

2007 Western Section Meeting

Code Panel Questions and Answers

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Many thanks to the participants of the 2007 Western Section IAEI Code Panels: Moderators Mike Forister and O.P. Post, Mark Earley, Monte Ewing Ron Janikowski, Richard Loyd, Chuck Mello, Don Offerdahl, Dick Owen, Jim Pauley, Tom Lichtenstein, Tim McClintock, Tom Moore, Marcus Sampson, Phil Simmons, Charlie Trout, Ray Weber and Dave Williams.

List of panel members and the question assignments are located at the end of the document.

1. Can a fire pump controller be fed from a UPS? Or is a separate service and separate transfer switch required? MWE

*695.3 requires that electric motor driven fire pumps have a **reliable** source of power and permits either individual sources [695.3(A)] or multiple sources [695.3(B)]. The requirement that the source be capable of carrying indefinitely the locked rotor current of the fire pump motor would rule out UPS systems because they have a fixed amount of energy storage.*

Either a separate service or a connection to the service before the facility service disconnect switch is acceptable as well as a on-site power production facility.

2. Section 518.4(B) of the NEC permits NM cable to be installed in buildings or portions of buildings that are not required to be fire rated construction. If only the exterior walls are fire rated, how do we determine where NM can be installed?

518.4(B) FPN (pg 426), "Fire-rated construction is the fire-resistive classification used in building codes"; Annex E (pg 726) of five types of construction (NFPA & ICC are similar) only Types 1 & 2 are fire-resistive construction. Wiring located within the confines of Type 1 or 2 construction must comply with 518.4(A). Wiring within the confines of nonrated Types 3, 4, & 5 construction may be wired per 518.4(A) or (B) which permits the use of NM cable.

3. Can a #6 AWG grounding electrode conductor be run through bored holes in the basement joists?

NO 250.64(B)

(B) Securing and Protection Against Physical Damage. Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. A 4 AWG or larger copper or aluminum grounding electrode conductor shall be protected where exposed to physical damage. A 6 AWG grounding electrode conductor that is free from exposure to physical damage shall be permitted to be run along the surface of the building

construction without metal covering or protection where it is securely fastened to the construction; otherwise, it shall be in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, or cable armor. Grounding electrode conductors smaller than 6 AWG shall be in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, or cable armor.

4. During an inspection of a new restaurant located in a mall, there is a shaft for rooftop equipment and there is no way to enter the shaft for installation of raceways. The contractor wants to install five runs of ½" flexible metal conduit with a maximum of four # 12 AWG conductors. Section 348.30(A) Exception permits flex to be unsupported where fished. Do product standards limit the maximum weight a flex connector can withstand and is this installation permitted? If permitted is there a maximum vertical length flex can be fished?

It appears that the language in 348.30(A) does permit FMC to be unsecured and unsupported when fished. Also unless the shaft is one of the areas not permitted by 348.12 and it appears it is not then the NEC would permit it. There are rules for conductor support in 300.19. The UL white book PG 99-101 does not address the pull out requirements however; UL 514B UL514B requires a 50 lbs pull for 5 minutes for FMC connectors. To me, this is a classic decision for the AHJ on site. I don't believe that the CMP intended the unsupported length to be open ended. I don't have the NEC reference at hand, but there is also a requirement for conductor support in vertical risers that may have to be considered.

In response to your FMC question, the UL pullout requirement for the 1/2 size is 75 lbs. I would think that the length of the run would be a major consideration for this installation. Obviously the longer the run the more weight the connector would have to contend with. Personally, I have always associated fished wiring more with an old work installation than with a new work installation. If this is a new restaurant, perhaps the option of support during the run is viable and this would obviously be the best solution to the application.

5. At a 4-story hotel, we are installing 480-volt feeders up to each floor and the design calls for the grounding electrode for the transformers to be installed in the power wiring conduit that feeds the into the transformer disconnect at each floor. The bonding is done in the transformer. The building is poured concrete so the grounding electrode system consists of the underground water piping and the concrete encased electrode. The power wiring is installed in PVC conduit with an equipment-grounding conductor. Doesn't the NEC require the GEC to be run separately?

No, as long as all the applicable Code rules are followed. For the raceway aspect that is the majority of the question, section 250.64B covers this. The grounding electrode conductor can be installed in the power conduit, in a separate conduit where physical protection is required or open where protection from physical damage is not necessary. . If any of the raceway parts or enclosures are ferrous metal then those parts must be bonded at the entry and exit to the grounding electrode conductor per 250.64(E) and 250.92(A)(3). The other key part is terminations. The question states the connection is in the transformer and that is fine, but the connection where the feeder originates has to be considered. To meet the definition in Article 100 and section 250.24 the end of the grounding electrode conductor at the beginning of the feeder must be connected directly to a grounding electrode or to a common grounding electrode conductor by one of the connection means specified in 250.70.

6. Does Section 240.24(D) absolutely prohibit a panelboard from being located within a closet? The installation is a large, 6-foot by 8-foot closet with shelving and clothes rods on three sides. The panel is on the "blank" wall and there is adequate working clearance around it .

No, 240.24 (D) states Overcurrent devices shall not be located in the vicinity of easily ignitable material, such as in clothes closets.

The authority having jurisdiction has some discretion with this, but keep in mind the reasons for this rule is when the overcurrent device in the panel has a problem clearing a fault or short circuit. The panelboard is designed to contend the arc and sparks their also may be additional heat in the area around the panel board. In North Dakota we have not allow this for years. Also there is a new definitions in Article 100 in the 2008 code for Clothes Closet is a non-habitable room or space intended primarily for storage of garments and apparel.

7. A contractor installed a new 2000-amp service into a building, using Type MC Cable approved for direct burial. The cables leave the utility transformer at the far side of the parking lot, extend under the parking lot and then 35-feet under the building before entering the bottom of the switchgear. Isn't this prohibited by Section 300.5 that requires a raceway for cables installed under a building?

Yes. Section 300.5(C) requires that cables be in a raceway that extends out from under the building. This is to theoretically allow replacement of the cable without having to tunnel under the building to replace it. The 2008 NEC will also extend that requirement to cables that stay totally underneath a building.

8. What are the electric code requirements for serving a small cabin with a propane-operated generator? The cabin has a small kitchen with a microwave, fridge and sink, a bedroom, and a bathroom.

The requirements are no different than they would be for any other building of this type supplied with a utility service. From the definition, it does not appear that the cabin would be considered a "dwelling unit" since it does not appear to contain "permanent provisions for cooking" [NEC 100 Definition of Dwelling Unit]. However, keep in mind that the AHJ has to make the determination as to whether or not the building meets the definition. CMP 2 has clarified on more than one occasion that it did not consider a cord and plug connected microwave as permanent provisions for cooking. If the AHJ agrees that it does not meet the definition, you would follow the rules for non-dwelling units. For example, receptacles would be required in 210.50(B) and (C). Lighting outlets would be required to meet any illumination requirements of the building code. Wiring methods would have to be in accordance with Chapter 3. Since the unit is supplied from a generator, it should be noted that you would apply Article 225 (Outside Branch Circuits and Feeders) for the connection to the supply.

9. I need to supply four 40-amp, 3-phase, 120/208 receptacle openings. These openings are all adjacent to one another but the supply panel is quite some distance away. There is an existing unused 90-amp (#4's & #8 ground.) set of feeders less than 10 ft. from the proposed new openings. The nameplate ampacity rating for each appliance is 25 amps

(ovens). Am I correct in understanding that the 10 ft. tap rule can be used to supply the new openings provided that the tap conductor's ampacity is not less than the combined calculated loads of the tap feeder? If the tap conductors are individually routed properly, do I need to provide an additional disconnecting means for these individual openings other than the receptacles themselves? These commercial ovens are considered to be non-continuous loads. (MWE)

*220.14 (A) [Specific Appliances or Loads] requires the branch circuit loading to be calculated based on the equipment rating. In your case the branch circuit would need to be rated for 100 amperes (4 * 25 amps) not 90 amperes. (Don't let them confuse the next higher rating of overcurrent device when selecting the conductor at a rating lower than load). 210.19 and 210.19(A)(4) require the branch circuit conductors to have an ampacity not less than the maximum load served for non continuous loads. Receptacles (not outlets) are mentioned in the question, so I'm assuming the ovens are cord and plug connected and also portable. Section 210.19(A)(2) requires the conductors serving more than one receptacle to have a rating not less than the rating of the branch circuit. There are no branch circuit tap rules; only feeder tap rules. (see 240.21(A))*

10. I am wiring a hot tub on my deck at home and an electrician told me I cannot use nonmetallic-sheathed cable (NM) to wire it. The salesman at Swimming Pools and Tubs said it was acceptable. Who is correct?

680.42 and 680.42(C) (pgs 538 & 539) Both may be partially correct. A 1-family dwelling is permitted to install any Chapter 3 wiring method (except underwater lighting which requires raceway) for the interior portion of wiring supplying a self-contained or packaged spa or hot tub which must include an insulated or enclosed copper equipment grounding conductor. The exterior wiring method must comply with 680 Part II; 680.23(F) (pg 534) Branch Circuits or 680.25 (pg 536) Feeders respectively.

11. I ran a raceway (tucked in a corner) up the entire length of a stairwell in a five-story building. The raceway was for some new signs on the outside of the building. The Building Inspector red-tagged it without leaving any explanation. Is this a violation of the NEC? If not, what code is it from?

NO. Not an NEC violation. However there are many instances when the applicable building codes prevail. Building codes do not allow anything in stairwell shaft enclosures unless they are related to the stairwell. Example lighting, Fire Alarm ect. In Wisconsin the IBC building code sections are 707.7.1 "Prohibited openings. Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures"

12. When a UFER ground is installed, is a supplemental electrode required? If one is required do I need 2 rods and do they have to be 6' min away from each other and the foundation? (Since this is used for an electrode) Can the #4 grounding electrode conductor be run through bored holes in the 2x10's to the panel?

NO, 250.50, 250.52(A)(3) However; this section requires all present must be used and bonded together to form a grounding electrode system.

13. I have a 200-amp, 120/240 volt, single-phase service, grounded to earth from the meter enclosure, that is bonded to the neutral buss. Then neutral buss is bonded to enclosure of service disconnecting means. PVC connectors are installed between the enclosures (two males back to back). The inspector made me run a separate EGC from the meter base to main breaker panel. What for? Isn't the neutral already doing this? I could understand four wires if they were leaving the main panel and going to a subpanel but from a meter enclosure to the main panel?

The bonding of the meter enclosure to the service disconnect enclosure is required by section 250.92(A)(2). The means to accomplish this is detailed in 250.92(B). Only one of the methods is required and 250.92(B)(1) provides that the connection of the grounded (neutral) conductor in each conductor is sufficient. Adding an additional equipment grounding conductor in essence in parallel with the grounded conductor and probably sized differently creates issues with division of current on the two wires and does not add to the overall safety of the installation.

250.92(B) Method of Bonding at the Service. Electrical continuity at service equipment, service raceways, and service conductor enclosures shall be ensured by one of the following methods:

- (1) Bonding equipment to the grounded service conductor in a manner provided in 250.8
 - (2) Connections utilizing threaded couplings or threaded bosses on enclosures where made up wrenchtight
 - (3) Threadless couplings and connectors where made up tight for metal raceways and metal-clad cables
 - (4) Other listed devices, such as bonding-type locknuts, bushings, or bushings with bonding jumpers
- Bonding jumpers meeting the other requirements of this article shall be used around concentric or eccentric knockouts that are punched or otherwise formed so as to impair the electrical connection to ground. Standard locknuts or bushings shall not be the sole means for the bonding required by this section.

