

# WISCONSIN CHAPTER IAEI

## 83<sup>rd</sup> ANNUAL SEMINAR

### CODE QUESTIONS

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- Note: The answers to these questions were prepared with all intentions of following the State of Wisconsin's interpretations of the NEC per Comm 16.04
- 1) Why is 601 amperes a standard size fuse in Section 240.6 of the NEC?  
**ANS:** The reason there is a 601 fuse is to give flexibility. Class R and J fuses only go up to 600A. Above 600A, a Class L fuse must be used. Class L fuses range from 601A-6000A. The first case size of a listed Class L fuse is 800A with fuses sizes typically of 601, 650, 700, 750 and 800A. Thus, if you have a circuit that could be sized at 600A, but may have to be increased in the future due to future expansion or motor inrush issues, Class L is the obvious choice. By going with a 601A Class L fuse, in an 800A disconnect, the fuses could be increased in the future up to 800A, provided conductors with an appropriate ampacity are used.
  - 2) When running feeders in parallel, for example a 2000 ampere motor control center, how do you size the ground in the raceways?  
**ANS:** The grounding conductor is sized according to table 250.122 ( for 2000 amps = 250 kcmil copper or 400 kcmil aluminum). Each of the paralleled equipment grounding conductors shall be sized on the basis of the ampere rating of the overcurrent device 250.122 F 1 & shall be that full size in each paralleled raceway.
  - 3) My house has a vaulted ceiling with a lot of can lights installed. The insulation process was to install a spray foam product throughout the joist area. This process pretty much enveloped all the can lights. The inspector said this was not allowed as the foam would not allow heat to dissipate and the foam material was not "evaluated(huh?)" for what it may do to the can assembly. I pointed out that these can lights are all energy qualified and IC rated assemblies. Isn't this OK?  
**ANS:** No it isn't OK. UL White Book IEZX, 410.66(A)(2) – 2005 NEC and 410.116(A)(2) for 2008 NEC. As the inspector explained, these are not evaluated by a testing laboratory for being in contact with any insulating product beside batt style or loose fill (blown – in) insulation.
  - 4) The central vacuum system installer scabbed a bunch of their suction outlets onto existing electrical receptacle outlets. In some cases these existing outlets are 20 amp wire and breakers. The wire that comes from the assembly is a five foot chunk of #14 AWG. He says UL allows this as the devices are listed. Is this correct?  
**ANS:** No the items are a recognized component, not a "listed system". UL White Book DMLW NEC 422.15(A) which references 210.23(A) and also

422.15(B) which states that the conductors cannot be less in size than the conductors they connect to.

- 5) The central vacuum system installer installed a suction outlet in a kitchen at an existing house. The vacuum outlet was adjacent to a kitchen wall receptacle. The circuit he tapped his five foot whip to was one of the 20 amp small appliance branch circuits. When he was told that he can't tap off of this circuit, he said that the 30 foot vacuum cleaner hose is also serving the kitchen, so this is OK.....is this OK?

**ANS:** No this is not code compliant. 210.52(B)(1) & (2). These circuits may only serve receptacle outlets, not vacuum cleaner specialty outlets.

- 6) I have a 3,000 amp service and two 2,000 amp services in the same room. The water main is located 400 feet away. A designer insists that I install either three separate 3/0 AWG copper grounding electrode conductors or two 300 kcmil conductors in parallel. May I run a single 3/0 AWG copper wire from a bus bar (1/4" x 2" x 12") that is in the room containing these services to the water main to serve as the ground for all the services and connect each service to this bus bar?

**ANS:** Yes, A common grounding electrode is acceptable. The 250.64(a) thru (F) of the 2008 NEC makes it clear that a common GEC must be a 3/0 cu conductor. While all three services could fail, they would not all fail at the same instance. The grounding electrode connection is not there to open an overcurrent device and when you look at an installation if there are just made (rod) type electrodes a #6 is the maximum size required. A separate grounding electrode conductor shall be run from each electrical service to a grounding electrode or a common grounding electrode conductor. 250.58 requires the same electrode(s) be used as the common tie point for all services. 250.64(F) allows the installer to use a bus bar for connecting "(B)onding jumpers from grounding electrodes" if there are more than one. Typically each service may be connected with a properly sized EGC to the closest steel framing member and the steel frame is grounded properly per 250.52(A)(2).

- 7) The 2005 NEC Section 410.73(G) says that as of January 1, 2008 we will have to have "disconnects" for ballasts in fluorescent lights. Will these be required to be installed in existing lights when I do remodeling projects? Many times we take down ceilings and redo or shift tenant spaces and walls and then reinstall the original lights. At what point will we be required to install disconnects? Can we use the internal type or do we need a switch on the side of a fixture?

**ANS:** Yes, For alteration where the lights are disconnected and come down, they will have to have disconnects installed and the switch can be installed internal or external per 410.130(G)(1). If they are not disconnected and taken down, the State of Wisconsin will not apply this code section to existing luminaires.

- 8) We are wiring a condominium that is basically a duplex. It has two water mains coming in from the street. The service wires to the panels are run under the garage slabs to opposite sides of the building. The inspector says we can't simply go from each panel to the unit's individual copper water main. He says we have to connect each water main to each other by running a #4 AWG copper wire between the two units. He also told me that I have to tie both sets of ground rods to the underground metal water pipe. This seems excessive as they come out of their respective panels and the grounding electrode conductors from these panels go to the water pipes. How do I have to do this?

**ANS:** The systems need to be bonded together to form the grounding electrode system 250.50 & 250.53(D)(2). Note: you would not have needed the ground rods as 250.53(D)(2) requires that a metal water pipe be supplemented “by an additional electrode of a type” listed in the laundry list of 250.52(A)(2) thru (8) – such as rods, steel, concrete encased grounds, etc. The second water pipe is an acceptable supplemental grounding electrode.

- 9) Does NEC 300.11 (A)(2) Exception allow fixture whips to be secured to the grid wires installed by the ceiling contractor?

**ANS:** No. NEC 300.11(1) & Comm 16.18. Note: if a set of two fixtures (luminaires) has a “whip” of MC or AC or FMC that is run as part of the assembly – to directly connect the two parts, this is technically part of the fixture – per UL and may be secured to the ceiling grid and wires by definition of the assembly. Typically these fixtures have all ballasts in only one of the two paired assemblies.

- 10) Building B is powered by a 60 amp feeder from building A. The two buildings are 10 feet apart. Can one pair of ground rods be used as the grounding electrode for both buildings? Would this be considered a ground path similar to a metal water pipe between the two buildings? Does it matter if it is a three- wire or four- wire feeder?

**ANS:** Yes, it is OK to use the same ground rods to meet the requirements of 250.32. Yes it is a parallel path and you have to install a “4-wire system”. Note: in 2008 you will always have to install a “4 wire system” for new construction.

- 11) An owner wants me to install some low voltage wiring in a clothes closet for her house. What kinds of rules apply to these light fixtures? Are there any special distances required?

**ANS:** Yes, see Article 411 for some installation rules. For the 2005 NEC – Section 410.8 still has to be followed, based on the scope of this article, for distance separations from shelves and other storage areas in clothes closets. (2008 NEC changes this section to 410.16)

- 12) Recently a code inspector mentioned to us that building service entrance conductors need to be sized for 100% of the service entrance main circuit breaker rating. Is this correct, or does NEC 240.4 (B) still apply for service entrance conductors? In our particular situation we had an 800A MCB with 2~500 MCM conductors per phase. The inspector indicated that we could not use these conductors because the ampacity ratings listed in Table 310-16 indicated the conductor were only good for 380 amps, 760 amps total. We were asked to up size the conductors to 2~600 MCM per phase.

**ANS:** You are correct. Section 230.90 of the NEC requires that each ungrounded service conductor shall have overload protection. 230.90 (A) tells where and how and the Exception No. 2 says that Fuses and circuit breakers with a rating or setting that conform to Section 240.4(B) or (C) and 240.6 shall be permitted. Section 240.4(B) and (C) are the rules that allow the next standard size provided it is not over 800 Amperes. 240.4 (C) says if greater than 800 amperes it cannot exceed the conductor ampacity and 240.6 lists the standard ampere sizes of protection. The inspector may be confusing service conductors with tap conductors in Section 240.21. A clarification in the code indicates that the rules of Section 240.6 (B) cannot be applied to taps or the secondary conductors of transformers. While this has always been the case, new language in these areas on taps and transformers is intended to make it clear that section 240.4 does not apply.

