance with 424.28.

66. A kitchen counter has the receptacles properly spaced on the counter. At the end of the counter there is a two-foot wall space with no counter. Is a floor receptacle required in the two-foot wall space?

Answer: Yes, 210.52 (A) & (1) & (2) (1) and see (B) (1). Install them and they will be used.

67. I found a sign with the listing inside the sign and not on the outside. Is this ok to approve this way?

Answer: I would say no. Electric Signs are Listed under the category of Signs (UXYT) located on page 115 in the 2005 White Book. Listed signs are required to be marked with the Listing Mark as well as other required information such as manufacturers name or trade mark, electrical rating, etc on the outside of the sign where visible after installation. A Field Inspection would be necessary. If you run across this in the field, please file a field report, either call or email me or file a report online on the regulators page on UL.com.

68. I am wiring a 480-volt, 3-phase, 40-hp motor and have tapped off my 200-ampere disconnect with No. 6 wire to feed a combination disconnect and motor starter, all located within 3 feet. I am having trouble starting the motor and increased my breaker size to 100 amperes. Does this affect the tap rule?

Answer: No it does not affect the tap rule. NEC 430.28(1)

69. Are Type NM cables allowed to be routed through a PVC stub out of the bottom of a panel into a basement or crawl space?

Answer: NO

CMP 9 in 1990 cycle or earlier. Risers are installed and not covered by the Code. What is wrong, derating, ... one concern how big of hole in panel is still safe? No, can pipe do this? No why in top? If you have two feet piece then anyone could "fish into the box and shock hazard". Can use junction box for transition.

312.5(C) Cables Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure.

The main rule of 312.5(C) prohibits the installation of several cables bunched together and run through a knockout or chase nipple. Individual cable clamps or connectors are required to be used with only one cable per clamp or connector, unless the clamp or connector is identified for more than a single cable.

Exception: Cables with entirely nonmetallic sheaths shall be permitted to enter the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 450 mm (18 in.) and not more than 3.0 m (10 ft) in length, provided all of the following conditions are met:

- (a) Each cable is fastened within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.
- (b) The raceway extends directly above the enclosure and does not penetrate a structural ceiling.
- (c) A fitting is provided on each end of the raceway to protect the cable(s) from abrasion and the fittings remain accessible after installation.
- (d) The raceway is sealed or plugged at the outer end using approved means so as to prevent access to the enclosure through the raceway.
- (e) The cable sheath is continuous through the raceway and extends into the enclosure beyond the fitting not less than 6 mm (1/ 4 in.).
- (f) The raceway is fastened at its outer end and at other points in accordance with the applicable article.
- (g) Where installed as conduit or tubing, the allowable cable fill does not exceed that permitted for complete conduit or tubing systems by Table 1 of Chapter 9 of this Code and all applicable notes thereto.

This exception allows multiple nonmetallic cables such as Type NM, NMC, NMS, UF, SE, and USE to enter the top of a surface-mounted enclosure through a nonflexible raceway sleeve or nipple. These sleeves or nipples are permitted to be between 18 in. and 10 ft in length. However, if the nipple length exceeds 24 in., the ampacity adjustment factors of 310.15(B)(2) apply.

FPN: See Table 1 in Chapter 9, including Note 9, for allowable cable fill in circular raceways. See 310.15(B)(2)(a) for required ampacity reductions for multiple cables installed in a common raceway.

70. Split AC units are installed in a school. The compressor is on the roof and the blower unit is inside. The unit comes with a 7-conductor Type SOW cord that is run from the unit on the roof to the unit inside. This cord is run free aired above the false ceiling. Does this have to be installed in a conduit because the school is a place of assembly, or is this ok because it is part of the listed unit?

Answer: Even Listed equipment has to comply with the NEC it would not be permitted unless done in accordance with the NEC .

71. A livestock feedlot has concrete slabs where the cattle feed. Does this meet Article 547 and does this concrete require bonding for equipotential plane requirement?

Answer: 547.10(A) states only in areas containing metallic equipment that may become energized and accessible to livestock.

72. What is the minimum size grounding electrode conductor for the underground metal water line in a 4-plex with a service consisting of (5) 100-Amp service disconnects with a 600-Amp rated meter center? The meter center is fed by 350 MCM aluminum by the utility. There are no service-entrance conductors by which to use 250-66 for sizing.