14. Section 314.23(H) requires a box supported by a multi-conductor cord or cable pendant to also protect the conductors against strain, and suggests a strain relief connector threaded into a box with a hub, but stops short of requiring a connector threaded into a box with a hub. Does this mean a strain relief connector installed with a locknut into a standard box would be acceptable?

Yes if the conductors are protected against strain 314.23(H) states An enclosure supported by a pendant shall comply with 314.23(H)(1) or (H)(2).

(1) Flexible Cord. A box shall be supported from a multiconductor cord or cable in an approved manner that protects the conductors against strain, such as a strain-relief connector threaded into a box with a hub.

15. We have quite a bit of abandoned low-voltage communication cable in our facilities. Where are the requirements in the NEC to remove this cable?

Section 640.3(A) for Audio Cable, Section 645.5(D)(6) for cables in Information Technology Equipment spaces, Section 725.3(B) for Class 2 & 3 Circuits, Section 760.3(A) for Fire Alarm Cables, Sections 770.3(A), 770.154(A) & 770.154(B)(1) for Optical Fiber Cables and Raceways, Sections 800.3(C), 800.154(A) & 800.154(B)(1) for Communications Circuits, Sections 820.3(A), 820.154 (A) and 820.154(B)(1) & (D) for CATV systems, Section 830.3(A) for Network-powered Broadband cables. In the 2008 NEC, a task group recommended to standardize the language in all the different Articles to require only the accessible portion of abandoned cables to be removed. Otherwise, some articles would have required removing even those parts of cables that were inaccessible behind finished walls and ceilings, possibly requiring demolishing those walls and ceilings to gain access.

16. A contractor installed several three-phase circuits from a 480-volt panel board. He installed the first 3-phase circuit with 3 red conductors, the second with 3 blue conductors, another with 3 black conductors, etc. It appears that Section 210.5(C) in the 2005 NEC allows this, as conductors need only be identified by system, not by phase as in previous editions. Is this correct?

It is correct that the 2005 requirements for conductor ID require that only the system be identified. CMP 2 clarified in the 2008 edition that the requirement will apply to both phase and system.

17. Does an outdoor hot tub need a disconnect as per 680.12? Does it need a general-purpose receptacle as per 680.22(3)? This is to be installed at a single-family residence outside on a deck. Also this is a manufactured home if that matters. (MWE)

680.42 requires outdoor hot tubs to comply with Parts I and II of article 680 with a few exceptions listed in that section. 680.12 is in part I and therefore required of both indoor and outdoor hot tubs. 680.22(A)(3) is in part II and is required because the hot tub is outdoors. There is nothing in Article 550 for manufactured homes relating to hot tubs.

18. Can we use 16 inches of NM cable from a box to the garbage disposal where we tape the cable to the drainpipe for support?

No. 334.15(A) (pg 179) Type NM cable is required to closely follow the surface of the building finish or of running boards.

19. Do panels located under a porch cover in a damp location require sealing locknuts for conduits?

*Maybe. Judgement call by the AHJ Wet or Damp Location.
See 312.2(A)*

312.2 Damp, Wet, or Hazardous (Classified) Locations.

(A) Damp and Wet Locations. In damp or wet locations, surface-type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 6-mm ($\frac{1}{4}$ -in.) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables entering above the level of uninsulated live parts shall use fittings listed for wet locations.

If AHJ determines that it is a damp location not wet then the equipment can just be mounted to prevent moisture or water from entering and accumulating within the enclosure.

20. If service drop conductors are increased in size due to voltage drop, is it required to increase the size of the grounding electrode conductor?

No, 250.66 it must be sized based on the SE conductors not the service drop conductors

21. Are hot and cold water pipes required to be bonded at water heaters?

The metallic water system must be bonded together and connected to the service equipment per 250.104(A). There is no differentiation between the metallic cold water or the metallic hot water system so both would be required. The point of bonding is not specified, while the hot water heater is the most logical location to easily accomplish this, it would be permitted to be completed at any convenient location. One key here is that for the bonding to be required under 250.104(A), the water piping must be a metallic piping system. If there is non-metallic sections or if the system is CPVC or PEX, then 250.104(B) is applicable only for those sections of hot or cold water piping that are likely to become energized.

22. I recently installed a 45-KVA transformer, 480-volt primary and 120/208Y secondary. The secondary conductors are # 2 THHN copper with an ampacity of 115 amperes. The calculated load is 102 amperes. Using Section 240.21(C) (2) the secondary conductors supply a MLO 42-circuit lighting and appliance branch circuit panel. The inspector rejected the installation citing 240.4(F), requiring a main breaker. Is the installation in compliance? Will the 2008 change in 408.34 deleting the classification of panel boards have an effect on this installation?

No, 408.36(D) states: Where a panelboard is supplied through a transformer, the overcurrent protection required by 408.36(A), (B), and (C) shall be located on the secondary side of the transformer. The exception refers you to 240.21 (c) but that requires the conductors to be not less than the rating of the device supplied by the secondary conductors or not less than the rating of the overcurrent-protective device at the termination of the secondary conductors. The overcurrent protection needs to be a single device to meet this requirement for panelboards

23. A traffic detection loop consisting of several "turns" of wire is laid out in a circular pattern under a street to activate a traffic signal. Is that wiring, which extends from the controller, subject to the regulations of the NEC? If so, which article should be used?

There is a question as to whether the NEC would specifically apply to these loops and their conductors, since a loop and its attachment wires are not connected to a power supply, nor do they carry any current. They only pick up a change in inductance caused by a car passing over the loop which registers on a piece of equipment in the controller cabinet. However, looking at the scope of Article 725 and the power supply parameters in Table 11(A) which makes it a Class 2 remote control and signaling circuit.

24. Can molded-case circuit breakers with "SWD" markings be used to switch HID (high-intensity) lighting fixtures?

Answer: No. See 240.83(D). SWD ratings are applicable only for fluorescent lighting. However, a breaker marked HID can be used to switch fluorescent or HID lighting.

25. Is there a requirement in the code similar to the one in Article 550 that addresses a maximum distance from the building a disconnecting means can be located? I would like to have a pole-mounted service and then feed the building which is 200' away there will be a main breaker in the panel closet to the point of entrance inside the building.

Basically service on pole and feeder to building, service at building treated as sub-panel with isolated neutral, 4 conductors and also a GEC. Or in other words. how far can the service disconnecting means be from the building? (MWE)

The maximum distance you discuss is not addressed in the Code. A service disconnect is required at the service point. If you put a service disconnect (230.70) on a pole (now a structure since you installed it, per definition of structure) 200 feet from a building, then the conductors from the disconnect to the building are now feeder conductors and need to be protected at the source. 225.31 (more than one building or structure- pole is one structure, building is the second) requires a disconnecting means (rated as a service disconnect) at a building or structure and the location is defined in 225.32 as at a readily accessible location nearest the point of entry of the conductors.

26. Do you need to staple NMB within 8" of a non-metallic box if it is supported by the hole in the stud within 8" of the box?

Yes. 314.17(C) Exception (pg 164) Where the cable is not secured to a 1-gang box it must be secured within 8" of the box entry to act as the box clamp. 334.30 (pg 180) requires cables to be secured within 12" of every outlet box, junction box, cabinet, or fitting.

27. Is a refrigerator receptacle located within 6' of a bar sink required to be GFCI protected if it is only accessible by pulling out the refrigerator?

Assuming residential installation: See 210.8(A)(7).

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

FPN: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(7) Laundry, utility, and wet bar sinks — where the receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

No exceptions- they must be GFCI protected.

28. Is a clamp required where a grounding electrode conductor goes through the weep hole in the bottom of an electrical panel?

No, 250.64 this is not a weep hole it is placed exactly for this purpose. I answered this question Yes at another meeting and still feel the code is not clear on this subject; 312.5(B) seems to make this a requirement however, I agree this practice is common and I do not know of any problem it has ever caused.

29. A 13,200-volt, 3-phase/4 wire system is supplied from the local utility company. The service point is on the load side of cutouts at the top of a pole, located at the edge of the property. Customer-owned primary is then run down the pole (3-#2 copper, shielded, 133 percent insulation, Type MV-105 (this cable does not have a "concentric neutral)) to a listed disconnect rated 600 amps and fused at 125 amps. The disconnect feeds a 2500

KVA delta/wye pad mount transformer which steps the voltage down to 480/277 to feed the building. Since the system supplied by the utility company is a 4-wire system, is it required to run a grounding conductor with the MV cable from the top of the pole to the disconnect and transformer? I can't find anything in Article 250 that REQUIRES a grounded or grounding conductor to be run with the ungrounded conductors. Part X of Art 250 covers grounding for systems over 1000 volts and it only addresses grounding requirements if the system IS grounded. Section 250.24 clearly requires it, but that section doesn't apply to this system. Or, since the "service point" is at the top of the pole, can the contractor elect to go with the proposed shielded cable (cable specs reflect use for an ungrounded system) and supply the premises with an ungrounded system (all three shields are connected together at both ends) and derive a grounded conductor/neutral at the pad mounted delta/wye transformer?

250.180 establishes that all the rules in the preceding sections apply except as modified by the requirements 250.182 through 250.190. Going back, the general requirement to bring the grounded (neutral) conductor to a service where the supply is solidly grounded is found in 250.24(C). The problem is that this section specifically says it is for systems 1000 Volts and less. There is no modifier to 250.24(C) found in sections 250.182 to 250.190, therefore the situation in the question appears to be in limbo. From a safety standpoint, there needs to be a low impedance path back to the source, utility substation, for ground fault current from any point on the medium voltage system from the service to the primary of the step down transformer in this case. From the service disconnect to the transformer this is accomplished by the required equipment-grounding conductor. It needs to be stated here that the copper tape shield for this cable is not suitable as the equipment-grounding conductor. Although not specifically stated in prescriptive requirements, a neutral or equipment grounding conductor suitably sized for the ground fault current would be required by the performance requirements found in 250.4(A)(5). Here is an opportunity for a Code proposal to clarify the prescriptive requirements to fill the identified void.

30. Can ½ inch stainless steel rods be used for grounding electrodes?

250.52 (a) 5. Yes If listed. This is found in the UL white book under Grounding and Bonding Equipment KDER

This category covers bonding devices, ground clamps, grounding and bonding bushings and locknuts, ground rods, armored grounding wire, protector grounding wire, grounding wedges, ground clips for securing the ground wire to an outlet box, water meter shunts, and similar equipment.

Ground rods are marked with the rod length, and manufacturer's name and catalog number within 12 in. of the top of the rod.

31. If a piece of Type NM cable is run down the side of a 1X2 wood stud in a residence, and the 1-1/4" clearance is not possible from the front edge of the stud, does the mechanical protection have to be a continuous piece of metal that complies with the construction requirements in Section 300.4(D), or could I stack standard "nailer plates" end to end the length of the run to protect it?

The code reference is Section 300.4(D). In the 2005 NEC, it's unclear whether the "nailer plate" has to be one piece or could be several "stacked" end-to-end. The Panel accepted a proposal for the 2008 NEC to clarify that the standard nailer plates can be placed end-to-end if one isn't long enough.