- 13) A plan calls for some isolated ground receptacles to be installed in the patient care areas of a facility. Article 517 of the NEC requires a redundant grounding system to be installed for these areas. Where in the Code does it say that this type of receptacle is allowed for this use? The intent of the requirement for the required metallic pathway was for a redundant ground path to equipment hooked up to a patient, and now the metallic path is not connected to the ground pin of the isolated receptacle.  
**ANS:** Section 250.146(D) covers isolated ground receptacles and is referenced in 517.16 (read section and FPN) which allows this installation.
- 14) Do the neutral and ground wires have to be pigtailed to be uninterrupted with the removal of a device on regular branch circuits or just on multiwire branch circuits?  
**ANS:** This requirement is only for multiwire branch circuits in accordance with Section 300.13 (B) Device Removal for the neutral conductor. The ground wires usually have to be “pigtailed” as typical receptacle and switch devices are only listed for landing one ground wire under the green termination screw.
- 15) With regards to grounding and bonding of gas appliances (furnace, water heater, ranges) What is the Inspector looking for?  
**ANS:** Bonding of gas piping is accomplished with the equipment grounding conductor of the circuit (appliance) that may energize the gas piping usually the furnace. CSST is required to be bonded by installation instructions **and is the installer’s responsibility** (not the electrician). Note: Gastite has come out recently with modified installation instructions for bonding their product. Basically, all manufacturers want the gas supply system bonded to the electrical service wiring before the first connection of a CSST.
- 16) Was the National Electrical Code adopted in Wisconsin before the 1980 UDC? What year was the NEC adopted nationwide?  
**ANS:** Yes, Wisconsin has adopted the NEC since the 1971 edition. The NEC is not adopted nationwide in other than OSHA requirements where in August of 2007 they adopted the 2002 NEC. Quite a few states adopt the NEC as well as local or municipal jurisdictions. Wisconsin adopted the 1915 NEC for its existing building code on September 20<sup>th</sup>, 1915
- 17) Will the NEC Arc-Fault Circuit-Interrupter requirements of the 2008 NEC go into effect when Wisconsin adopts the 2008?  
**ANS:** The department is not opposed to the requirement for AFCI protection although legislative approval is required.
- 18) When hooking up a 100 amp mobile home feeder, can I use a 200 amp breaker in the pedestal and use tap rules to the panel?  
**ANS:** No, The requirement for power to a mobile home in Section 550.23 calls for a feeder. There is no provision to use a tap.
- 19) A fluorescent fixture hangs 15 feet below a ceiling. Can I use a cord to connect power to the fixture? Does the fixture need a disconnect at the ceiling? Can the fixture be wired directly into a junction box? Can I wire tie the cord to the support chains that hold the fixture?  
**ANS:** Yes, No, maybe, Yes: 410.30, 410.73(G)Exc. 3: The use of a flexible cord to supply fluorescent fixtures is allowed by 410.30 provided the requirements of (C)(1)(1)&(2) are met. These include the luminaire being located directly below the outlet, the cord be visible it’s entire length and not subject to strain or damage, and be terminated in an attachment plug, or be part of a listed assembly. 410.73(G) exc. 3

allows an accessible plug and receptacle to be permitted to serve as the disconnecting means required by 410.73(G). The cord could only be directly wired into a junction box if part of a listed assembly with a strain relief and canopy 410.30(C)(2) While 400.8 does not allow cord to be attached to building surfaces the exception to (4) does allow an approved means of attachment to relieve strain.

20) What are grounding requirements for a UPS system?

**ANS:** 250.30, 250.130, 250.134, 250.118: NEC 250.130 refers us to 250.30 if the UPS is a separately derived system. The requirements in 250.30 would need to be met in regards to the connection of the grounded conductor to a grounding electrode. 250.134 requires all non-current-carrying metal parts of equipment be grounded by any of the equipment grounding conductors permitted by 250.118.

21) I have a hard wired UPS system. Do I need a separate disconnecting means in the room? The breaker supplying it is on the other side of the building.

**ANS:** Yes. Article 100. Article 422 Part III. Although the NEC's definition of an appliance is somewhat vague, UL treats these units as one and the rules in Article 422 apply. 422.30 requires a means to disconnect the unit from all ungrounded conductors. 422.31(B) usually applies as these units are typically larger than 300 volt-amperes. This section would allow the breaker to serve as the required disconnecting means if it was in sight of the unit. A remote breaker with a breaker lock may provide an alternative. 422.33 would allow a cord and plug to provide the disconnecting means. Finally, 422.34(D) would allow a built in "unit switch" to provide the required disconnecting means provided it turns off all power in the unit (including battery power) for the purposes of safely working on the unit. A separate disconnecting means in another part of the building would also be required such as switch or circuit breaker. If the UPS is part of an Information Technology Equipment room as outlined in Article 645 other disconnecting means may be required.

22) Can I drill a one inch (1") hole in the shoulder studs and cripples under a window?

**ANS:** The building code considers 3 studs or more a column which is considered a structural member. Structural members cannot have a hole drilled which exceeds 1/3 the depth of the member and it must be located in the center 1/3 of the member.

23) A local electrician says where he uses a Square D feeder panel with a 100 amp main breaker installed (because it's cheaper to buy them that way) and it's okay if he protects the panel with a 60 amp breaker back at the main provided that all wiring is correct. I say incorrect because a home owner buying this house is under the impression there is a 100 amp supply at the detached garage, in addition to a code violation. I hang my hat on 110.3(b). Who is correct?

**ANS:** You are incorrect. The panel in question is a feeder panel and not a service panel where the overcurrent device (230.90 and 91) must also provide overload protection for the conductors that feed it. You are dealing with a feeder and the conductor protection is provided by the feeder circuit breaker while the panel is only required to be sized appropriately and have a disconnect (225.30 - 230.40). Now assuming we have to protect a lighting and appliance panelboard at not greater than the panelboard rating (Section 408.36), we will use Exception No. 1 to say that the 60 ampere device is protecting the 100 ampere panel at or below its rating. Assuming the load is less than 60 Amperes we are all set. Section 110.3 (B) does not have any bearing on the use since the use is in compliance with the NEC. Section 110.3 (A)(1) Suitability for installation and use in conformity with the provisions of this code is more appropriate.

24) Is it allowable to have a switched receptacle outlet (for a lighting outlet) for a stairway? Does installing a midpoint landing have any bearing on the issue?

**ANS:** A lighting outlet is defined as "An outlet intended for the direct connection of a lampholder, a luminaire (lighting fixture), or a pendant cord terminating in a lampholder." A switched receptacle is not acceptable for stairwells. Exception No 1 to 210.70 (A)(1) allows the use of switched receptacles for habitable rooms except kitchens and bathrooms. A landing in the stairwell would not make a difference. The switching is specified in Section 210.70 (A)(2)(c) of the NEC.

25) I went to the Mike Holt Code Forum where the majority of the senior members say the Code requires bushings on PVC for #4 AWG or larger conductors. Section 352.46 of the NEC states that a bushing or adapter shall be provided to protect the wire from 'abrasion'. The fine print note refers the reader to 300.4 for protection of conductors 4 AWG and larger where it requires a 'smoothly rounded insulating surface'. The edge of a PVC connector is not smoothly rounded. I have seen many large conductors with the nylon jacket and/or insulation compromised because they were bent against a PVC connector with no bushing.