Answer: Assuming there is no main disconnect, do a load calculation according to Article 220, assume conductors are installed from Table 310.16, use these conductors in Table 250.66 to determine the correct size of grounding electrode conductor. See Note 2 to Table 250.66.

73. What types of rigid unions are required in a Class I, Division 1 area?

Answer: Listed explosion-proof unions are permitted between a sealing fitting and the explosion-proof enclosure (501.15(A)(1). No unions are permitted between the conduit seal and the point at which the conduit leaves the Division 1 location (501.15(A)(4).

74. Does a kitchen “island” with a center sink and over 12” of workspace on both ends require two receptacles? The kitchen has “plenty” of other counter space.

Answer: Yes, this would be a required installation according to Article 210.52(C)(2).

75. I want to run just one large neutral conductor from the service panel about 10 feet away to a junction box and put a 20 space terminal strip in and then run my individual conductors with their ungrounded conductors. Can I do this?

Answer: I would say NO. See Section 408.41. Each grounded conductor shall terminate within the panelboard. It appears that this attempt is to circumvent Table 310.15(B)(2)(a) for purposes of derating and possible decreasing the size of the installed conduit to the terminal block enclosure.

Column panelboards with an auxiliary gutter that is used to terminate neutrals are Listed together as a panelboard with the gutter, as an assembly so the neutrals are terminated inside the panelboard in accordance with 408.41. Column panels are also permitted to be wired that way in accordance with 300.3(B)(4).

However, what is described in the question is not a Listed assembly or panelboard and would not be permitted.

76. Is a disconnect required in sight of the evaporator fans in a walk-in cooler? The refrigeration people insist they don’t want one in case someone shuts it off by accident and causes the unit to freeze up.

Answer: Yes, a disconnect must be in sight or if out of sight must be capable of being locked in the open position. NEC 430.102(B)

77. Is a weep hole required in an LB fitting to allow moisture to escape?

Answer: No, but per 225.22 raceways on exterior of buildings shall be arranged to drain. If an LB fitting is used at the bottom of a run turning into a building it would seem logical that the LB be the point that the raceway is allowed to drain.

225.22 Raceways on Exterior Surfaces of Buildings or Other Structures

Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be raintight in wet locations.

78. Can PVC buried 6" deep be used under the concrete in a commercial airplane hanger?

Answer: No, Rigid Non-Metallic raceway installed in a Class 1 Div 1 area requires at least 24" of cover as well as being encased in 2" of concrete. NEC 513.8(A), 501.10(A) Exception

79. I have a house that is fed with two services. One is a 200-amp main breaker panel for the lighting and the other is a 150-amp MLO panel for the heat, that is on a separate rate with 6-2 pole breakers. Does this violate the six disconnect rule?

Answer: No, 230.2(D) allows another service when it is a separate power company rate schedule.

80. 250.52(A)(2) gives requirements for when a metal frame of building can be used as a grounding electrode. Will any anchored beam be considered a grounding electrode, and what is meant by "other approved means" in (D)?

Answer: For an anchored beam; it must be assured that the anchor bolts connect to a concrete encased electrode. "J" bolts themselves do not make an earth connection unless they connect to a qualifying grounding electrode.

"Other approved means" allows the AHJ to review the installation and determine that an earth connection is made.

81. I have a 2000-amp service that is maxed out. Can I set another service at a different location or do they have to be grouped? They are going to be the same systems, but I have no room for the new service to group them.

Answer: NEC 230.2(C)(1) provides for additional services where the load requirements are in excess of 2000 amperes at a supply voltage of 600 volts or less. The NEC does not require that the services be grouped but you may need to consult with the serving utility.

82. At a McDonalds there are computer screens mounted on the ceiling at 7 feet with a 120-volt, 20-amp isolated ground receptacle with a twist lock. This is in the kitchen area. Would GFCI protection be required?

Answer: Yes, 210.8 (B) (2) all if present, no exceptions listed.