32. Many fast-food restaurants and convenience stores have backroom areas meeting the definition of a kitchen in Section 210.8(B)(2), but how far does that extend into the rest of the store? If there are dispensers for carbonated drinks, food heaters, etc. on 15- or 20-ampere, 125-volt receptacles that the general public use, are those required to be ground-fault protected?

Answer: The AHJ must make the judgment on how far to extend the kitchen "area". The definition was written to allow the flexibility for the AHJ to make a judgment on a case by case basis. From what is described in the question, it would not appear that the kitchen would extend to the "public use area" of the restaurant. See 210.8(B)(2) in the 2005 NEC and Article 100 – Definition of Kitchen in the 2008 NEC.

33. My builder used ½ inch plywood corner bracing with 1 inch foam insulation on an addition. I installed outdoor receptacles using siding boxes fastened to the plywood. The inspector required the builder to install 2X4's behind the plywood to comply with NEC Section 314.23 (B)(2) which says wood braces shall have a cross section not less than a nominal 1X 2 inch. Are these blocks required behind the plywood when they allow a panel to be supported by ½ or ¾ inch plywood? (MWE)

In this instance, the plywood is used as wind bracing, making it structural. It is directly supported by the plywood, making the additional support unnecessary.

34. Why does the NEC limit the length of sealtight to 6' for a hot tub?

680.42(A)(1) (pg 539) According to the NEC handbook, this section was created to provide some flexibility to 680.25(A) (pg 536) for Feeders. 680.25(A) permits the use of liquidtight flexible nonmetallic conduit (LFNC) restricted in length by Article 356 (pg 196). 680.42(A)(1) adds the use of liquidtight flexible metal conduit (LFMC) and also adds the 6' length restriction to both LFNC and LFMC without mention of use for branch circuit, feeder, or underwater lighting. The few changes submitted to revise this section were rejected by CMP 17 for the 2008 cycle however, we all have the opportunity to submit proposals for the 2011 NEC.

35. Can a duplex receptacle, with the tab removed so that only one side is energized, satisfy the single non-GFCI receptacle requirement for a freezer located in a garage?

In my opinion NO.

NEC specifically calls for a "single outlet" A duplex outlet with the tab removed is still a duplex outlet whether it works or not.

See 210.8(2)ex 2.

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

FPN: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

Exception No. 1 to (2): Receptacles that are not readily accessible.

Exception No. 2 to (2): A single receptacle or a duplex receptacle for two appliances located within dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and-plug connected

36. I looked at an electrical panel where the electrician used green feed-through wire nuts to splice the equipment grounds together and make 4 terminations to the ground bar. Is this allowed in the code?

Maybe, but it would have to be equal to the largest of the group and comply with 250.122(C)

37. What is the maximum length of an equipment-bonding conductor installed on the outside of a raceway?

In general the maximum length is 6 feet as specified in 250.102(E). An exception allows greater than 6 feet for outside pole locations where the 6 foot limitation is not practicable to bond isolated sections of metal raceway. An example for the exception is a metal raceway as a riser on a pole for physical protection and stops at 8 to 10 feet above grade, but the bonding jumper from the pole line grounded conductor to the metal raceway will generally be longer than 6 feet.

250.102(E) Installation. The equipment bonding jumper shall be permitted to be installed inside or outside of a raceway or enclosure. Where installed on the outside, the length of the equipment bonding jumper shall not exceed 1.8 m (6 ft) and shall be routed with the raceway or enclosure. Where installed inside of a raceway, the equipment bonding jumper shall comply with the requirements of 250.119 and 250.148.

Exception: An equipment bonding jumper longer than 1.8 m (6 ft) shall be permitted at outside pole locations for the purpose of bonding or grounding isolated sections of metal raceways or elbows installed in exposed risers of metal conduit or other metal raceway.

38. Which code takes precedent when the requirements are different from the electrical, building, mechanical, plumbing for the manufacturer specifications for the equipment installation?

110.3b Manufacturer's instruction should not have any such conflicts if listed with NRTL. In North Dakota will have the following statement in our administration rules "In cases where requirements differ or are in conflict with the requirements of the National Electrical the more restrictive requirements shall be the minimum."

39. A large trailer-mounted portable generator is being used for the temporary power at a construction site. The electrical contractor argues that since the generator has no provisions for a grounding electrode that the generator is isolated from ground and so does not need GFCI protection for personnel for 125-volt, 15- 20- and 30-ampere receptacles. Is he correct?

No. Section 590.6(A) requires all temporary wiring to have GFCI protection for those particular receptacles. This requirement is clarified in a change for 2008 that specifies generators as a power source.

40. The new 2008 NEC will require AFCI protection on all 15 and 20 amp circuits. What will become of the panels that accommodate mostly thin breakers?

Answer: The market will determine what happens. Currently, I am not aware of any manufacturer of an AFCI in a "thin" breaker configuration.

41. An electrician installed Type NM cable under a kitchen cabinet for under-cabinet fluorescent fixtures. Is this cable subject to physical damage? (MWE)

There is not enough information in the question to make a judgment. Section 334.10(A)(1) permits NM to be used in exposed work. The NM cable has to be installed so that it is not subject to physical damage. See 334.15 and 300.11 installation methods. Those requirements need to be met.

42. Do cord & plug-connected vending machines need GFCI protection?

Yes. 422.51 (pg 269) It must be included as an integral part of the vending machine (mfg. on or after Jan. 1, 2005) or it must be installed as a GFCI protected outlet.

43. Is the inside of a raceway using all watertight fittings and installed on the outside of a building considered a wet location? Does it make a difference if it is installed vertically or horizontally?

Yes the inside of a raceway installed outside or underground is considered a wet location. Select your conductors accordingly.

*No. I cannot find any listing specifying vertical or horizontal installation requirements. If listed for wet location it should not matter if it is installed vertically or horizontally.
Reference UL White Book*

44. Is it permissible to use cellular metal floor raceways in a commercial garage?

Response; Likely No, unless deemed not in violation of 374.3

374.3 Uses Not Permitted.

Conductors shall not be installed in cellular metal floor raceways as follows:

- (1) Where subject to corrosive vapor
- (2) In any hazardous (classified) location except as permitted by 504.20, and in Class I, Division 2 locations as permitted by 501.10(B)(3)
- (3) In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above

FPN: See 300.8 for installation of conductors with other systems.

45. The NEC requires conductors that are run through bored holes and foamed-in to be de-rated. Do the wires that are run through a nipple in the back of a panel and are foamed-in to prevent temperature migration need to be de-rated also?

To be correct 334.80 for de-rating of two or more cables passing through structural members with draft or fire stopping only applies to NM cable, and is not a general requirement for conductors or cables in general. With regard to conductors and temperature limitations in general the first place to review is 310.10 where the base requirement is that no conductor along any part of its length can exceed the temperature rating of the insulation. The ampacity tables and de-rating calculations that are in 310.15 all go to ensure that the temperature limitations are not exceeded. In 310.15(B)(2) exception 3, we find that conductors that are bundled or passing through a nipple of less than 24 inches are not required to be de-rated. So the question posed would not require de-rating.

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 stacked or bundled longer than 600 mm (24 in.) without maintaining spacing 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.

Exception No. 3: Derating factors shall not apply to conductors in nipples having a length not exceeding 600 mm (24 in.).

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 bundled together and pass through wood framing that is to be fire- or draft-stopped using thermal insulation or sealing foam

46. I am wiring a remote cabin and using an outdoor generator with a factory-installed main. It is located 35' away and is the cabin's sole source of power. Do I need a main in the panel at the cabin or does the main at the generator satisfy the requirement?

702.11 Outdoor Generator Sets

Where an outdoor housed generator set is equipped with a readily accessible disconnecting means located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure.

225.31 requires a disconnecting means "Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure."

225.36 requires a disconnecting means suitable for use as service equipment. I don't believe the disconnect on the generator would meet that requirement.

47. Is there any chemical reaction between EMT and copper water pipe that are in contact with each other?

It's called galvanic action. "Two or more different metals in contact with each other in the presence of an electrolyte will cause current to flow through their point of contact at the expense of the metal"

with the higher potential which is gradually consumed in the Electro-chemical reaction." An electrolyte could be moisture, and the more the pipe corrodes, the more the electrolyte is available. You could use Section 300.6(Protection Against Corrosion and Deterioration) as a reference to require that the EMT be isolated from the copper pipe.

48. Would a series-rated system protect the equipment as well as a fully rated system when the fault current is over 60K AIC?

Answer: Yes. See NEC 240.86. Series ratings are permitted in any application that is within its specified rating. There are series ratings all the way up to 200kA. If properly tested and evaluated, a series rating will function to protect the system during the short circuit event.

49. What does IACS mean in note 1 below Table 9 in Chapter 9?

IACS -International Annealed Copper Standard for conductivity

50. Can a reducing bushing be used in the middle of a pipe run to reduce the size of a conduit run from 2" to 1 ½"?

Yes, providing the conductor fill of the smaller raceway complies with Chapter 9.

51. Does the receptacle located behind a small floor refrigerator count as one of the required outlets for a hotel guest room?

NO see 210.60(B)(2)

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.

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, and so forth.

52. EMT is allowed as a means of grounding. What if the EMT is encased in concrete where the integrity of the connections may deteriorate over time?

Response; 358.10 clearly permits this installation where corrosion is a known problem supplementary corrosion protection can be applied.

53. A meter hub comes with setscrews. If these screws are lost is it permissible to use substitute screws without violating the listing?

No, reference 110.3(B), the investigation of the hub depends on using the supplied screws, gasket and other components. Use of the manufactures components was how the assembly was tested to achieve compliance with the requirement for connection of the conduit as well as the suitability for grounding and bonding. Substituting any of the components for alternate screws or a different gasket introduces an unknown into the performance of the hub to properly do its function. The guide card for conduit hubs is DWTT found on page 57 of the 2006 UL White Book. On a practical note, if the screws were replaced with exactly the same type, length etc. as what was supplied with the manufacturer, then you do not have a modified product different than what was listed.

54. Is it legal to install a non-fused disconnect next to a meter, run 20' on the outside of a building, then into the back of a main breaker panel?

No 230.91 The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto.

Unless it meet the requiements of 230.82 (a) 3

230.82 Equipment Connected to the Supply Side of Service Disconnect.

(3) Meter disconnect switches nominally rated not in excess of 600 volts that have a short-circuit current rating equal to or greater than the available short-circuit current, provided all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250. A meter disconnect switch shall be capable of interrupting the load served.

55. Is the 1 ¼" required distance from the edge of the wood stud to the NMC measured to the edge of the staple or to the NMC?

The Code reference is Section 300.4(D). Since the idea is to protect the cable, not necessarily the strap, I suppose the 1-1/4" clearance should be measured from the cable.

56. NEC 408.36 seems to apply the definition of a lighting and appliance panel board to a power panel board. Why is it defined this way?

Answer: Actually, the definition in 408.36(B) is different than the LABCPB definition. To count as a lighting and appliance branch circuit, it must be a circuit that includes a neutral conductor. In the Power Panelboard description, the 30A or less provision does not have to have a neutral conductor. For example, a 2P 30A circuit that supplies a 240V load, counts in the 10% calculation for power panelboards, but does not count in the 10% calculation for the LABCPB.

Note that in the 2008 NEC, the discussion is moot because the provisions associated with LABCPB and power panelboards go away.