**ANS:** Comm 16.04(1) and 352.46 apply not Mike Holt's forum (although the forum is a fun reference to see what others think). The code panel pointed out in the ROP the need for a fitting on all raceways metal or nonmetallic which follows 300.15. This fitting must then comply with 300.4(F) where #4 and larger conductors are installed. If the raceway were EMT a fitting with a nylon throat could be used rather than a bushing. Where IMC or RMC are used they're stuck using a nonmetallic bushing (fiber or plastic). With PVC fittings the listing agency tests them for compliance with 352.46 ("unless the fitting design provides equivalent protection") by pulling a thin strip of metal foil across the throat of the fitting and the throat of the fitting is required to be rounded enough so not to tear the foil. When fittings don't get manufactured in compliance with the listing inspectors have the option to file a product violation report with the listing agency

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

**ANS:** The question: Can a remote control satisfy the requirement of 210.70 (A)(1) for a wall switch controlled lighting outlet? For this question the answer would be no, a wall switched lighting outlet is required. If someone installs as in your case a fan/light and then uses a remote to control it would meet the code provided the switch remains so that we can have a switched outlet at some later time. The switched outlet is required to be installed but there is no similar requirement to use it. It is equivalent to installing switched receptacles but never bringing in a lamp to plug into them.

27) We are wiring an addition to a single family residence. In the master bedroom there is a bench with cabinets and open shelves underneath it. The bench is over 12 feet long and 18 inches high and is placed along an outside wall. Does that wall space require outlets per 210-52? The owner does not want to place the outlets in the wall space above the bench. If they are required, could they go inside the cabinets underneath the bench?

**ANS:** The bench is wall space and receptacle(s) are required. One receptacle centered would cover the space with other receptacles in the walls to meet the spacing requirement. The receptacles could be inside such as allowed on bookcases with open

shelves, above where they would be useful or in the floor less than 18 inches from the front edge.

- 28) I am working in a commercial building and have a security box above the ceiling that needs a receptacle. Can I install the receptacle above the ceiling for that device? I know that cords running through the ceiling grid are prohibited. The inspector made me remove one and I am just contacting you to clarify the grey area that I have.

**ANS:** 410.8(2): There is no prohibition to installing receptacles above a suspended ceiling. However 410.8(2) does not allow flexible cords to be installed above a suspended ceiling. Many times security systems are supplied by a Class 2 power supply where the transformer is supplied with an integral plug and mounted directly on the receptacle and would be an allowed use of the receptacle.

- 29) Could you tell me the Section that would apply to a switch next to the shower? There is also a Thomas I/C air-tight light fixture in the ceiling at 8' height, shouldn't this be approved for damp or wet location?

**ANS:** 404.4, Comm. 16.18, 410.4(D). The Code does not require a minimum setback between the switch and the shower. Is the switch located where it will be protected from the spray from the shower head? Will there be glass doors or similar that will protect the switch from shower spray? If not, the switch must be moved to a dry location or equipped with a weatherproof enclosure in accordance with NEC 404.4. The recessed fixture probably is approved for use in damp or wet locations. However, the types of trim are restricted to those approved with the housing for such a location. Check the label on the inside of the fixture (magnifying glass and flashlight may be required) or check out the manufacturers website or product catalogue. You're looking for approved combinations of housing, trim, and lamp type and wattage for damp or wet locations. Use 410.4(D) as a guide for classifying the location around the shower stall.

- 30) The requirement calls for disconnection of all "electronic equipment" in the IT room. Is it a reasonable interpretation to allow fluorescent lighting with electronic ballasts to remain connected? If not, is it reasonable to allow unit equipment to provide emergency lighting in the room?

**ANS:** 645.10. The purpose of the disconnects in Article 645 is to minimize the spread of fire in the event of a catastrophe. IT equipment has come a long way in reducing the amount of power consumed. By disconnecting the power we could eliminate the ignition and by disconnecting the HVAC we could restrict the oxygen and minimize the spread of combustion and smoke. There is no mention about the lighting being disconnected and it would be nice to have the lights on to ensure egress. In looking at the scope of Article 645 there is no mention that lighting in the room would be part of the Information Technology equipment disconnected in accordance with the Article. The lights could and should remain energized

- 31) Can lugs for equipment grounding conductors be stacked on a stud?

**ANS:** Yes UL Cat. ZMVV: The UL White Book Category ZMVV indicates stacking of wire connectors may be permitted where mechanical interference is reduced or eliminated with the use of offset tangs, stacking adapters, and the like. The surface contact area of the mounting tang should make complete contact with the mounting surface or the previously stacked connector tang.

- 32) I have a question on the use of Type MC cable for the critical branch in a hospital. We are having a debate if it is legal to use per Art 517.30 (C) (3). That Article refers you to

517.13 (A) and from that you would gather it is acceptable as long as it is listed for redundant grounding. Can Hospital grade MC cable be used for Critical Branch in wall wiring methods on new construction?

**ANS:** No. It can be used if it is in compliance with 517.30(C)(3)(3)a., b., c., or d. Letter a states: where used in listed prefabricated medical headwalls. This would not be within walls of new construction. Letter b states: in listed office furnishings. This also would not be found within walls of new construction and would probably not be in a patient care area. Letter c states: where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage. Once again, not in the walls of new construction. Letter d states: where necessary for flexible connection to equipment. This would be used from some point at the wall to the equipment requiring flexibility and not in the wall of new construction. Therefore it would not be acceptable to use Hospital Grade MC cable for Critical Branch in wall wiring on new construction.

33) Is a QO Square D breaker ok to use as a dc disconnect for a platform lift?. Nothing on the breaker indicates it is ok for dc voltage, but the information supplied with the breaker indicates it may be used for dc voltage less than 48v. Does this sound ok?

**ANS:** The Underwriters White Book in DIVQ says, under Ratings; "A circuit breaker is marked AC or DC or both AC and DC,". Then going to the Marking Guide for Molded Case Circuit Breakers it says under Voltage Rating, "If the voltage rating does not include the words "ac" or "dc," the breaker is rated for both ac and dc voltages." This means, with an absence of marking on the breaker it is suitable for AC or DC use.

34) An elevator contractor installed a camera in an elevator and used Cat 5 wiring to connect it, wire-tying the Cat 5 to the traveling cable. Can Cat 5 be used in this way? If not, which cable from Table 400.4 would be used for this purpose? Can a light weight cable be wire-tied to a traveling cable?

**ANS:** No. NEC 620.11(B) states: Traveling cables used as flexible connections between the elevator or dumbwaiter car or counterweight and the raceway shall be of the types of elevator cable listed in Table 400.4 or other approved types. Note 5 following Table 400.4 says; 5. Elevator traveling cables for operating control and signal circuits shall contain nonmetallic fillers as necessary to maintain concentricity. Cables shall have steel supporting members as required for suspension by 620.41. In locations subject to excessive moisture or corrosive vapors or gases, supporting members of other materials shall be permitted. Where steel supporting members are used, they shall run straight through the center of the cable assembly and shall not be cabled with the copper strands of any conductor. In addition to conductors used for control and signaling circuits, Types E, EO, ETP, and ETT elevator cables shall be permitted to incorporate in the construction one or more 20 AWG telephone conductor pairs, one or more coaxial cables, or one or more optical fibers. The 20 AWG conductor pairs shall be permitted to be covered with suitable shielding for telephone, audio, or higher frequency communications circuits; the coaxial cables consist of a center conductor, insulation, and shield for use in video or other radio frequency communications circuits. The optical fiber shall be suitably covered with flame-retardant thermoplastic. The insulation of the conductors shall be rubber or thermoplastic of thickness not less than specified for the other conductors of the particular type of cable. Metallic shields shall have their own protective covering. Where used, these components shall be permitted to be incorporated in any layer of the cable assembly but shall not run straight through the center. The cable for the camera would have to be built into the Type E, EO, ETP, or ETT elevator cable to comply. Field installing a Cat 5 cable onto an elevator traveling cable would not be acceptable.

35) Section 645.5(D)(5) of the NEC allows types of non-plenum cable to be used in the under floor area as long as the room is designed to meet the special requirement listed in Section 645.4. IBC Mechanical Code Chapter 6 article 602.2.1 prohibits the use of non-plenum cable in a plenum. Is there any exception or condition you can think of in the IBC to justify the use of non-plenum cable in the under floor space of an NEC Article 645 room? While the NEC has a less restrictive set of requirements for an information technology room, we have to follow the requirements of the International Mechanical Code (IMC) as adopted in the State Building Code.