83. In accordance with the U.L. “White book”, the installation of Type SE cable is prohibited to be installed underground. If a contractor runs Type SER (4 conductor) cable across the basement of a house, then runs underground through a non-metallic conduit to an unattached garage, is it acceptable to utilize only the three insulated conductors in the SER as long as compliance with 250.32(B)(2) is met? What is the purpose of the listing if the individual conductors are Type XHHW?

Answer: I would say NO. Type SE cable is Listed under the category of Service Entrance Cable (TYLZ), located on page 113 of the 2005 White Book. The Guide Information for TYLZ states “Type SE — Indicates cable for aboveground installation. SE cable has not been evaluated for underground installation. This would be a violation of Section 110.3(B). I would say if underground installation is required, then a transition to type USE or USE-2 which is suitable for underground and direct burial installation would be required.

84. In a dwelling, a 200-amp disconnect is installed at the nearest point of entry because panel is to be located on an inside wall. The feeder panel is a 200-amp, 40-circuit main lug only panel. A 100-amp main lug only 24-circuit sub panel is fed from it and is located immediately adjacent to it. Is overcurrent protection required for the 100-amp panel?

Answer: Yes, Article 408.36 requires overcurrent protection for the 100-amp panel.

85. Are freestanding office partitions that are hard wired to wall outlets using sealtite and connectors permitted to be fed with multi-wired branch circuits (black, red, blue & white #12) or is a super neutral or individual neutrals required for each branch circuit?

Answer: Lets see ...

1) Free Standing partitions that are have permanently connected power are covered by 605.7. Multiwire branch circuits are allowed provided a means to disconnect simultaneously all ungrounded conductors. Note that in 605.8 for Freestanding-Type Partitions, Cord-and-Plug-Connected multiwire branch circuits are not permitted.

2) Are mutli or oversized neutrals required? No they are not. 210.4 or 310.15(B)(4) recognize nonlinear loads and harmonic currents but do not require oversized or multi-neutrals.

ARTICLE 605 Office Furnishings (Consisting of Lighting Accessories and Wired Partitions)

605.1 Scope

This article covers electrical equipment, lighting accessories, and wiring systems used to connect, or contained within, or installed on relocatable wired partitions.

605.6 Fixed-Type Partitions

Wired partitions that are fixed (secured to building surfaces) shall be permanently connected to the building electrical system by one of the wiring methods of Chapter 3. Multiwire branch circuits supplying power to the partition shall be provided with a means to disconnect simultaneously all ungrounded conductors at the panelboard where the branch circuit originates.

605.7 Freestanding-Type Partitions

Partitions of the freestanding type (not fixed) shall be permitted to be connected to the building electrical system by one of the wiring methods of Chapter 3. Multiwire branch circuits supplying power to permanently connected freestanding partitions shall be provided with a means to disconnect simultaneously all ungrounded conductors at the panelboard where the branch circuit originates.

Handbook: Intended to enhance the safety of those servicing permanently connected office partitions, a new requirement for the 2005 Code specifies simultaneous disconnection of all ungrounded conductors of multiwire branch circuits supplying fixed and freestanding-type office partitions.

605.8 Freestanding-Type Partitions, Cord-and-Plug-Connected

Individual partitions of the freestanding type, or groups of individual partitions that are electrically connected, are mechanically contiguous, and do not exceed 9.0 m (30 ft) when assembled, **shall be permitted to be connected to the building electrical system by a single flexible cord and plug, provided all of the conditions of 605.8(A) through 605.8(D) are met.**

(A) Flexible Power-Supply Cord The flexible power-supply cord shall be extra-hard usage type with 12 AWG or larger conductors with an insulated equipment grounding conductor and shall not exceed 600 mm (2 ft) in length.

(B) Receptacle Supplying Power The receptacle(s) supplying power shall be on a separate circuit serving only panels and no other loads and shall be located not more than 300 mm (12 in.) from the partition that is connected to it.

(C) Receptacle Outlets, Maximum Individual partitions or groups of interconnected individual partitions shall not contain more than thirteen 15-ampere, 125-volt receptacle outlets.

(D) Multiwire Circuits, Not Permitted Individual partitions or groups of interconnected individual partitions shall not contain multiwire circuits.

FPN: See 210.4 for circuits supplying partitions in 605.6 and 605.7.

Handbook: Cord-and-plug-connected freestanding-type office partitions are not permitted to contain multiwire branch circuits.