57. The NEC allows seven different feeders/branch circuits and seven different services to a building. This would allow 84 different handles to throw, all at different locations in the building. Is the general rule that only one service is allowed to a building still valid or is it an overlooked section of the NEC? (MWE)

I don't follow the math. For example, I am not sure why the question assumes that there can be seven services to a building. The logic to this comes from the pragmatic options offered in 230.2 and 225.30 permitting more than one service or feeder. Number of disconnects (230.71) (225.33).

The basic rule is one service with up to six disconnects. There are some conditions permitting additional services. The rules for feeders are similar. It is unlikely that the rules that permit more than 6 disconnects, which were revised for each one of those services or feeders. Each of the services or feeders is permitted to have disconnecting means consisting of not more than six operations of the hand. The multiple services or feeders (not the multiple disconnects for each service or feeder) can be located in the same area or in different areas. Section 230.71(A) requires separate locations only under the "single service supplying multiple sets of service entrance conductors at buildings with more than one occupancy" provision permitted by 230.40 Exception No. 1.

58. Is Type NMC cable allowed to be run perpendicular through the open studs of an unfinished garage 48" above the finished floor without protection? The old 8' above the floor rule that required mechanical protection seems to have gone away.

No. 334.15(B) (pg 179) and 300.4 (pg 123) Type NM cable shall be protected from physical damage. By comparison 320.23(A) (pg 169) armored cable installed within an accessible attic is required to be protected from physical damage from the floor or top of joist to a min. height of 7'.

59. NEC 410.8 does not specify AFCI protection for closet lighting. The closets are usually located within bedrooms, which require AFCI protection for all outlets. Do these closet lights require AFCI protection?

Most building codes recognize that a closet accessed via a bedroom is part of the bedroom. YES. See 210.12(B) All outlets lighting or receptacle outlets.

210.12 Arc-Fault Circuit-Interrupter Protection.

(A) Definition: Arc-Fault Circuit Interrupter. An arc-fault circuit interrupter is a device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

(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.

Branch/feeder AFCIs shall be permitted to be used to meet the requirements of 210.12(B) until January 1, 2008.

60. What loads are considered diversified loads regarding NEC 310.15 (B) (2) FPN # 1? How and when is this applied to table B 310.11 in Annex B?

Response; the FPN is not enforceable however; I would recommend that anyone wishing to exceed the allowances in the table do so as per 310.15(C) under engineering supervision. If an engineer desires to use this section then annex B offers some examples of the use of the formula. Diversity is a condition that exists when the peak demands occur at different times

61. We are being asked to wire a baptism tank where the people will be submerged. It is in the front of a church. What rules should we use for wiring this equipment?

I would say the rules contained in Article 680 for Swimming Pools and Spas. What is a baptismal, it is a tank of water typically with an electric heater and may have a filter, a handrail and stairs so that people can walk into it for immerison. Section 680.1, The scope of Article 680 states The provisions of this article apply to the construction and installation of electrical wiring for and equipment in or adjacent to all swimming, wading, therapeutic, and decorative pools; fountains; hot tubs; spas; and hydromassage bathtubs, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment.

A pool is defined as Pool. Manufactured or field-constructed equipment designed to contain water on a permanent or semipermanent basis and used for swimming, wading, or other purposes.

I have received many questions on these over the years and typically they are not Listed and they utilize a Recognized or Listed submersible heating element intended for industrial applications, not Heaters Listed for use in Spa Equipment. Presnetly there is at least one manufacturer with Listing of Baptismal assembles. They are Listed under If UL Listed these products they would be Listed under Swimming Pool and Spa Equipment, Miscellaneous (WDUT), located on page 325 in the 2007 White Book

62. Are in-wall mounted ovens required to be hard-wired or can they be cord & plug connected?

They can be installed either way:

422.16(B)(3) Wall-Mounted Ovens and Counter-Mounted Cooking Units

Wall-mounted ovens and counter-mounted cooking units complete with provisions for mounting and for making electrical connections shall be permitted to be permanently connected or, only for ease in servicing or for installation, cord-and-plug connected.

Code References: 422.16(B)(3)

63. A new contractor has been wiring residential air conditioning units. He is mounting the disconnect switch on the exterior of the house and using a FNMC whip to the outdoor compressor. He has also installed the class 2 wiring for the relay in Type UF cable, inside the FNMC whip. Does the jacket of the UF provide the "barrier" required by 725.55(B)?

The answer is NO

(B) Separated by Barriers Class 2 and Class 3 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

Barrier – Something immaterial that obstructs or impedes.

The non-metallic sheathing of type UF cable would not satisfy the "barrier" requirements of 725.55(B).

64. A large grocery store chain in our city is installing "minute clinics" at each retail location. A nurse who can take a person's temperature, prescribe medications and give

injections staffs these. Although there is a waiting area and two "exam rooms" the only electrical equipment being used is a cash register. Would the receptacle outlets in these "exam rooms" require redundant grounding per Article 517?

ANSWER: YES

The scope of Article 517 calls out the electrical construction and installation criteria in health care facilities that provide services to human beings. So, what is a health care facility?

Health Care Facilities. Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

If there are receptacles in those "exam rooms" they would have to comply with 517. If they do not intend to use electrical equipment while doing the examinations, they do not need to install receptacles. If they need receptacles, those installations must comply.

65. Is a supplemental electrode required when you establish a GES at another building like a detached garage? Does it need 2 ground rods like at a house if the 25 ohms is not met?

While not necessarily a "supplemental grounding electrode," a grounding electrode system is required to be established at each building or structure served. See 250.32. Bond all the grounding electrodes that are present together to form a grounding electrode system. If a ground rod is used, it has to meet the 25-ohm rule of 250.56. If one 8 ft ground rod has a resistance of more than 25 ohms, one more grounding electrode is required not less than 6 ft from the first one.

66. What is the defining difference between a damp and a wet location?

Article 100 in the definition of these locations does an excellent job in defining the differences.

A damp location is one protected from weather and not subject to saturation with water and other liquids but subject to moderate degrees of moisture.

A wet location is one installed underground or in concrete slabs or masonry in direct contact with the earth. In locations subject to saturation with water or other liquids and in unprotected locations exposed to the weather.

67. At my local pharmacy they have a fancy blood pressure machine where you sit down and stick your upper arm into a cuff or sleeve. After you deposit a quarter, the machine automatically inflates the arm cuff and measures your blood pressure. Is this a vending machine requiring GFCI protection? If there was an electrical problem with this unit, GFCI protection would be more important here than on a Pepsi vending machine?

Yes, let's start with section 422.1, pg. 265, Scope. This article covers electrical appliances used in any occupancy. Then 422.51, pg. 269, (Read). Also per ROP 17-27, 2008 NEC pg. 277, (Read),

vending machine defined for that section. Note: if out doors in a public space the 210.8 (B) (4) applies and GFCI protection would need to be provided to the receptacle.

68. As an inspector I was on a job where the electrician (?) had Type NM cable running in all directions like a spider web. I was always told parallel and perpendicular. Can cables be installed at all different angles?

We can all appreciate the question mark after the word electrician. There are many homeowners that run NM Cables in a variety of directions. Parallel and perpendicular sounds great but it really is not addressed in Article 334 for NM Cable or in any of the cable and raceway articles.

Section 110.12 Mechanical Execution of Work

Electrical equipment shall be installed in a neat and workmanlike manner.

FPN: Accepted industry practices are described in ANSI/NECA 1-2000, Standard Practices for Good Workmanship in Electrical Contracting, and other ANSI-approved installation standards. The 2008 NEC references the 2006 edition of the standard.

The use of this section by various inspectors has led to many controversies. Since "Neat and Workmanlike" is difficult to define it is left up to the person making that decision. The FPN in the code directs the user to an industry accepted ANSI standard that clearly describes and illustrates what is meant by a neat and workmanlike manner. NECA 1-2000 and 2006 editions reference in the wire and cable section part

(h) "Cables that are installed exposed shall be run parallel and perpendicular to the surface or exposed structural members and follow the surface contours as much as practical."

My answer to the question is no they cannot in be routed exposed in different angles. Section 110.12 and NECA 1-2000/06.

69. My question concerns duplex receptacles and cords above a suspended drop ceiling. Over the years, we are asked to wire projectors, cameras, and intercom systems. Most of the power supplies or equipment are cord connected with a 5-15R. The cord is normally installed up through a large conduit used to support the equipment. The 2" conduit has a hole bored out of the side, which the cord passes through, and now is above the drop ceiling. Most inspectors quote NEC 400.8, *Uses Not Permitted*, and then end up allowing the installation. Section 400.8(5) is not very clear where it states: Unless specifically permitted in 400.7, flexible cords shall not be used where located above suspended ceilings. Section 400.7 specifically permits flexible cord to be used in many installations but does not say where located above suspended ceilings. My interpretation is that flexible cords cannot be used above suspended ceilings. A hard-wired system must be used. Section: 400.7, 400.8(5). Am I correctly interpreting this question?

Answer: Yes, I would say you are correctly interpreting those two sections.

70. Can SER be run from a main residential panel to a disconnect that has conduit to a swimming pool panel and satisfy the NEC?

Generally No; unless it is an existing feeder between the service equipment and the remote panelboard.

680.25(A) requires rigid metal conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or rigid nonmetallic conduit. Electrical metallic tubing shall be permitted where installed on or within a building, and electrical nonmetallic tubing shall be permitted where installed within a building.

Additionally, 680.25(B) requires an insulated equipment grounding conductor, so the use of SER cable is not permitted.

Code References: 680.25(A) & 680.25(B)

71. Can the disconnect for a 120-volt air handler / remote AC be a 15A single-pole switch mounted to the unit as in furnace applications? Or do I need a disconnect on the unit if the panel is in sight of the unit?

This question seems to have two parts so lets look at the first issue, can 15A single pole switch be used and the answer is more than likely. Referencing: 430.109(C)(2)

430.109 Type

The disconnecting means shall be a type specified in 430.109(A), unless otherwise permitted in 430.109(B) through 430.109(G), under the conditions specified.

(C) Stationary Motors of 2 Horsepower or Less For stationary motors rated at 2 hp or less and 300 volts or less, the disconnecting means shall be permitted to be one of the devices specified in (1), (2), or (3):

- (1) A general-use switch having an ampere rating not less than twice the full-load current rating of the motor
- (2) On ac circuits, a general-use snap switch suitable only for use on ac (not general-use ac-dc snap switches) where the motor full-load current rating is not more than 80 percent of the ampere rating of the switch
- (3) A listed manual motor controller having a horsepower rating not less than the rating of the motor and marked "Suitable as Motor Disconnect"

As for the second part of the question referencing 430.102(B)

(B) Motor: A disconnecting means shall be located in sight from the motor location and the driven machinery location.

Therefore an additional disconnecting means would not be required.

72. Section 517.17(B) prohibits secondary ground-fault protection on the load side of the essential system transfer switch, and 517.17(C) requires the system to be fully selectively coordinated. This is literally impossible if ground-fault protection is provided (as required) on a solidly grounded wye system of more than 150-volts to ground. Has CMP 15 looked into this?

ANSWER: YES, the panel spent considerable time researching and discussing this.

During the 2008 Code cycle, proposal #15-29 (Log #2738) was submitted by (our very own) Jim Pauley asking the panel to delete the text in 517.17(B) that prohibits ground-fault protection on the line and load side of the essential transfer switch and on those systems that are not solidly grounded wye systems of less than 150 volts to ground.