**ANS:** The 2006 International Mechanical Code section 602.2.1.1 requires that materials exposed within plenum be noncombustible or have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84. Acceptable wiring in a plenum is specifically addressed under 602.2.1.1, with exceptions specifically addressed. If indeed the room complies with all the requirements (many pick and choose but do not follow all) of Article 645 of the National Electrical Code (NEC), the simple fix would be to bring the return air duct(s) to the floor level. If this is done, the space below the floor is no longer a plenum in accordance with the IMC and the installation of equipment and cables could follow the NEC.

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

**ANS:** Yes, meter sockets and meter pedestals are required by the 2005 NEC to comply with fault current withstand ratings in accordance with Section 110.10. There is an effort to exempt meter sockets and meter pedestals from this requirement in the 2008 version of COMM 16 and so far the proposed 16.110 will not allow an exception for these items.

37) Section 690.4(B) on Solar Photovoltaic Systems, talks about “other systems” not being allowed in the same raceway. The question is whether or not a 120vAC feed from the house for the “tracking motor” of the array can be in the same raceway as the 360vDC from the panels to the house? Is this part of the “system”? Some thought the system to be only the ‘DC voltage side’ and others thought anything to do with the ‘Project’ would apply.

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

38) Do you have anything in the works to cover electrical inspection of commercial buildings? Is there ever going to be a "Home Safety Act" for commercial businesses? In a town that we serve, the commercial electrical inspector left and we were told by the Town to go back to accepting affidavits from the electrician for commercial buildings. My response to our manager was to accept the affidavit. I also told him to check the local ordinance. If it required inspections on commercial buildings we would need something from someone high up in the Town letting us know the ordinance is

being overridden. What would you suggest from the perspective of the Dept of Commerce?

**ANS:** I can see the department eventually going to complete inspection for commercial buildings similar to the UDC program. Right now it is "on the books" to take place in 2010, if acceptable language and structure is written by the Department of Commerce. Unfortunately it does not exist at this time and in a municipality that does not provide the commercial inspection an affidavit would be required. You are correct in that if a local ordinance provides for inspection the municipality should provide the inspection or rescind the ordinance that says they provide commercial inspection.

- 39) Do cable tray cables for use in a class 1 Div. 2 location need to have that listing on the cable itself? We have cables from different manufactures that in their data sheets or specification sheets indicate that the cable is for use in Class 1 Div 2 locations. The cable itself does not have that wording on it. I am going to try the manufactures for more information. But the question is are the cables required to have the listing for class 1 Div 2 on the cable or does the data sheet meet the requirement of the code?

**ANS:** The only tray cable for use in a Class 1 Division 2 area that I can find in the NEC is instrumentation tray cable (ITC-HL) per 501.10(A)(1)(d), 501.(B)(1)(5), 727.4(3), power-limited tray cable (PLTC) per 501.10(B)(1)(4), and 725.61(D). If you are installing PLTC or ITC-HL then 725.82(L), 727.7, 310.11(A)(2), and 310.11(B)(1)&(5) require the PLTC, or ITC-HL respective marking every 24" min. on the cable jackets (as does UL). According to the UL White Book both cable types are listed with gas/vapor tight sheathes but they are not evaluated for transmission of gases or vapors through the core (meaning seals are required to be poured with the sheathing removed). It may be that the cables need to be listed to be able to have the proper marking on the product but, listed or not the NEC requires the marking on the cables.

- 40) We have a homeowner who sub contracted his own well guy. They decided to install a 240 volt 3 h/p motor and the owner "forgot" to tell us. The problem is the well guy ran a 12-2 from the well head to the house. ( He states he dropped a #8 down the well to the pump but we have not yet been able to verify that ). The pump is drawing 22 amps, as the well itself is 300 feet deep, the run from the well head is 100 feet, and then another 75 feet from where it enters the dwelling to the breaker box. So we have a situation where there is a total of 175 feet where a #12 wire is installed feeding this pump. Can we install a 25 amp breaker on this? Are we allowed to install a 30 ampere breaker? We told our builder the well wiring should\_ have been run in a #10. Of course, the well guy says otherwise and insists that using the motor tables we can up size the over current protection.

**ANS:** You are dealing with a motor, my guess 3 horsepower single-phase? Based on Table 430.248 the FLA is 17 and given the distance the voltage drop probably gets the 22 amps you are measuring. Let's start with the 17 amps. Section 240.4 (G) deals with overcurrent protection and sends us to Article 430 for motors. Part IV says we can provide protection in accordance with the Table 430.52 and given a circuit breaker this allows up to 250% of the FLA or  $17 \times 2.5 = 42.5$  Amperes which cannot be exceeded. This indicates that we could use a 40 Ampere breaker. Let's go back to the conductor in Section 430.22 where the ampacity shall be not less than 125% of the FLA.  $17 \times 1.25 = 21.25$  Amperes. From here we go back to the ampacity table in 310.16 and we need a conductor that is capable of carrying 21.25 Amperes indefinitely. A #12 conductor is good for 25 Amperes at 75 Deg C which meets all of our criteria. Yes a 25 Ampere circuit breaker is acceptable. You could go as high as 40 Amperes. I agree with you that a #10 conductor would be more appropriate but the #12 is legal. The voltage drop can be calculated based on conductor lengths and the FLA of the motor.

41) I'm working on a new building on a hospital campus here in Madison and had a question for you on NEC section 230.6. We're feeding the new building from the existing hospital physical plant. The feeders are being run underground from the physical plant (about a block away) and into the lower level of the new building. The feeders then run for some distance across the ceiling of the lower level inside the new building prior to reaching the main electrical room, and the disconnecting means. To keep the conductors "outside" the building for the run across the lower level, would 4 layers of 1/2" cement board (Durock) be acceptable to meet the 2" concrete/brick requirement of section 230.6(2)?

**ANS:** There is no provision to accept multiple layers of drywall as meeting the requirement of NEC 230.6 for conductors to be considered outside of the building.. A two-inch layer of concrete is expressly required. If the raceways were encased in the floor with two inches minimum of concrete above and below them, the installation would meet the requirements of 230.6. A disconnect at the point of entry in accordance with NEC 225.32 and Comm 16.24 (4) would also meet the requirement. A petition for equivalency is required.

42) Wis. Stat 101.865 says that a power company, need a certificate of inspection prior to energizing a service if there is an inspector to inspect. The Home Safety Act changed the law to say that there will always be an inspector available for one and two family dwellings. My question is; how do we know that the inspection was performed by an inspector that was qualified enough to provide a valid certificate?

**ANS:** Comm. 5 says that anyone doing inspections, to ensure that the requirements for one and two family dwellings in Comm. 16 are being met, must be certified as a UDC-Electrical Inspector.

43) Could you advise me on the proper mounting height for electrical panels where accessibility may be required?

**ANS:** Accessibility for this issue is addressed in the IBC. COMM 62.1101(1) states: Type A and Type B Units. (a) *Circuit breakers*. Circuit breakers, when provided for tenants in occupancies with dwelling and sleeping units, shall comply with ICC/ANSI A117.1 section 309.2 and 309.3. Section 309.2 requires a clear floor space complying with Section 305 of A117.1 shall be provided. 309.3 requires that operable parts shall be placed within one or more of the reach ranges specified in Section 308. Section 308 is divided into 2 sections – Forward Reach and Side Reach. 308.2.1 - Where a forward reach is unobstructed, the high forward reach shall be 48 inches maximum and the low forward reach shall be 15 inches minimum above the floor. 308.2.2 addresses obstructed reach range. NEC 110.26 would not permit an obstruction in front of an electrical panel. 308.3.1 – Where a clear floor space allows a parallel approach to an element and the side reach is unobstructed, the high side reach shall be 48 inches maximum and the low side reach shall be 15 inches minimum above the floor. Therefore circuit breaker heights for Type A and Type B units would be required to be installed between 15 and 48 inches above the floor. Type A and B units are covered in COMM 62.1101.1 of the IBC, which refers to Chapter 10 of ANSI A117.1 standards. This chapter covers 20 pages in the book. I will not go through it here. Have your architect or building inspector designate which units are required to be accessible and install the panels accordingly.