210.4 Multiwire Branch Circuits

(A) General Branch circuits recognized by this article shall be permitted as multiwire circuits. A multiwire circuit shall be permitted to be considered as multiple circuits. All conductors shall originate from the same panelboard or similar distribution equipment.

FPN: A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads may necessitate that the power system design allow for the possibility of high harmonic neutral currents.

310.15(B)(4) Neutral Conductor

(a) A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(2)(a).

(b) In a 3-wire circuit consisting of two phase wires and the neutral of a 4-wire, 3-phase, wye-connected system, a common conductor carries approximately the same current as the line-to-neutral load currents of the other conductors and shall be counted when applying the provisions of 310.15(B)(2)(a).

(c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral shall therefore be considered a current-carrying conductor.

86. A new item #6 has been added to 230.2(A) and 225.30(A) for enhanced reliability under special conditions. Why was this put into the code and when can we use this?

Answer: It may be used anytime a second service would be deemed more reliable. So, in case one service would be lost, the redundant feature would hopefully still provide power. It may be used wherever enhanced reliability is needed, such as hospitals, installations with computers, etc.

87. When bonding hydromassage tubs, what is required to be bonded if a plastic water line supplies the tub and the motor has a plastic housing? Is the bond required to be routed back to service panel?

Answer: 680.74 states all metal piping system and all grounded metal parts in contact with the circulating water shall be bonded together using a copper bonding jumper. So in this case, if there is metal parts in the pump motor or metal water faucet, that would need to be grounded. No, it is not required to be routed back to the service panel.

88. Does 250.52(A)(5)(b) where it states, “Stainless steel rods less than 16 mm ($\frac{5}{8}$ in.) diameter, nonferrous rods, or their equivalent shall be listed and shall not be less than 13 mm ($\frac{1}{2}$ in.) in diameter” apply to ($\frac{1}{2}$ in.) galvanized rods? Also, it is my understanding that even though copper-clad rods have a ferrous core they are considered to be “equivalent” because of their listing. However, does UL actually state as a part of their listing per UL 467 that such ground rods with ferrous cores are equivalent to stainless steel or nonferrous rods?

Answer: The galvanized rods are listed according to UL 467 and are intended to meet the requirements of Article 250.52(A)(5)(b).

89. Can a dry-type transformer with a 480-volt, 3-phase delta primary and a 120/208, 3-phase Y secondary be reverse connected to boost 208 volts to 480 volts? There is no neutral connection and none of the phases are intentionally grounded on the 480-volt system.

Answer: Not unless the transformer is marked for this reverse connection. You may end up in violation of 110.3(B).

90. I recently inspected a restaurant where food preparation, dishwashing and sanitation, and food freezers and main refrigeration units for food products were all in separate rooms. Would these separate rooms be considered as separate areas and thus not a collective area as defined in 210.8(B)(2) that would require GFCI protection for 125-volt, 15- and 20-ampere receptacle outlets? I am also finding that many restaurants have their food storage including refrigeration and freezers separate from the area used for cooking and actual food preparation that only sometimes have secondary small refrigeration units in the actual food preparation area.

Answer: TRICKY, question, but Yes if in the same area, No if not and in a room with out other elements of the Kitchen definition. Reference 210.8 (B) think in the area concept similiar to the motel room and guest suite area requirements and needs.

91. Is there a reason why the neutral conductor is coiled on arc-fault and GFCI breakers?

Answer: No, it’s just for convenience in packaging and installation, it serves no technical reason.

92. Does a transfer switch installed on the exterior of a building for an optional standby system require overcurrent protection as an integral part of or adjacent to the transfer switch in accordance with 230.91? The transfer switch is connected in series with the service-entrance conductors feeding

the building. The transfer switch feeds an MDP (which includes a main circuit breaker) located inside of the building.

Answer: Yes, overcurrent protection must be provided in the transfer switch or immediately adjacent thereto. NEC 230.91

93. Is it permissible to install Romex and Type MC cable in the same-drilled hole? Example: In a medical facility common wall between “patient care area” and “records” office.

Answer: No prohibition.

You can use ...