If a fault has caused one portion of the "Normal" system to shut down, starting the generator and then trying to get the system to transfer into that same fault could cause the entire "Emergency" system to fail. Emergency systems must be designed to properly isolate a faulty portion of the electrical system.

However, the hospital design engineers on the panel argue that automatic disconnection of any type must NEVER be installed on critical power circuits.

Proposal 15-21, Log #2233 was submitted that simply changed the wording to "additional levels of ground fault protection shall not be required on the following systems" then 1, 2, and 3 as before.

The panel has decided to HOLD the proposals for further review. Stay Tuned!

73. Is it necessary to bond natural gas or LP gas lines to the electrical service?

Look at 250.104(B). If the metallic piping is "likely to become energized," the piping is required to be bonded. If so, the equipment grounding conductor for the circuit that is likely to energize the piping is permitted to bond the piping. (Manufacturers of CSST require 6 AWG bonding conductor. Many reports of fires caused from lightning making pin holes in the thin material. Installers are putting a pipe clamps on the hex-head nut. UL does not list these ground clamps for making a connection to the brass nut. Some inspectors mentioned they are requiring the pipe clamp with 6 AWG to be connected to black iron piping on the premises side of the gas meter so as to near the point of entrance.)

74. Can a 10.5-amp, 120-volt rated fan-light-heat unit be installed and supplied from the same 20-amp circuit supplying the bathroom receptacle?

NEC 210.11(C)(3) requires at least one 20-ampere branch circuit to supply bathroom receptacle outlets. This means that all of the receptacle outlets, in all of the bathrooms you desire, may be supplied by that one 20-ampere circuit. Such circuits shall have no other outlets. There is an exception that permits where the 20-ampere supplies only one bathroom, outlets for other equipment within that same bathroom may be supplied in accordance with 210.23(A)(1) & (A2).

210.23(A)(1) tells us that the rating of any one cord and plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch circuit rating. This may be difficult to enforce since the installer and the AHJ may be long gone when the homeowner brings in an appliance that exceeds 80 percent of the 20-ampere circuit.

210.23(A)(2) tells us the total rating of utilization equipment, other than lighting fixtures, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord and plug connected utilization equipment not fastened in place, or both, are supplied.

Again this may be difficult to enforce unless the installer or the AHJ have some way to control what the homeowner plugs in after they are gone.

So in answer to your question, Can a 10.5-amp, 120-volt rated fan-light-heat unit be installed and supplied from the same 20-amp circuit supplying the bathroom receptacle? Well that depends. The 10.5 amperes exceeds the 50 percent of the 20-ampere circuit that is permitted for utilization equipment fastened in place but is cord and plug connected utilization equipment not fastened in place also supplied? Can we control what the homeowner is going to plug in after the installer and the AHJ are gone.

75. On a sub panel installation in a residential garage of 4 two-wire branch circuits I say that the minimum feeder ampacity should be 60-Amp, based on the fact that the disconnecting means must be rated at 60-Amp by code. The inspector says that it is based on the computed load and could be 40Amp or 50Amp. Who is correct?

It depends upon if the garage is an attached unit or detached stand alone structure. If attached 215.2, pg. 55, (A) (1), applies and feeder conductors shall have an ampacity not less than required to supply the load as calculated per Article 220. Thus the 40/50 ampere feeder could be acceptable. NEC 215.5, pg., 56 allows the AHJ to ask for a feeder diagram and details. Now lets review the detached structure option which I believe the question was designed for; 225.39 (D) pg. 70, (Read), indicates that the rating shall not be less than 60 ampere since there are (4 two-wire branch circuits) mentioned. The 60 ampere requirement is then correct.

76. We always are stumped when asked to install a telephone line or cable TV to a detached garage or workshop. Can we use listed low voltage or communication cable such as CAT 5 for the underground run to these buildings?

Yes, if it is in a raceway and listed for wet locations, or not in a raceway, listed for direct burial.

VI. Listing Requirements

800.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 800.179(A) through (I) and marked in accordance with Table 800.179. Conductors in communications cables, other than in a coaxial cable, shall be copper.

VI. Listing Requirements

820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A) through (D) and marked in accordance with Table 820.179. The cable voltage rating shall not be marked on the cable.

The 2007 UL White Book includes the 2007 Marking Guide for Wire and Cable.

Page 10 of the Marking Guide shows CMX references if marked "Outdoor" is suitable for installations outdoors on dwellings.

Page 22-24, Communication Cable (DUZX) Shows that they are designed for within buildings.

Nothing indicating for outdoor use or a direct burial marking.

Community Antenna Television Cable (DVCS) is able to be marked for direct burial.

I have seen CATV listed for Direct burial, I am not positive regarding communication wiring listed for wet locations.

77. There is always a lot of discussion on the use of Relocatable Power Taps. Where can I find the requirements or limitations on their use?

The NEC doesn't address relocatable power taps directly because they are a cord connected product except, depending on how they are used, may be rejected based on NEC 400.8(5) as a substitute for the fixed wiring of a structure.

UL Lists relocatable Power Taps under the category of the same name and the category code (XBYS) located on page 343 in the 2007 White Book. The Guide Information on page 343 states 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 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.

Relocatable power taps are not intended for use at construction sites and similar locations. Relocatable power taps are not intended to be permanently secured to building structures, tables, work benches or similar structures, nor are they intended to be used as a substitute for fixed wiring. The cords of relocatable power taps are not intended to be routed through walls, windows, ceilings, floors or similar openings. Relocatable power taps have not been investigated and are not intended for use with general patient care areas or critical patient care areas of health care facilities as defined in Article 517 of ANSI/NFPA 70, "National Electrical Code."

78. Does the NEC require a drip loop on coaxial cable?

Unless the coaxial cable is installed under the purview of Article 800 as a communication circuit, I found no requirement for drip loops on coaxial cable in the NEC. Section 800.50(C) requires drip loops be formed when raceways or bushings cannot be sloped upward from the outside. Only other reference to drip loops I found are in Article 230 (230.54(F)) for service entrance conductors, 398 (398.15(B)) for open wiring on insulators. Although not required cable TV installations under the NEC, it would be beneficial to provide a drip loop to prevent the entrance of water or moisture to a building.

From the UL Whitebook:

COMMUNICATIONS CABLE (DUZX) USE AND INSTALLATION

This category covers communications cable which is a single conductor coaxial cable or a multiple conductor jacketed cable for telephone and other communications circuits for use as described in Article 800 of ANSI/NFPA 70, "National Electrical Code" (NEC).

This cable is used as wiring from a protector to a telephone or other communications equipment within a building, and for use as interconnecting wiring between parts of a communications system.

Except for special locations specifically required by the NEC, communications cable, in general, is not required to be installed in conduit or raceway.

Code References: 800.50(C)

79. Is it acceptable to connect the dishwasher and garbage disposal on the same circuit?

Yes, depending on total connected load of both appliances.

210.23 Permissible Loads

In no case shall the load exceed the branch-circuit ampere rating. An individual branch circuit shall be permitted to supply any load for which it is rated. A branch circuit supplying two or more outlets or receptacles shall supply only the loads specified according to its size as specified in 210.23(A) through (D) and as summarized in 210.24 and Table 210.24

(A) 15- and 20-Ampere Branch Circuits A 15- or 20-ampere branch circuit shall be permitted to supply lighting units or other utilization equipment, or a combination of both, and shall comply with 210.23(A)(1) and (A)(2).

(2) Utilization Equipment Fastened in Place The total rating of utilization equipment fastened in place, other than luminaires (lighting fixtures), shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.

Just as a side note it is worth noting what seems to be a hidden exception (430.5(A)(1) Exception No. 3

Exception No. 3: For a listed motor-operated appliance that is marked with both motor horsepower and full-load current, the motor full-load current marked on the nameplate of the appliance shall be used instead of the horsepower rating on the appliance nameplate to determine the ampacity or rating of the disconnecting means, the branch-circuit conductors, the controller, the branch-circuit short-circuit and ground-fault protection, and any separate overload protection.

Which would permit the nameplate FLC on the nameplate instead of mandating table 430.248.

80. A builder is putting up a limited care facility, classified by the building code as an I-2 occupancy. This is a single story building of wood-frame construction with the walls and ceilings sheet-rocked (no suspended ceilings.) Can Type NM cable be used in this building?

ANSWER: Yes and No. Let's look at a few things:

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

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.
- (2) Multifamily dwellings permitted to be of Types III, IV, and V construction except as prohibited in 334.12.
- (3) Other structures permitted to be of Types III, IV, and V construction except as prohibited in 334.12. Cables shall be concealed within walls, floors, or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

So, yes, this type of construction (single story building of wood-frame construction with the walls and ceilings sheet-rocked) would permit the use of Type NM cable. BUT - it's a Limited Care Facility, classified by the building code as Group I-2

Definition: Group I-2. This occupancy shall include buildings and structures used for medical, surgical, psychiatric, nursing or custodial care on a 24-hour basis of more than five persons who are not capable of self-preservation. This group shall include, but not be limited to the following: hospitals, nursing homes (both intermediate care facilities and skilled nursing facilities), mental hospitals and detoxification facilities.

Definition: Limited Care Facility. A building or portion thereof used on a 24-hour basis for the housing of four or more persons who are incapable of self-preservation because of age; physical limitation due to accident or illness; or limitations such as mental retardation/developmental disability, mental illness, or chemical dependency.

So, we know it's a Health Care Facility, because it fits into that definition in Article 517. But does it have Patient Care Areas?

Patient Care Area. Any portion of a health care facility wherein patients are intended to be examined or treated. Areas of a health care facility in which patient care is administered are classified as general care areas or critical care areas.

General Care Areas. Patient bedrooms, examining rooms, treatment rooms, clinics, and similar areas in which it is intended that the patient will come in contact with ordinary appliances such as a nurse call system, electric beds, examining lamps, telephones, and entertainment devices.

OK, so it has Patient Care Areas, specifically General Care Areas. What does that mean? Those areas that are patient bedrooms, exam rooms, treatment rooms, etc. shall be wired per 517.13

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.

(B) Insulated Equipment Grounding Conductor. The grounding terminals of all receptacles and all non-current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts, shall be connected to an insulated copper equipment grounding conductor. The equipment grounding conductor shall be sized in accordance with Table 250.122 and installed in metal raceways or as a part of listed cables having a metallic armor or sheath assembly with the branch-circuit conductors supplying these receptacles or fixed equipment.

81. Can ¾ inch rigid metal conduit be used as a made electrode?

The NEC no longer uses the phrase, "made electrode." The answer to the question is in 250.52(A)(5). Galvanized rigid conduit not smaller than trade size ¾ in. is permitted to be used as a grounding electrode. Eight feet must be in contact with the earth.

82. Is it permitted to install a hasp on the cover of the panel containing the breakers for the motors of the fuel-dispensing pump to satisfy the requirements of 514.13?

NEC 514.13 requires that each dispensing device be provided with a disconnecting means capable of being locked in the open position. Locking an enclosure containing more than one disconnecting means would deny access to other disconnecting means and could lead to a problem where the other disconnecting means need to be used.

I believe it would be a poor design to put several disconnects in a locked enclosure where they are not accessible for their intended use.

83. I am installing a ceiling paddle fan on a porch. Are there any restrictions on the installation? The porch has a roof but is open on the sides.