44) When does the State of Wisconsin formally adopt the 2008 NEC? Also what is the correct course of action for those projects that are being designed when Wisconsin does adopt the new code? Is there a cutoff date that determines which projects will be

required to meet the new code?

**ANS:** The 2005 NEC took effect September 1, 2005. It is anticipated the 2008 NEC will be effective January 1, 2009. The code in effect is generally applied on the date of plan receipt for approval (State) or on the date the electrical permit is taken out (local). If a project is under design it would be subject to the new code until a plan submittal or permit is dated.

- 45) We have a job, that we used PVC schedule 40 inside of a heated building for a processing plant. The area is a shirt sleeve environment. They make a type of soap for the dairy industry. The PVC is mounted on Unistrut with fittings that allow movement. All of the boxes are fed by a short, 50 ft. or less length of conduit and then there is an elbow. The maximum size of the conduit is 1 in. and 90 percent is ¾ inch diameter. The City inspector is saying that I need to put expansion fittings between the elbows and between elbows and boxes. I am saying that the elbows will bend and take up the expansion of the conduit in this area.

**ANS:** The use of expansion fittings on PVC raceways in the interior of a heated building is not common. The building code would require a minimum interior temperature of 60 degrees and then the summer temperature while not regulated may be 85 to 90 degrees Fahrenheit. Section 352.44 of the NEC requires "Expansion fittings for RNC to compensate for thermal expansion and contraction where the length change in accordance with Table 352.44 (A) is expected to be 1/4 inch or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations." Given the interior temperature differential of 25 degrees, using the Table values, a length of 50 feet could be expected to expand or contract about 1/2 inch. A good design with elbows and appropriate clamps would eliminate the need for expansion fittings on all but the largest runs. Based on Table 352.44 (A), a 5 foot section would expand or contract about 1/16 of an inch or 1/20 inches [(1.01 inch/100 feet) times 5 feet] with a 30 degree temperature differential. With thermal expansion it is common to install expansion joints for outdoor installations where the temperature differential is expected to exceed 100 degrees. The commentary in the NEC Handbook states, "Expansion fittings are generally provided in exposed runs of rigid nonmetallic conduit where (1) the run is long, (2) the run is subject to large temperature variations during or after installation or (3) expansion and contraction measures are provided for in the building or other structure." Layout of the PVC installation to allow for movement should eliminate expansion issues in all but the longest runs. The diameter of the raceway does not enter into expansion calculations. While the diameter will expand the expansion is small and only the length is affected.

- 46) Will the department accept the building steel in the penthouse of a high rise Type I building as a concrete encased electrode? We have no reason to believe that it is not an effective ground. Others have used it in the past. We have measured the resistance through the steel from the penthouse to the main building ground and found it has zero Ohms of resistance.

**ANS:** Your question involves the use of building steel in a high-rise reinforced concrete construction as a grounding electrode meeting the requirements of Section 250.52 of the NEC. Paragraph (2) of this section recognizes the structural steel of a building as meeting the requirements as a grounding electrode and grounding electrode conductor. Paragraph (3) describes a concrete encased electrode and requires that the electrode itself is 20 feet of 1/2 inch or larger diameter reinforcing steel embedded in the concrete near the bottom of the foundation or footing. The correct application in your case is Paragraph (3) with a concrete encased electrode that is comprised of the reinforcing steel of the poured concrete building. You indicated that others (previous

installers of electrical systems) have used the building steel as an electrode. You measured the resistance of the building steel and found that it is zero ohms from the penthouse to the main building grounding electrode in the basement. You indicated that the structural steel in the penthouse is bonded to the building reinforcing steel and comprises a grounding electrode system. In effect you are dealing with a concrete encased electrode that spans the height of the building. You ask if the department will accept this as a grounding electrode for the building. The answer is yes, concrete encased electrodes are recognized by the NEC and are actually a grounding electrode system that is reliable to the point that a supplemental electrode is not required.

- 47) I am sending some attachments of a product that is available to transition HDPE to PVC. There are also other manufacturers of a similar product I understand that this product is not UL listed, but to my understanding neither is PVC glue. We feel that this provides a stronger bond than the UL listed coupling manufactured for this purpose. What we are requesting is that you please take a look at the product spec sheets, areas and Companies that have approved this product, and let us know if the State of Wisconsin would approve its use. We have some future projects that we would like to use this method of transitioning HDPE to PVC pending your approval.

**ANS:** Section 353.48 on HDPE in the NEC requires all joints between lengths of conduit, and between conduit and couplings, fittings, and boxes shall be made by an approved method. There are listed approved methods available. While the department can approve other methods, in doing so we would ask for a listing by a Nationally Recognized Testing Laboratory. (NRTL). Since there are listed/approved methods available they are the methods that are approved and should be used for joints in HDPE or between PVC and HDPE. Use of the epoxy would be on a test basis.

- 48) A customer of ours is interested in combining two meters on their facility into one meter directly at our transformer. When we combine these meters ownership of the services feeding the buildings will be passed to him. Do we need to install a main disconnect before the service branches to separate buildings?

**ANS:** I will restate my understanding of the question and the answer provided. A utility meter will be placed at the utility transformer. There are two sets of conductors originating at the transformer to supply two separate buildings. Ownership of these conductors will be passed to the customer. Is a main disconnect required before these conductors branch to their respective buildings? The answer is no, a main disconnect is not required. The conductors are outside and a disconnect is required when they enter a building. The concern I would raise with the electrical code is the size of the conductors. Section 230.90 of the NEC requires that each ungrounded service conductor shall have overload protection and such protection shall be provided by an overcurrent device in series with each ungrounded conductor that has a rating or setting not higher than the allowable ampacity of the conductor. Utility conductors are generally sized smaller for a given ampacity than that allowed by the NEC. Comm 15.25(5) {2005 NEC} requires a disconnecting means at the point where the utility ends and "premises wiring extends overhead or underground to more than one building or structure." Note this will be renumbered as Comm 16.230(4) for the 2008 NEC.

- 49) We are currently working on an existing vehicle maintenance facility. I realize that there are special provisions in the code that deal with these particular types of buildings; however our particular building has a designated welding room, (arc welding, TIG welding, oxy-acetylene, etc...) and a paint storage/mixing room (for vehicle body work). Should these spaces be listed as Class 1, Div 1 spaces? The

existing equipment within these spaces are not listed for this type of classification. How would you recommend we proceed?

**ANS:** You indicate the building is a vehicle maintenance facility or per the National Electrical Code and Article 511 Commercial Garage, Repair and Storage. The Article provides the classification for the facility as well as requirements for the areas above the classified location. The painting area I am assuming is an open spray painting area and would be classified in accordance with Article 516, Spray Application, Dipping, and Coating Processes (see Figure 516.3(B)(1)). The use of welders in the repair facility is of some concern. They would not be used near the spray area and unless rated for use in a classified location the electric welder must be located above the 18 inch from the floor classified area of the repair facility. Oxy-acetylene cutting and welding would normally be accomplished in the repair facility, with care exercised in the use of an open flame. Based on Article 511 there may be Class I, Division 1 locations but it is more likely there is Class I, Division 2 locations which extend 18 inches from the floor or ceiling depending on the type of vehicle fuels. The Class 1, Division 2 extends throughout the building except for unpierced walls or 18 inch changes in elevation. Doors do not restrict the classified area.

- 50) Could you please let me know when the state code first prohibited the placement of EMT in the earth or in concrete in contact with the earth? I will pass the information on to the local inspector that requested it.

**ANS:** Effective with the State of Wisconsin's adoption of the 1981 NEC.

- 51) A commercial customer has a backup generator that is mounted 8'8" from the 3 phase transformer. They were told by a crane operator that the uniform building code says that it has to be 20' away, is that true? Is there a distance that the generator needs to be away from the transformer? Would they be okay if they built a block wall between them?