90.4 Enforcement

This Code is intended to be suitable for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors. The authority having jurisdiction for enforcement of the Code has the responsibility for making interpretations of the rules, for deciding on the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules.

334.15 Exposed Work

In exposed work, except as provided in 300.11(A), cable shall be installed as specified in 334.15(A) through (C).

(A) To Follow Surface Cable shall closely follow the surface of the building finish or of running boards.

(B) Protection from Physical Damage Cable shall be protected from physical damage where necessary by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means. Where passing through a floor, the cable shall be enclosed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC rigid nonmetallic conduit, or other approved means extending at least 150 mm (6 in.) above the floor.

334.17 Through or Parallel to Framing Members

Types NM, NMC, or NMS cable shall be protected in accordance with 300.4 where installed through or parallel to framing members. Grommets used as required in 300.4(B)(1) shall remain in place and be listed for the purpose of cable protection.

300.4 Protection Against Physical Damage

Where subject to physical damage, conductors shall be protected.

(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 or bushing, at least 1.6 mm (1/16 in.) thick, and of appropriate length and width installed to cover the area of the wiring.

(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through **Metal Framing Members**

(1) Nonmetallic-Sheathed Cable In both exposed and concealed locations where nonmetallic-sheathed cables pass through either factory or field punched, cut, or drilled slots or holes in metal members, the **cable shall be protected by listed bushings or listed grommets** covering all metal edges that are securely fastened in the opening prior to installation of the cable.

94. Does the Exception to 695.6(A) mean that service conductors may be routed through a building unprotected by either overcurrent protection or by the provisions of 230.6(1) or 230.6(2), where there are multiple sources of supply with means for automatic connection from one source to the other?

Answer: No.

95. I am installing a one to one isolation transformer to help eliminate harmonics from the motor to my VFD. I will have 480 volts in, 480 volts out, and no neutral connected loads. What are my grounding requirements for my transformer?

Answer: This is covered in 250.30(B)1-2. It should be connected to the metal enclosure of the derived system. What is not required to be grounded is covered in 250.21.

96. In 2005 revised 250.64(C), a new item (3) has been added that seems to indicate that bonding jumpers from grounding electrodes are actually grounding electrode conductors. This seems to be reinforced as 250.64(C) states, "Grounding electrode conductor(s) shall be installed in one continuous length without a splice or joint except as permitted in (1) through (4) with item (3) as mentioned being a part of the (1) through (4). Also, as 250.64(C) states, "...without a splice or joint except as permitted in (1) through (4)", this seems to indicate that even though 250.64(F) allows a grounding electrode conductor to be permitted to be run to any convenient grounding electrode available in the grounding electrode system, the provisions in 250.64(C) require that any bonding jumpers from one electrode to another be attached with either irreversible compression-type connectors listed as grounding and bonding equipment or by the exothermic welding process as the provisions in (1) through (4) to 250.64(C) as the connection of grounding electrode bonding jumpers do not seem to allow the use of listed lugs, listed pressure connectors, listed clamps, or other listed means as allowed by 250.70? Is this correct?

Answer: Start at 250.50; grounding electrodes are bonded together to form the grounding electrode system. A single grounding electrode conductor can be used to connect the grounding electrode system to the service disconnecting means or building disconnecting means.

250.53(C) refers to the conductor used to connect the grounding electrodes together as a bonding jumper(s). Installation rules are provided.

250.64(C) intends to allow the conductors from the grounding electrodes to be connected together and to the grounding electrode conductor by use of a copper or aluminum busbar. Notice that the term "bonding jumper(s)" is used to describe the conductors from the grounding electrodes and "grounding electrode conductor(s)" for the conductor from the service or building disconnecting means to the busbar.

Finally, The last sentence of 250.64(C)(3) permits connections to the busbar to be made by a listed connector (not specifically listed as grounding and bonding equipment) or by the exothermic welding process.

97. Is a bonding bushing required by code to be installed on an offset nipple where one end is screwed into a Myers hub mounted on the main disconnect enclosure and the other end installed into the bottom of a meter socket? These are service-entrance conductors from the bottom of the meter to the top of the main disconnect (line side).

Answer: A bonding jumper is required by 250.90(A). In accordance with NEC 250.92(B) standard locknuts and bushings shall not be the sole means for the bonding requirements.