Yes, per Article 100 Definitions, Locations Damp, pg. 30; lists the area in question as damp. The electrical box installed will need to be fan rated and listed as such per 314.27 (D) pg. 166, also if a light kit attachment is installed at that location as well, per 410.4 (A) pg. 254 it shall be "Suitable for Wet or Damp Locations". The data from the UL White Book, (The Rosette Stone for Electrical Code Cross Referencing) in on pg. 91, under category (GPRT), fans shall be marked as being acceptable for such use. Thus 110.3 (B) pg. 34 shall be complied with as well and follow the guide information indicated for that place and use. Note: per 2008 NEC and via ROP 9-60, a last sentence was added; "Where two or more separately switched, ungrounded conductors are provided to a ceiling mounted outlet box the outlet box or outlet box system shall be listed for sole support of a ceiling-suspended (paddle) fan. This means that if the branch circuit conductors are present and that the fan is not or may be added in the future, then the box must be fan rated at the time of installation of the circuit.

84. We installed a separately derived system (transformer) at the far end of a large warehouse. We proposed to use a primary equipment ground on the circuit that would be sized based on the required grounding electrode conductor size. This would have one conductor serve as both the equipment grounding and grounding electrode conductor.

The inspector said no they are separate conductors but cannot point to a code requirement. Is there a prohibition on this type of installation?

Yes, The grounding electrode conductor is required to be routed from the grounding electrode to the separately derived system. 250.30(A)(3).

250.30(A)(3) Grounding Electrode Conductor, Single Separately Derived System A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived phase conductors and shall be used to connect the grounded conductor of the derived system to the grounding electrode as specified in 250.30(A)(7). This connection shall be made at the same point on the separately derived system where the system bonding jumper is installed.

The question has it routed from the primary overcurrent enclosure and not the grounding electrode. If the grounding electrode conductor was routed from the electrode and installed with the primary conductors, there is nothing in the code that would prohibit the equipment grounding conductor and the grounding electrode conductor to occupy the same raceway. 250.30(A)(5) requires the installation of the grounding electrode conductor to comply with 250.64(A)(B)(C)&(E). 250.64(C) requires the conductor to be one continuous length without a splice. 250.64(E) has requirements for the conductor in enclosures and bonding applies and each end of a ferrous metal raceways. Though PRESENTLY not prohibited by the code the installation requirements really makes it unrealistic in most applications to utilized one conductor for both the grounding electrode conductor and the equipment grounding conductor.

85. We've seen these "pop-up" receptacle towers that are mounted in a countertop or a similar surface. These towers are connected to the electrical system by a 6-8 foot grounded cord. Are these acceptable as required receptacles under Section 210.52? Are these listed for use in kitchen countertops where they may be subject to liquid spillage?

These relocatable power taps are Listed under the category Relocatable Power Taps (XBYS), located on page 343 in the 2007 White Book. They are intended for indoor use as relocatable multiple outlet extensions of a single branch circuit to supply equipment. Relocatable power taps are not intended to be permanently secured to building structures, tables, work benches or similar structures, nor are they intended to be used as a substitute for fixed wiring. They are not intended to be a substitute for the required receptacles in 210.52. The towers that are intended for use in a kitchen countertops and identified that way have been evaluated for spills when the tower is closed with nothing plugged in.

86. I am working on a project started by an owner. He has a business that spreads straw for use as erosion control for highway/construction sites. At his mixing site, all of the motors are hydraulic, and all the electric pumps are in a different building. When in production the dust form the straw gets quite thick, and they have a hard time seeing. What type of wiring method, lights, and boxes are acceptable?

The first step in determining acceptable wiring methods and equipment for this application is by evaluating whether or not Article 500, Hazardous (Classified) Locations is applicable.

500.6 states in part, that for area classification, various air mixtures shall be grouped in accordance with **500.6(A)** (Class I) and **500.6(B)** (Class II). **Note: There is no Group Classification for Class III Locations.**

Section **500.6(B)(3)** identifies grain as a Group G Atmosphere and "Straw" would be classified as a grain. The FPN following **500.6(B)(3)** references NFPA 499, Locations for Electrical Installations in Chemical Process Areas, for additional information.

According to NFPA 499, dusts having ignition sensitivities equal to or greater than 0.2, or explosion severities equal to or greater than 0.5, are listed in Table 2-5. Dusts whose explosibility parameters fall below these limits are not generally considered to be significant explosion hazards and are, therefore, not included in this table. Wheat straw is included in this table. Another useful reference source is the IAEE "Hazardous Locations" Commentary.

Therefore, this area would be a Class II Location.

The question indicates that the dust is very thick under normal operating conditions, thus warranting a Class II Division I classification in accordance with **500.5(C)(1)(1)**.

502.10(A)(1) The types of wiring methods for Class II Division 1 locations include Threaded Rigid Metal Conduit, or Threaded Steel Intermediate Conduit. **502.10(A)(2)** lists acceptable wiring methods for flexible connections. permits:

502.10(B)(4) requires boxes and fittings to be dusttight.

502.115(A)(1) requires switches to be dust-ignition proof

502.130(A)(1) requires luminaires to be identified for a Class II location and marked with the maximum wattage lamp

Code References: **500.6**, **500.6(B)(3)**, **500.6(B)(3) FPN**, **500.5(C)(1)(1)**, **502.10(A)(1)**, **502.10(B)(4)** & **502.130(A)(1)**

87. An air-conditioner consisting of two separate units is installed in a residence. The self-contained fan unit is inside the house and a hermetic refrigerant unit outside. Is it permitted to use the supplied five-conductor (with ground) cable between the two units? The conditions and materials are: a 15-amp, two-pole circuit feeds the unit outside and the cable between the units is a CSA listed# 14 AWG rated 600 volts TC cable. The cable is sunlight resistant and suitable for a wet location. The cable is tie wrapped to the insulated Freon lines between the two units and runs through the wall of the house with them. Is this cable a proper one to use, considering it is rated only as Type TC cable?

NO – code reference 336.12(2)

336.12 Uses Not Permitted

Type TC tray cable shall not be installed or used as follows:

- (1) Installed where it will be exposed to physical damage
- (2) Installed outside a raceway or cable tray system, except as permitted in 336.10(7)
- (3) Used where exposed to direct rays of the sun, unless identified as sunlight resistant
- (4) Direct buried, unless identified for such use

Product Standard used is UL 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members under Category QPDR on page 208 of the UL white book.

Although the general rule in 336.12(2) only permits type TC cable to be installed inside a raceway or cable tray, other than as permitted in 336.10(7) in industrial establishments for Type TC-ER shall be permitted between a cable tray and the utilization equipment or device, or 336.12(4) for direct burial where identified for such use and 336.10 (4) In outdoor locations supported by a messenger wire. Therefore the application as presented would not be code compliant.

88. An outpatient clinic for eating disorders is being built in my jurisdiction. Part of the therapy includes having the patients prepare meals in a large kitchen area. Since this is an outpatient clinic, does Article 517 apply? If so, does it apply to the entire building?

ANSWER: Article 517 would NOT apply to any part of the building.

It's kind of a double edged sword. Many of these institutions want all the medical authority and respectability implied in the word "clinic" but I'm not sure at all that they fall into any of the Code definitions.

Let's look at the definition of Health Care Facility found in 517.2

Health Care Facilities. Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

Ambulatory Health Care Occupancy. A building or portion thereof used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

- (1) Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without assistance of others.
- (2) Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.
- (3) Emergency or urgent care for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

OUTPATIENT: a patient who is not hospitalized overnight but who visits a hospital, clinic, or associated facility for diagnosis or treatment (Merriam-Webster)

[INPATIENT: a hospital patient who receives lodging and food as well as treatment]

I think this institution fits better into the general "dictionary" definition of clinic:

CLINIC: a class or group convening for instruction or remedial work or for the diagnosis and treatment of specific problems: *a reading clinic; a speech clinic; a summer baseball clinic for promising young players.*

If, however, they for some reason they have "examination rooms" or treatment rooms" that fit into The definition of Patient Care Area as defined in 517.2, then the receptacles and fixed equipment In those rooms would have to comply with 517.13.

89. Are wireways listed for grounding? We constructed one of 16-gauge steel and want to use it as the equipment-grounding conductor.

Metal wireways are covered in Article 378. Nothing in this Article requires the wireways to be listed or to be listed for grounding. Section 250.118(13) contains the phrase "Other listed

electrically continuous metal raceways and listed auxiliary gutters." Wireways are included in the definition of "Raceways" in Article 100.

The UL Guide Card on Wireways, Auxiliary Gutters and Associated Fittings (ZOYX) Use and Installation contains the following paragraph,

"Metallic wireways installed in accordance with the product markings and manufacturer's instructions are suitable for use as equipment grounding conductors, and are Listed for grounding."

Be sure to follow manufacturers installation instructions which no doubt require that the paint be scraped at connection or splice points for continuity or bonding jumpers should be installed to ensure an effective ground fault return path is provided as required by 250.4(A)(5).

90. I can't find Code section that gives the ampacity of copper bus bars size 4" x 1/2" copper bus bars. Can you help me to find it?

The NEC does not give the ampacity of bus bars other than in 366.23 where the current carried continuously in bare copper bars, in sheet metal auxiliary gutters, shall not exceed 1000 amperes per inch squared or 700 amperes per inch squared for aluminum bars. Tables for the ampacity of bus bars may be found elsewhere and generally show 1200 amperes for copper bus and 1000 amperes for aluminum bus.

91. If there is electrical power in a detached residential garage, and an electric garage-door opener has a light with a wall-mounted control for the light in the unit, does this count as the required lighting outlet in Section 210.70?

Maybe, depending on if the lighting source is on a separate circuit and will illuminate the area without having to open and close the garage door opener mechanism that normally allows for the light to be shut off after a timing sequence. Section 210.70 (A) (2) (a), pg 54, requires a wall switched-controlled lighting outlet. (b) Also requires detached garages to have one wall switched lighting outlet on the exterior side of outdoor entrances and exits. Just to have a light that cycles on by the function of the garage door opening and closing and then switching off after a period of time does not meet need for lighting while one is in the area for unspecified periods of time.

92. We installed two feeders in a raceway. Does each circuit need an equipment-grounding conductor?

Section 250.122 provides the requirements for sizing the equipment grounding conductor in a raceway based on the branch circuit overcurrent device. Where multiple circuits are installed in the same raceway 250.122(C) would apply.

250.122(C) Multiple Circuits Where a single equipment grounding conductor is run with multiple circuits in the same raceway or cable, it shall be sized for the largest overcurrent device protecting conductors in the raceway or cable.

This section does not address multiple feeders in a raceway. It would be my interpretation that this section would also apply to feeders even though it is not specifically addressed in this code section.

93. A company advertises a "Romex 3 Conductor Splice Kit" which has been used in the past for connecting power in sections of a modular home. This company is now also claiming that these splice kits can be used in remodeling work in an existing house and be buried in the wall per "Article 334-40b" (their exact terminology). The UL listing category appears to be QAAV, which in the brief description in the White Book indicates that these must be capable of withstanding"... mechanical shock that might occur while transporting the units in which they are used." which would seem to indicate their use is for the modular home connections and not for burial in a wall. Is this the correct listing for the product? Can they be buried in a wall?