**ANS:** There is a requirement in Comm 16, the State Electrical Code, for generators used for emergency or legally required power that they be 20 feet from a transformer or normal power distribution equipment. Comm 16.45(2) and 16.48(1) are the Sections. I am not aware of a building code requirement but in Wisconsin it is in the Electrical Code. Note that the rules apply to generators used for emergency and legally required power. They do not affect generators used for optional standby power only. This distance may be reduced by a properly sized and properly installed barrier as listed in these code sections. The renumbered Comm 16 for the 2008 NEC renumbers these to 16.700(2) & 16.701(1) respectively.

- 52) I am installing transfer switches and would like to know when a 3 pole switch is required and when is a 4 pole required?

**ANS:** By someone's design, you have to decide whether or not the power source is a separately derived system or not. When using a separately derived system, you must use a 3-pole transfer switch for a single-phase, 3-wire system and a 4-pole transfer switch for a 3-phase, 4-wire system. A 4-pole switch opens the grounded (neutral) conductor.

- 53) In a dwelling unit, what are the receptacle requirements for island counter tops?

**ANS:** In dwelling unit kitchens, at least one receptacle outlet must be installed at each island countertop space with a long dimension of 2 feet or greater, and a short dimension of 1 foot or greater. When breaks occur in countertop spaces for appliances, sinks, etc., and the width of the counter space behind the appliance or sink is less than 1 foot, each countertop space is considered as a separate island for determining receptacle

placement [210.52(C)(2), and (4)]. The receptacle outlet for the island countertop space can be installed below the countertop where no wall space or backsplash is available, as long as the required receptacle(s) is located no more than 1 foot below the countertop surface and no more than 6 inches from the counter's edge, measured horizontally [210.52(C)(5) Ex].

- 54) There is a requirement limiting the number of disconnects to six for Services. Article 230.71(A)-says "(s)hall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard." Do you know when this first appeared in the NEC? Why is it limited to six? t.  
**ANS:** The six disconnect requirement was a compromise in determining the time required and permitted to completely disconnect the service equipment from the service if necessary when a problem occurs requiring complete de-energizing of the premises wiring. There was some disagreement regarding two or three single pole devices used on multi-wire installations and the words - to disconnect all conductors of the service with no more than six operations of the hand was added. Ray Mullin of Ray Mullin Books has it in the 1947 NEC.230.71(A)
- 55) Can a feeder run through the basement of the first unit in a duplex to the second unit?  
**ANS:** Yes, other than for service conductors as shown in 230.3, I don't know of any NEC requirements that would prohibit this.
- 56) Is there anything in the code that would prevent you from putting a panelboard in a bedroom?  
**ANS:** There is no prohibition to installing this panel in a bedroom, but it must follow the requirements of 240.24. If the panel is part of the service disconnecting means, it must be installed at a readily-accessible location nearest the point of entrance of the service conductors in accordance with 230.70. Also it may not be installed in a clothes closet per 240.4(C).
- 57) Can a meter base be closer than 3 ft. to a window? Our Utility says the meter base must be three feet from a window. I cannot find it in the code.  
**ANS:** The meter base is under the jurisdiction of the utility and their rules must be followed if you wish to have electrical service. The NEC does not prohibit this.
- 58) When installing a high-impedance grounded neutral system for a 480V, 3-phase electrical system, the following question arises. Where is the proper location for the grounding impedance (resistor)?  
**ANS:** As per 250.36(A), "The grounding impedance shall be installed between the grounding electrode conductor and the system neutral. Where a neutral is not available, the grounding impedance shall be installed between the grounding electrode conductor and the neutral derived from a grounding transformer."
- 59) When a lighting and appliance panelboard is fed from the secondary of a 3-phase transformer, is the panelboard required to have a main breaker installed in it?  
**ANS:** No. Lighting and appliance branch-circuit panelboards supplied from a transformer, as permitted in 240.21(C), must have overcurrent protection for the panelboard on the secondary side of the transformer. The required overcurrent protection can be in a separate enclosure ahead of the panelboard, or it can be in the panelboard [408.36(A), 408.36(A) Ex. 1, and 408.36(D)]. *Exception:* A panelboard supplied by a 2-wire system or a 3-wire, delta/delta-connected, 3-phase system, is

considered protected by the primary protection device when installed in accordance with 240.4(F) and 240.21(C)(1). *Note:* A lighting and appliance branch-circuit panelboard is one with more than 10% of its overcurrent protection devices protecting “lighting and appliance branch circuits,” which are 30A or less circuits with neutral connections [408.34(A)].

- 60) Is GFCI protection for personnel required for sump pumps and sewage ejector pumps located outdoors as part of an installation at a dwelling. Some inspectors say GFCI protection is not required, because of possible nuisance tripping and the damage such an incident could pose. Section 210.8(A) requires GFCI protection for personnel for all 125-volt, single-phase, 15- and 20-ampere receptacles in location specified in (1) through (8). This includes (3) for Outdoors. Does the NEC require GFCI protection for receptacles (for cord-and-plug connected pumps) or for breakers serving sump pumps and sewage ejector pumps located Outdoors? If the answer is NO, what is the Code justification for the answer?

**ANS:** Yes GFCI protection is required if these assemblies are not part of a “private sewage system”. Comm 16.28 (see proposed Comm 16.300(1) NEC 2008) allows a single recep (non duplex) “located at the pump chamber that has an alarm or pump connected to it” without GFCI protection.

- 61) Does the exception to 210.11(C)(3) in NEC 2002 allow for the required bathroom 20 Amp receptacle circuit, to also supply lighting and fans as the “outlets for other equipment”, if the circuit only supplies that bathroom?

**ANS:** Yes, the 20-ampere receptacle circuit can supply outlets for other equipment within the same bathroom but the requirements of 210.23(A)(1) & (A)(2) must be followed regarding the rating of utilization equipment supplied.

- 62) I have a situation where I am required to terminate a #4 AWG THHN to a 20-amp single pole circuit breaker. The maximum size conductor for my breaker is #8 AWG wire. The reason for my #4 AWG is voltage drop. My question is... does the NEC address how this situation would be handled. My only thought would be to terminate the largest size wire possible at the breaker and then connect that to the #4 AWG wire.

**ANS:** YES. I believe you have the correct solution. Use a short length of #8 AWG terminated in the breaker, then splice it to the #4 AWG. The 8 AWG and the #4 AWG conductors would be in series... so, if you ran a voltage drop calculation for one foot of #8 AWG, it would not have much effect on your voltage drop calculations. NEC 312.8 permits this splice.

- 63) What is the minimum size and metal thickness required for a junction box constructed of sheet steel, with one 4-inch RMC conduit (per wall) connected on opposite walls of the box (i.e., directly across from one another)? The conductors within the raceways are 600kcmil type XHHW. The outer diameter (O.D.) of each of these insulated conductors is 1.2 inches.

**ANS:** As per 314.28(A)(1), the length of the box shall not be less than eight times the metric designator of the largest raceway. Therefore, the calculation is as follows: (4-inch trade size diameter) x (8) = 32 inches. As per 314.40(C), metal boxes constructed of sheet steel more than 1,650 cubic centimeters (100 cubic inches) in size shall not have an uncoated metal thickness of less than 1.35 millimeters (0.053 inches).

- 64) Can I install conductors from different panels in the same raceway?

**ANS:** YES. Power conductors can occupy the same raceway, cable, or enclosure if all conductors have an insulation voltage rating not less than the maximum circuit voltage

[300.3(C)(1)]. However, the life safety branch and critical branch of the emergency system must not enter the same raceways, boxes, or cabinets with each other or other wiring. In addition, all wiring to emergency loads must be kept entirely independent of all other wiring, except as permitted in 700.9(B).