98. A 2" PVC rigid conduit extends from an electrical disconnect into a trench and the 90-degree bend sits tight to the bottom of the undisturbed soil of the trench. The inspector is requiring a slip fitting in case of soil expansion and possible damage to the electrical disconnect. Is this a NEC requirement?

Answer: Yes, 300.7 (B), & 300.5 (D) & (J) and consider temps. per 352.44 of greater than 1/4" inch movement and Tables 352.44 (A) & (B).

99. What are some examples of approved non-explosion proof sealing methods used between Class 1, Division 2 locations and unclassified areas?

Answer: Well approved would be up to the AHJ, so I can't comment on what would be approved, however, I can tell you what might be Listed. I assume this reference is to Section 501.15(B)(2). Addressing all seals at the boundary location between Class I Div. 2 and unclassified areas requires that Conduits shall be sealed to minimize the amount of gas or vapor within the Division 2 portion of the conduit from being communicated to the conduit beyond the seal. Such seals shall not be required to be explosion proof but shall be identified for the purpose of minimizing passage of gases under normal operating conditions and shall be accessible. Conduit seals are Classified by UL under the category of Conduit Fittings for Use in Hazardous Locations (EBNV) found on Page 157 in the White Book. However, the only seals that are Classified are Explosion proof seals. No one has submitted seal for evaluation that would comply with 501.15(B)(2).

100. Vehicle hoist motors in a commercial garage are never thermally protected in the listed hoist assembly. Does code require it to be protected from overloads?

Answer: No, Hoists are Listed under the category titled Hoists (MSXT), this category is not in the White Book. They are Listed utilization equipment with short attended intermittent duty operation, typically operated by momentary contact pendant switches. The motor is never operated continuously. The branch circuit protection provides all the protection that is needed, follow the installation and user instructions per NEC 110.3(B). This is consistent with the NEC requirements for motors that are operated intermittently or on a duty cycle. Section 430.33 does not require overload protection; branch circuit protection can act as overload protection.

101. Am I required to identify the unused breakers in my panel on the panel directory?

Answer: Based on the question, I am assuming that there are breakers in the panel that are not connected to anything. Therefore if you go to 110.22 it states...Yes -- 110.22 Identification of Disconnecting Means

Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. The marking shall be of sufficient durability to withstand the environment involved.

102. A generator is mounted on a trailer and is used for carnival rides. Is it necessary to establish a grounding electrode system?

Answer: Yes, a grounding electrode system must be installed. NEC 525.31, 250.4(A)(1)

103. If there is an outdoor buried metal water line that can serve as a grounding electrode per 250.52(A) and this metal water line transitions to a nonmetallic water piping system before it enters into or attaches to the dwelling, and the outdoor service equipment is located 5-feet away on the back of a dwelling from where the water line is located, is the outdoor metal water line required to be a part of the required grounding electrode system per 250.50 of the 2005 NEC? A concrete-encased electrode is also used to ground this service.

Answer: The water pipe is not in the building it is located outside, so by Article 250.50, it would not be required to be one of the required electrodes.

104. Section 680.21(B) appears to be in conflict. The first sentence of 680.21(B) suggests any recognized wiring method in Chapter 3 is permitted if the motor employs a method of double insulation. The second sentence requires you to comply with the wiring methods prescribed in 680.21(A), where the bonding grid is connected to the equipment-grounding conductor in accordance with 680.26(B)(4). 680.26(B)(4) requires the bonding conductor to be connected to the equipment-grounding conductor, which subsequently limits you to the wiring methods in 680.21(A). Could you clarify when a wiring method other than those prescribed in 680.21(A) would be permitted for a double insulated pump motor?

Answer: 680.21 applies to wiring of pool motors. (B) applies to wiring double-insulated pool pumps. The second paragraph of 680.26(B)(4) applies to providing an 8 AWG bonding conductor to the vicinity of the double-insulated water pump to provide bonding for a replacement pool pump that might not be double-insulated pump. It requires that "Where there is no connection between the swimming pool bonding grid and the equipment grounding system for the premises, this bonding conductor shall be connected to the equipment grounding conductor of the motor circuit." I think you always have to use the wiring methods of 680.21(A) as a result of the language in 680.26(B)(4).