As the question states that these NM cable and splice kits are listed under the category Non Metallic Sheathed Cable Interconnectors (QAAV), located on page 240 in the 2007 White Book. This category covers self-contained interconnectors employing pressure cable connectors, insulation displacement or insulation piercing connectors for splicing or tapping nonmetallic (NM) sheathed cable. These interconnectors are intended for installation in accordance with ANSI/NFPA 70, "National Electrical Code."

These devices have been investigated for equivalency to Type NM cable in insulation and temperature rise, and for capability to withstand fault currents, vibration and mechanical shock that may occur during transport of the units in which they are used.

300.15 Where boxes or fittings are required, (H) Insulated Devices As permitted in 334.40(B), a box or conduit body shall not be required for insulated devices supplied by nonmetallic-sheathed cable.

334.40 (B) Devices of Insulating Material Switch, outlet, and tap devices of insulating material shall be permitted to be used without boxes in exposed cable wiring and for rewiring in existing buildings where the cable is concealed and fished. Openings in such devices shall form a close fit around the outer covering of the cable, and the device shall fully enclose the part of the cable from which any part of the covering has been removed.

These interconnectors are insulating devices equivalent to NM cable and can be installed in accordance with Section 33.40(B), so if is being used for rewiring in existing building, it can be concealed and fished.

94. When installing a stand-by generator being fed with 4 wires, is it required to drive a ground rod at the generator to bond the metal frame? We are not using the generator as a separately derived system.

No, it's not required to install a ground rod when the generator is not set up as a separately derived system and would not fall under the purview of 250.30(A). In this case the system is grounded by its solid connection to the neutral of the premises wiring system. It is also important to remove the bonding jumper at the generator.

See also page 225 of the 9th Edition Soares Grounding. Although not required, some manufacturer installation instructions require a ground rod. In this instance Section 110.3(B) would require the ground rod. Note the ground rod would be considered a supplementary electrode.

The 2008 NEC further clarifies this concept by modifying Section 250.20(D) and accompanying FPN 1:

(D) Separately Derived Systems. Separately derived systems, as covered in 250.20(A) or (B), shall be grounded as specified in 250.30(A). Where an alternate source such as an on-site generator is provided with transfer equipment that

includes a grounded conductor that is not solidly interconnected to the service-supplied grounded conductor, the alternate source (derived system) shall be grounded in accordance with 250.30(A).

FPN No. 1: An alternate ac power source such as an on-site generator is not a separately derived system if the grounded conductor is solidly interconnected to a service-supplied system grounded conductor. An example of such situations is where alternate source transfer equipment does not include a switching action in the grounded conductor and allows it to remain solidly connected to the service-supplied grounded conductor when the alternate source is operational and supplying the load served.

Code References: 250.24 & 250.30(A)

95. Is the same working clearances required for air conditioning disconnects with fuses and those without fuses?

Yes

110.26(A) Working Space Working space for equipment operating at 600 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), and (A)(3) or as required or permitted elsewhere in this Code.

96. What determines the grounding conductor size for a satellite dish or a communication system antenna?

ANSWER: The size of wire on the spool in the back of the truck.

Actually, 810.21(H) Size. *The grounding conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.*

ARTICLE 810 Radio and Television Equipment

I. General

810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as multi-element, vertical rod, and dish, and also covers the wiring and cabling that connects them to equipment.

810.21 Grounding Conductors — Receiving Stations.

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

(A) Material. The grounding conductor shall be of copper, aluminum, copper-clad steel, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum grounding conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum shall not be installed within 450 mm (18 in.) of the earth.

(B) Insulation. Insulation on grounding conductors shall not be required.

(C) Supports. The grounding conductors shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

Exception: Where proper support cannot be provided, the size of the grounding conductors shall be increased proportionately.

(D) Mechanical Protection. The grounding conductor shall be protected where exposed to physical damage. Where the grounding conductor is run in a metal raceway, both ends of the raceway shall be bonded to the grounding conductor or to the same terminal or electrode to which the grounding conductor is connected.

(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
- (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).

- (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.

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

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

(I) Common Ground. A single grounding conductor shall be permitted for both protective and operating purposes.

(J) Bonding of Electrodes. A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

(K) Electrode Connection. Connections to grounding electrodes shall comply with 250.70.

97. Why are bonding bushings required on ringed knockouts in panels or cabinets for 277/480-volt wiring systems, but not for 120/240-volt wiring systems?

The higher voltage produces more heat at arcing connections. Also, if a metallic enclosure is downstream from an open connection, a higher shock voltage is created by fault to ground.

Bonding bushings and jumpers may be required by 250.96(A) if ringed knockouts are present for 208Y/120 volt systems if the effective ground fault return path required by 250.4(A)(5) is considered to be impaired by the ringed knockouts.

98. I have a question on renewable-link fuses. I was taught for years that renewable-link fuses aren't legal, but can't find a good Code reference for that.

NEC 240.60(D) was changed for the 2005 NEC to read that Class H renewable cartridge fuses shall only be permitted to be used for replacement in existing installations where there is no evidence of over-fusing or tampering. That's a good example of a "performance" requirement in a "prescriptive" code.

99. A break room in an office has a sink and receptacles above a countertop surface. There is a dedicated circuit and receptacle for a microwave that is set on the countertop.

Does this qualify as the permanent facilities for cooking in Section 210.8(B)? If there is a stove plugged into a 50-ampere receptacle, is this "permanent"?

NO; Section 210.8 (B) (2), PG 47 indicates that the space or area in other than dwelling units must have permanent facilities for food preparation and cooking. Having a countertop microwave appliance does not meet that test. Q. 2; yes if there is a stove or built in cooking top unit that is permanently set in place then GFCI protection would be required. Note; in the 2008 NEC via ROP 2-72 & 2-73, new wording was added to indicate "and other nonresidential kitchens" to help identify the break room areas that are in need of a GFCI protected receptacle. Also added as a (5) to that section, Sinks-where receptacles are installed within 1.8 m (6' ft.) of the outside sedge of the sink. This means an ARC type measurement in all directions would require GFCI protection as well. Normally most break rooms and areas also have a sink adjacent to the area and use and thus would indicate a need for a GFCI protected receptacle.

100. For a hydromassage tub, do the metallic faucets need to be bonded when the piping is all non-metallic?

The Section that requires the bonding of hydromassage bathtubs is 680.74.

680.74 Bonding All metal piping systems and all grounded metal parts in contact with the circulating water shall be bonded together using a copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG solid.

This section does not require you to bond plastic water piping systems and the faucets are not a part of the water circulating system and would not require them to be bonded.

The answer is no you do not need to bond the metallic faucets and the section is 680.74

101. The manufacturers of recessed light fixtures list the type of light bulbs that are approved to be installed within their fixtures. The newer type of medium base fluorescent light bulb is not listed for use in these recessed cans. Many people are buying them to conserve energy and are installing them in the recessed cans. Is this permissible?

Yes, this is permissible providing you install the lamp in accordance with it's markings and do not exceed the wattage rating on the luminaire..

The question is dealing with the proliferation of what the industry calls compact fluorescent lamps. UL Lists these as Self Ballasted Lamps and Lamp Adapters, (OOLR), located on page 222 in the 2007 White Book.

The Guide Information states these products have been investigated for use in the smaller of a 6- or 8-in. diameter recessed luminaire, if they will physically fit, and are intended for use in totally enclosed, recessed luminaires unless marked and stated not for such use.

102. There is a 14/3 wire from the switch box in a bedroom run up to the light box in the bedroom. The extra wire is there for a future paddle fan. Does the light box have to be a fan rated box?

Although it is good design to include a listed fan box where there is the potential to change a luminaire to a paddle fan, the code does not require it. NEC Section 314.27(D) & 422.18 requires paddle fans to be supported independently of the outlet box or must have a box listed for fan support. Even though a 3-wire is installed, unless the fan is also installed, it's not required.

Code References: 314.27(D) & 422.18

103. What working clearances are required for in-duct-heater disconnects, fused or non-fused, located above a t-grid ceiling and accessible only by a ladder? Would NEC 110.26 (a) 1 condition 3 apply?

It would depend on the voltage to ground of the circuit.

110.26(A)

(A) Working Space Working space for equipment operating at 600 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), and (A)(3) or as required or permitted elsewhere in this Code.

STEP 1. Reviewing Table 110.26(A) we need to determine voltage to ground and use the top row for 0-150 and bottom row for 151-600.

STEP 2. determine condition in columns 1 (line/insulated), 2 (line/grounded) or 3 (line/line).

104. Can a single-pole switch control the emergency lighting on the critical branch for a nurse's station?

ANSWER: YES, if the switch is accessible only to authorized persons

517.26 Application of Other Articles.

The essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

V. Control — Emergency Lighting Circuits

700.20 Switch Requirements.

The switch or switches installed in emergency lighting circuits shall be arranged so that only authorized persons have control of emergency lighting.

Exception No. 1: Where two or more single-throw switches are connected in parallel to control a single circuit, at least one of these switches shall be accessible only to authorized persons.

Exception No. 2: Additional switches that act only to put emergency lights into operation but not disconnect them shall be permissible.

Switches connected in series or 3- and 4-way switches shall not be used.

105. Why do the ground fault requirements for services over 1000 amps only apply when voltages are over 250 volts?

That is the voltage level where an arcing fault can be sustained. Also, that is the voltage where a history of destructive arcing ground faults demonstrated the need. See 210.10, 230.95 and 240.13 for the requirements.

106. Is an EMT strap suitable for strapping 6/3 romex?

NEC 334.30 requires that nonmetallic sheathed cable shall be supported and secured by fittings designed and installed so as not to damage the cable. There is no requirement for using only listed supports so if you feel the cable is properly supported and secured with EMT straps check with the AHJ for approval.

107. Is it permissible to install a non-GFCI receptacle in a crawl space for a sump pump if it labeled properly?

NO; if it is in a dwelling unit under (A) (4) of Section 210.8 pg. 47. Unlike (5) for unfinished basement that has (3) exceptions, (4) do not have the same option. Now what if it is in a non dwelling unit space type use, then it could be possible but not recommended. Note: under the 2008 NEC most of the exceptions that would allow for the use of non-GFCI protected receptacles have been removed. You may wish to verify for the non-dwelling uses what the listing and labeling of the product requirements are as well.

108. If you have 4/0, 4/0, 2/0 SER cable run into a panel and use a Romex connector on the cable, are you required to have a plastic bushing on the Romex connector?

No, 300.4(F) 2005 has been relocated to 300.4(G) which states:

300.4(G) Insulated Fittings. Where raceways contain 4 AWG or larger insulated circuit conductors and these conductors enter a cabinet, box, enclosure, or raceway, the conductors shall be protected by a substantial fitting providing a smoothly rounded insulating surface, unless the conductors are separated from the fitting or raceway by substantial insulating material that is securely fastened in place.

The SER cable is not a raceway and a bushing would not be required.

109. What is the required clearance to combustible materials for all recessed parts of a recessed luminaire that is not identified for contact with insulation?

UL Lists Recessed Fluorescent Luminaires under the category of the same name with the category code

(IEVV) located on page 141, Recessed Incandescent Luminaires (IEZX) on page 144 and Recessed HID under the category Code (IEXZ) located on page 143. All three of those category Guide Information state that for Type IC luminaires that may be in contact with combustible materials.

Type Non IC Luminaires are intended to be installed in an uninsulated or insulated ceiling (or wall), with all insulation kept a minimum distance of 3 inches from the sides of the luminaire and not placed over the luminaire such that it would entrap the heat produced by the luminaire. Other combustible materials are spaced, except at the points of support, at least 1/2 inch from the luminaire.