- 65) Please explain 230.40 Exception No 1? This exception is being used to install up to 6 means of disconnect per occupancy. A single building or structure could have many units, commercial or residential of one or multiple levels. Please give me your take on this. If this rule is not changed we will see some of the most unsafe structures. I thought this rule was intended to protect those persons who needed to shut off power in a structure. In the future some buildings using this rule could be in trouble to turn off power by use of the main disconnect as each would be in a different occupancy.  
**ANS:** this requirement was put into the NEC in the 1984 edition. Sufficient substantiation was presented to convince the Code-Making Panel to accept the proposal. Apparently there have been no problems that have been brought to the attention of the NEC and the requirement remains. I don't see a problem other than what you mention about a disconnecting means as being only in the occupancy itself. However, if a problem occurs in the occupancy, the occupant can turn it off. NEC 230-72(A) requires these disconnects in each occupancy to be grouped.
- 66) A contractor installed a 2,000A, 480V, 3-phase feeder in six separate raceways, consisting of a total of six 500 kcmil XHHW insulated conductors per phase. Four of the raceways are 3-inch trade size EMT. The other two raceways are 3½-inch RMC. All conductors are exactly the same length, per paralleled phase, and feature the same insulation type and conductor material. In addition, all are terminated in the same manner and have the same cross-sectional area. The inspector has turned this installation down. What could possibility make this installation non-Code compliant?  
**ANS:** This is not code compliant. Where run in separate raceways or cables, the raceways or cables shall have the same physical characteristics (i.e., same type conduit) [310.4]. In addition, the installation shall meet these five requirements: All conductors shall be exactly the same length per paralleled phase. All conductors shall have the same insulation type. All conductors shall be made of the same material. All conductors shall have the same cross-sectional area. All conductors shall be terminated in the same manner.
- 67) Can I connect a range hood in a dwelling unit kitchen to the small appliance circuit?  
**ANS:** No. The 20A, 120V small-appliance circuit is only permitted to supply the receptacle outlets as per 210.52(B) [210.11(C)(1)]. However, range hoods can be hardwired to a 15A or 20A, 120V circuit, unless the instructions state otherwise. Cord-and-plug connected range hoods must be supplied by an individual 15A or 20A, 120V branch circuit in accordance with the equipment instructions [422.16(B)(4) & (5)].
- 68) I'm checking out a job where the TV cable installer ran all the coaxial cables to a spot in the attic near the retractable ladder, made up his connections, and dropped the cables into the insulation. Isn't there a Code requirement that cable TV equipment such as the amplifier and splitters should be permanently mounted?  
**ANS:** There are Code requirements relating to these installations. NEC 820.24 Mechanical Execution of Work requires the installation to be in a neat and workmanlike manner and the cables to be properly secured in accordance with NEC 300.4(D) and 300.11. Amplifiers and splitters have mounting lugs as part of the equipment and should be used in accordance with NEC 110.3(B). NEC 800.24, 820.24, and 830.24 are all explicit requirements for Mechanical Execution of Work.

- 69) Can I use a 400-ampere breaker to protect paralleled 4/0 aluminum XHHW-2 conductors. according to Table 310.16,?
- ANS:** Yes. Conductors identified with the suffix "2" are rated 90 degrees C for wet, damp, or dry locations. However the 90 degree C rating can only be used where the conductor terminals are also rated 90 degree C. As far as I know, no panelboards come with 90 degree C terminals. Thus, the use of the 75 degree C ampacity column is the proper way to go in accordance with Table 310.16. As this column indicates XHHW is rated at 180 amps @ 75 degrees C, two paralleled would be 360 amps. As long as the load on this circuit is 360 amps or less, this circuit may be protected by a 400 amp circuit breaker per 240.4(B).
- 70) I have parallel 4/0 AWG XHHW-2 AL conductors using 2 conduits with no more than 3 conductors in each raceway. My position is that the ampacity equals 360 amperes and that I can use a 400-ampere breaker as per 240.6. Am I reading this wrong?
- ANS:** Yes. You are paralleling two 4/0 AWG AL conductors. Table 310.16 shows 4/0 AWG XHHW AL conductors to have an ampacity of 180 amperes. So yes, you have an ampacity of 360 amperes and 240.4(B) permits the next higher standard overcurrent device to be used. According to 240.6(A) that would be a 400-ampere rated device unless prohibited such as for tap or transformer secondary conductors in Section 240.21(B) and (C).
- 71) Can I secure signal or communications cables to ceiling-support wires or ceiling grid?
- ANS:** No. Ceiling-support wires and ceiling grids are not permitted to support raceways and cables. In this situation, you must provide independent support wires secured at both ends for this purpose in accordance with 300.11(A) [800.24].
- 72) In general, a disconnecting means is required for each sign and outline lighting system or feeder circuit and branch circuit supplying a sign or outline lighting system per 600.6. When is a disconnecting means not required per 600.6?
- ANS:** Exception No. 1 and Exception No. 2 of 600.6 permit the disconnecting means to be omitted. [exit directional sign and cord connected sign]
- 73) When does the derating Table 310.15(B)(2)(a) apply to feeders originating in a 4000A, 480V, 3-phase 4-wire switchboard in a large commercial installation. Section 310(15)(B)(4)(a) says the neutral isn't counted if it only carries the unbalanced loads, so derating is not necessary. However, section 310(15)(B)(4)(c) considers the neutral a current carrying conductor when the majority of the load is non-linear. How is this calculated?
- ANS:** Electronic equipment, electric discharge lighting, and adjustable speed drive systems are nonlinear loads. Nonlinear loads are defined as loads where the wave shape of the steady-state current does not follow the wave shape of the applied voltage. Nonlinear loads are a major cause of harmonic currents and result in heating of the neutral conductor. This is calculated as a fully loaded neutral and adds to on conduit for derating as a current carrying conductor.
- 74) The way I read 314.17(C) Exception, when using a single gang non-metallic box, you need to support the NM cable within 8 inches from the box if there's no cable connector at the box. Most of the boxes that I use have the plastic tabs inside the box that are pressed down when inserting the cable. For the purposes of the NEC, is this considered a cable connector? If this tab is accidentally broken off, then does it fall under this exception? If so, then when you break a tab off a double gang box or larger you either

need to replace the box or provide a connecting means at the box.

**ANS:** Yes, the tab is an acceptable means of securing the cable to a box. The tab isn't required where the exception is being used only for a single gang box. If the tab is broken off on two (or more) gang boxes, then you must secure the cable to the box in some other way to comply with 314.17(C) as all permitted wiring methods have to be secured to the box. The broken clamp then may violate the listing of the box, and the box would need to be replaced. See also UL White Book under QCMZ.

75) Can a 2-pole snap switch be used to switch a 277V and 120V circuit?

**ANS:** No. A multi-pole, general-use snap switch is not permitted to be fed by more than a single circuit unless the switch is listed and marked as a 2-circuit or 3-circuit switch, or the voltage rating of the switch is not less than the nominal line-to-line voltage of the two circuits supplying the switch. See UL White Book under WJQR.

76) I'm an electrical inspector in a large chemical plant. During a routine safety audit in one of the company office buildings, a 120/208-volt lighting distribution panel was inspected. Upon opening the hinged door, we discovered that several of the 20-amp single-pole breakers had been locked in the "ON" position, using a device which physically prevents the breaker from being switched OFF. The circuits feed a communications hub for the building, so it is understandable that the breakers shouldn't be turned off. However, we feel that this creates an unsafe condition in that they could not be de-energized quickly in case of a fire or other emergency. Is this a Code or safety violation? And would the breaker trip if it became overloaded?

**ANS:** The use of breaker locks is not a Code violation. The breaker lock won't prevent the circuit breaker from opening internally and de-energizing the circuit. Molded case circuit breakers use a "trip free" design, meaning that the relay inside the breaker reacts automatically to the thermal-magnetic conditions that cause a trip, even if the operating handle is locked in the ON position.

77) My question concerns second-level GFPE protection for feeders per 517.17. We are designing an eye clinic that has 3 operating rooms for Lasik procedures that require only a local anesthetic. There is no general anesthesia and patients are capable of self preservation; (517.2 Ambulatory Health Care Facility). The building is multiple-occupancy. It has a 1600 amp 277/480 volt service with GFPE. We are installing a 100 kW generator for the essential electrical system requirements of NFPA 99. We were going to use the existing panelboards for the normal power system. The new space does not have a critical care area, or life support equipment as mentioned in the NEC Handbook. Do either of these require the second level GFPE? My interpretation is that isn't required, in this case.