110. When romex is run in a bundle, when do you have to start derating the wires and is each hot and neutral conductor in the cable assembly counted individually or is the whole cable assembly counted as one wire?

334.80: The ampacity of Types NM, NMC, and NMS cable shall be determined in accordance with 310.15. 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. 310.15(B)(2) states that where multiconductor cables are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a).

Derating in accordance with Table 310.15(B)(2)(a) is required when you have more than three current carrying conductors.

310.15(B)(4) recognizes that a neutral conductor that carries only the unbalanced current from other conductors of the same circuit is not required to be counted. A multi-wire branch circuit would not require counting the neutral when supplying line to neutral loads, because it only carries the unbalanced current, however a 2-wire circuit would require counting the neutral as a current-carrying conductor.

310.15(B)(5) does not require the equipment grounding conductor to be counted.

Example:

Therefore, if there are ten – No. 12-2-G NM cables that are considered bundled, the ampacity would have to be derated using Table 310.15(B)(2)(a). Ten MN cables would have twenty current-carrying conductors and be required to be derated to 50 percent of the ampacity. Table 310.16 allows 30 amps in the 90-degree column with a derating of 50 percent, equaling fifteen amps allowed on these cables and fifteen amps of overcurrent protection.

Code References: 334.80, 310.15(B)(2), Table 310.15(B)(2)(a), 310.15(B)(4), & 114. Do I have to have GFCI protected receptacles in a farm shop?

There are no requirements in NEC 210.8(B) for GFCI protection of receptacles in a farm shop. They are not prohibited and if you feel additional safety will be obtained – have at it.

111. A new swamp cooler is installed on a residential roof. Can FLNC be run from the attic into and through the short piece of ductwork into the swamp cooler?

NO Reference 300.22(B)

(B) Ducts or Plenums Used for Environmental Air Only wiring methods consisting of Type MI cable, Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering, electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, or rigid metal conduit without an overall nonmetallic covering shall be installed in ducts or plenums specifically fabricated to transport environmental air. Flexible metal conduit shall be permitted, in lengths not to exceed 1.2 m (4 ft), to connect physically adjustable equipment and devices permitted to be in these ducts and plenum chambers. The connectors used with flexible metal conduit shall effectively close any openings in the connection. Equipment and devices shall be permitted within such ducts or plenum chambers only if necessary for their direct action upon, or sensing of, the contained air. Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type luminaires (fixtures) shall be permitted.

112. I have a 4 square box that has three pipes coming into it that are strapped within 3 feet. Is this considered a securely mounted box, or does the box have to be physically secured to something?

ANSWER: No Section 314.23(E)

II. Installation

(E) Raceway Supported Enclosure, Without Devices, Luminaires, or Lampholders. An enclosure that does not contain a device(s) other than splicing devices or support a luminaire(s), lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm³ (100 in.³) in size. It shall have threaded entries or have hubs identified for the purpose. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 900 mm (3 ft) of the enclosure, or within 450 mm (18 in.) of the enclosure if all conduit entries are on the same side.

(F) Raceway-Supported Enclosures, with Devices, Luminaires, or Lampholders. An enclosure that contains a device(s), other than splicing devices, or supports a luminaire(s), lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm³ (100 in.³) in size. It shall have threaded entries or have hubs identified for the purpose. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 450 mm (18 in.) of the enclosure.

113. Who is qualified to perform a GFP test of a GFP main breaker service?

Requirements for testing these systems can be found in 230.95(C) but the NEC is silent on any qualifications to perform such testing. The test is required to be performed in accordance with manufacturer's instructions and a written record of the test is required. Some AHJs may have additional requirements such as witnessing the test.

114. Do I have to have GFCI protected receptacles in a farm shop?

There are no requirements in NEC 210.8(B) for GFCI protection of receptacles in a farm shop. They are not prohibited and if you feel additional safety will be obtained – have at it.

115. Does the receptacle located behind a small floor refrigerator count as one of the required outlets for a hotel guest room?

Yes; Section 210.60 (A) & (B) pg. 54 would allow it; but it must be remembered that "At least two receptacle outlets shall be readily accessible" in that guest room area. Note: in the 2008 NEC "dormitories" was added to the list of location requiring the same placement of receptacles and uses.

116. In an indoor pool at a hotel, a new piece of metal pool playground equipment was added. Is there any bonding requirement?

Yes 680.26(B)(5) 2005 and 680.26(B)(7) 2008

680.26(B)(5) Metal Wiring Methods and Equipment. Metal-sheathed cables and raceways, metal piping, and all fixed metal parts that are within the following distances of the pool, except those separated from the pool by a permanent barrier, shall be bonded.

(1) Within 1.5 m (5 ft) horizontally of the inside walls of the pool

2008 NEC

680.26(B)(7) Metal Wiring Methods and Equipment. Metal-sheathed cables and raceways, metal piping, and all fixed metal parts shall be bonded.

Exception No. 1: Those separated from the pool by a permanent barrier shall not be required to be bonded.

Exception No. 2: Those greater than 1.5 m (5 ft) horizontally of the inside walls of the pool shall not be required to be bonded.

117. Are recessed fixtures, installed in a pitched ceiling 45degrees from the horizontal, required to be listed for that slope and orientation?

Not all Listed Incandescent Recessed Luminaires (IEZX) are suitable for use in sloped ceilings. There are UL Listed Incandescent Recessed Luminaires (IEZX) (located on page 144 of the 2007 UL White Book) specifically designed for use in sloped ceilings. These luminaires are constructed with the recessed housing mounted at an angle to the plaster (mounting) frame. There are no special markings required on these luminaires since the intended use and mounting orientation is obvious. They are tested with the lamp pointing straight down during the normal temperature test. "Standard" flat ceiling type incandescent recessed luminaires, without the sloped recessed housing, are typically not evaluated for use in a sloped ceiling, unless specifically requested by the manufacturer. This orientation option would also be outlined in the installation instructions. Presently, there are several "standard" flat ceiling type recessed luminaires that have been evaluated for use in a sloped ceiling and are marked as being suitable for use in sloped ceilings when used with specific trims.

118. Can I feed a permanently connected microwave with a nameplate current of 9 Amps from one of my two required kitchen countertop circuits? How about a refrigerator?

No, for the microwave and yes, for the refrigerator-Section 210.52(B)(1) identifies that the two or more 20-amp small appliance branch circuits required by 210.11(C)(1), shall serve all wall and floor receptacles covered under 210.52(A) and receptacle outlets for refrigeration equipment.

A receptacle installed in a cabinet for a permanently installed microwave does not fall under the purview of a general provision wall outlet covered under 210.52(A), Additionally, 210.52(B)(2) specifically prohibits any other outlets on these circuits, with limited exceptions for an electric clock and supplemental equipment & lighting on gas fired ranges, ovens, or counter-mounted cooking units.

In regard to the refrigerator, 210.52(B) does permit refrigeration equipment on the 20-amp small appliance branch circuit.

Permitting fastened in place appliances to be connected to these circuits would reduce the capacity to supply the typical higher wattage portable loads.

Code References: 210.52(A), 210.52(B)(1), 210.52(B)(2), 210.11(C)(1), 210.52(B)(2) Exceptions 1 & 2

119. In determining the proper feeder conductor size and overcurrent protection where the feeder supplies several variable frequency drives for several motors I believe 430.122(A) applies. Under a condition where not all motors run at the same time would you still take the sum of all the power conversion equipment x 125%, or, base it on the largest load at any one time (x 125%)?

The feeder conductors and OCPD would need to be sized in accordance with 430.122(A). Part X of Article 430 was a new Part accepted by CMP 11 for the 2005 edition (ROP 11-6 of the May 2004 ROP). 430.22(A) Exception No. 2 was relocated to the present 430.122(A) as it pertained to ASD systems. Article 430 does not contain provisions to permit reducing feeder conductor sizes where only one motor of the group would run at the same time.

120. I have an EMT with an equipment-grounding conductor feeding receptacles. If an EGC is pulled with the circuit, do you need to bond the metal boxes to the EGC or will a self-grounding receptacle take care of that?

ANSWER: Yes

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 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.

121. The 2006 International Residential Code requires the electrical panels mounted within outside walls to have an "R" rating. Is there an "R" rated panel made?

Not to my knowledge. This, perhaps can be verified by reviewing manufacturers catalogs.

122. There is a lot of confusion on the requirements and the construction of an equipotential plane for a swimming pool. Can we use the rolled reinforcing steel as the structural reinforcing steel required in Section 680.26 (C)(1) of the NEC?

I believe the intent was to permit steel reinforcing mesh to be used but the wording "where the reinforcing rods are bonded together by the usual steel tie wires" seems to require reinforcing rods and not wire mesh. Considerably more confusion is the result of not clarifying the grid structure with respect to a fiberglass pool.

123. Are residential stairways required to contain luminaries? Would a single pole switch at the top controlling one light and another switch at the bottom controlling another light satisfy the requirement?

NO, but a lighting outlet is required; 210.70 (A) (2) (a) and (c) pg. 54, address the concern. Q 2. NO, (c) stairs must have six risers or more shall have a wall switch at each floor level. Note: the IRC 303.6 Stairway Illuminations. All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. The light source shall be capable of illuminating treads and landings to levels not less than 1 foot-candle (11 lux) measured at the center of treads and landings.

124. Can I run one #4 from the rebar and tap off of it to a second 200 amp panel?

Assuming the rebar meets the requirements of 250.52(A)(3) and the 4 AWG conductor is copper. Yes, Sections 250.66(B) and 250.64(D)

250.66(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.

250.64(D) Grounding Electrode Conductor Taps Where a service consists of more than a single enclosure as permitted in 230.71(A), it shall be permitted to connect taps to the common grounding electrode conductor. Each such tap conductor shall extend to the inside of each such enclosure. 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 conductors.

Per Section 250.66(B). A grounding electrode conductor to a concrete encased electrode is not required to be larger than a 4 AWG copper conductor.

2007 WESTERN SECTION MEETING CODE PANEL MEMBERS

PANEL NO. 1

Moderator – Mike Forister

Panel Members:

Mark Earley – NFPA	1,9,17,25,33,41,49,57
Monte Ewing – CMP 19	2,10,18,26,34,42,50,58
Ron Janikowski, CMP 12	3,11,19,27,35,43,51,59
Richard Loyd - CMP 5 & 8	4,12,20,28,36,44,52,60
Chuck Mello – CMP 5	5,13,21,29,37,45,53
Don Offerdahl – CMP 9	6,14,22,30,38,46,54
Dick Owen – Past Chair CMP 3 & TCC	7,15,23,31,39,47,55
Jim Pauley – CMP 2 and TCC	8,16,24,32,40,48,56

PANEL NO. 2

Moderator – OP Post

Panel Members:

Tom Lichtenstein – CMP 19	61,69,77,85,93,101,109,117
Tim McClintock – CMP 12	62,70,78,86,94,102,110,118
Tom Moore – CMP 11	63,71,79,87,95,103,111,119
M. Sam Sampson – CMP 15	64,72,80,88,96,104,112,120
Phil Simmons – CMP 5	65,73,81,89,97,105,113,121
Charlie Trout – CMP 12	66,74,82,90,98,106,114,122
Ray Weber – Chairman CMP 2	67,75,83,91,99,107,115,123
Dave Williams – CMP 5	68,76,84,92,100,108,116,124