**ANS:** No, I don't believe your installation falls under the requirements of 517.17(A) applicability where a second level of ground-fault protection is required by the NEC. However, please note that NEC requirements are minimums that provide adequate safety while not necessarily providing an installation that is convenient, efficient or adequate for good service. GFPE is only required where the health care facility governing authority has classified the area as critical care or life support.

78) Where a transient voltage surge suppressor (TVSS) is installed what kind of requirements are placed on the installation?

**ANS:** See Sections 285.1, 285.3, 285.5, and 285.6 of the NEC. The rating of the TVSS shall be equal to or greater than the maximum continuous phase-to-ground power frequency voltage available at the point of application. TVSS shall be a listed device. TVSS shall be marked with short circuit current rating and shall not be installed at a

point on the system where the available fault current is in excess of that rating. TVSS shall not be installed on ungrounded systems, impedance grounded systems, or corner grounded delta systems unless listed specifically for use on these systems. All are these are requirements of a TVSS installation.

79) Can a circuit breaker be used to switch fluorescent lighting?

**ANS:** Yes, but the circuit breakers must be listed and marked SWD or HID. NEC 404.7, 404.11, 240.81 & 240.83. High-intensity discharge (HID) lighting can be switched only by circuit breakers marked HID in accordance with Section 240.83(D) of the NEC.

80) I can't find the code section for a max of one neutral conductor under one screw at the neutral bus in the panel.

**ANS:** NEC 110.14(A) and 408.41 One conductor per terminal unless terminal is specifically listed for more than one. Panelboard manufacturers also indicate this on one of the labels supplied with the assembly.

81) Where can we find a code section that prohibits the attachment of a male plug on the end of a section of NM for a garbage disposal. I have a reference site that points to Table 400.4 which doesn't list NM. Or would it be Article 334 - "closely follow the building surface, "securing and supporting"?"

**ANS:** You cannot find a code section that allows it, so you may not do so. Section 400.4 says flexible cords and cables, then go to 400.7, uses permitted and 400.7 (B) permits the use of attachment plugs but there is no listing for permanently installed wiring such as NM cable in Article 400.

82) I have a question regarding a bus cover building we will be wiring soon for the local School District. It is a three sided building with a roof, sort of like a lean-to. The back wall and the two end walls are poured concrete. There is no front wall. It will be used to store busses. Would we have to follow the code requirements in Article 511?

**ANS:** No, see Article 511. If you look at the scope of Article 511, parking garages do not fit since service and repair is not going on. The buses are probably all diesel and then 511 does not apply. If there is any doubt it sounds like the building is storage only and there would be no classified area based on 511.3. If you install receptacles they need to be GFCI protected or installed for block heaters per Comm 16.

83) I used Flexible Metal Conduit to connect to a sign outdoors in front of a shop and I'm being told I can't use Flexible Metal Conduit outdoors. Is this Correct? I am using THWN wire, which is good for wet locations.

**ANS:** Yes prior to the adoption of the 2008 NEC. No after words. There has been a change to 348.12(1) which permitted the installation of flexible metal conduit in wet locations where the conductors were approved for the specific conditions and where liquids are not likely to enter the raceway or enclosures to which the raceway is connected. This change in the 2008 NEC to 348.12(1) now specifically states that FMC shall not be used in wet locations.

84) Is a disconnect required at a detached residential garage or can I use the circuit breakers located in the panel in the house? I plan to run a hot, neutral and 2 travelers in a PVC conduit. The travelers are for an outside light at the garage door entrance. The hot will feed the 3-way at the house and at the garage will feed the single pole switch for the interior garage light, a receptacle and the garage door opener receptacle.

**ANS:** Yes. NEC 225.31 & 225.32 & also 225.30. 225.31 requires a disconnecting means be provided for disconnecting all ungrounded conductors that supply another structure on the same property and that is under single management. NEC 225.32 permits the disconnecting means to be installed either inside or outside the building and requires that it be at a readily accessible location nearest the point of entrance of the conductors. Your proposed installation does not incorporate a disconnecting means in accordance with 225.32. The only way to disconnect the circuit you are feeding the garage with is at the house panel. You must install a disconnecting means such as a snap switch at the garage to open the circuit you are using to feed the garage. Per 225.30 you must supply the three way circuit from the detached garage's portion of the circuit as you may not have more than one branch circuit in the garage unless it is part of a multiwire circuit as defined in 210.4.

85) I recently started working at a refinery. In their process, there are six emergency stop buttons used to shut down large heaters in the event of an emergency. They installed a cage over these buttons so they would not accidentally be activated. The cage does have hinges and can be moved quickly and you can put your hand underneath to activate an Emergency-stop. Is it allowable to obstruct E-stops in this way?

**ANS:** Yes, the NEC does not specifically cover the type of installation you are describing. From your description it appears that the design is sufficient to prevent hazards arising from the use of electricity.

86) If you connect the grounding electrode conductor to the street side of the water meter is it necessary to bond around the water meter?

**ANS:** Yes, 250.53(D). It is always necessary to bond around the water meter. If the grounding electrode conductor is connected to the street side of the water meter and the meter is removed you will lose the bonding connection to the interior water piping. NEC Section 250.53(D)(1) states - the bonding connection to interior piping shall not rely on water meters.

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

**ANS:** Yes 408.36(D). Plug-in circuit breakers that are back-fed from field-installed conductors must be secured in place by an additional fastener that requires other than a pull to release the breaker from the panelboard in accordance with Section 408.36(D) of the NEC.

88) What does duty rating mean on motors? How is continuous duty determined?

**ANS:** Duty rating is the length of time a motor can be operated without causing over-temperatures in the motor windings. A motor with a continuous duty rating can be run indefinitely at rated load without overheating. Several factors determine the duty rating of a motor, such as, type of motor enclosure and type of insulation. Section 430.22 of the NEC has information on duty ratings. See note: bottom of table 430.22(E) Any motor application shall be considered as continuous duty unless the nature of the apparatus it drives is such that the motor will not operate continuously with load under any condition of use.

89) Can a disconnect switch be located next to equipment installed above an accessible suspended ceiling, or must the switch be installed at a readily accessible location?

**ANS:** Yes, switches and circuit breakers used as switches can be mounted above 6 ft 7 inches, if they are installed next to the equipment they supply and are

accessible by portable means see Sections 240.24(A)(4) and 404.8(A) Exception No 2.

- 90) When installing wiring methods in ducts or plenums used for environmental air, which wiring methods are permitted?  
**ANS:** Metallic wiring methods without nonmetallic coverings. This correlates with the requirements of 300.21, which focuses on the topic of Spread of Fire or Products of Combustion. See 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),
- 91) I have an existing lab where gas tanks are drained for either engine replacement or fuel injector work. This lab falls under the definition of a major repair garage. The room apparently wasn't classified because of air exchanges. My concern is that there are cord reels and trouble lights both which extend into the hazardous area when the reels are extended. Do I need to treat these reels differently than I have in the past? If so, are there trouble lights that are safe to use in a Class 1 Division 2 location?  
**ANS:** Reference NEC Art 511.4(B)(2) Talks about Portable Lighting Equipment. Unless the and its cord are supported or arranged in such a manner that they cannot be used in the locations classified in 511.3, they shall be of a type identified for Class I, Division 1 locations. Also note: Comm 16.392 (2005) did not allow declassification of this area by virtue of ventilation. See proposed Comm 16.511 for 2008 NEC.
- 92) Does the NEC require a connection of a parking lot lighting pole to a ground rod?  
**ANS:** No, but metal poles used for the support of luminaires are required to be connected to an equipment grounding conductor of a type recognized in 250.118, sized in accordance to 250.122, and in accordance with Section 410.30(B)(5) of the NEC.
- 93) Can flexible metal conduit be used outdoors to supply AC units?  
**ANS:** a change in the 2008 NEC in 348.12(1) no longer permits FMC to be used in wet locations. Prior to the 2008 Code, FMC was permitted to be used where the conductors were approved for wet locations and the installation was such that water was not likely to enter the FMC. These requirements were difficult to enforce and the new rule will result in a more consistent judgment by the inspection authority.
- 94) Which methods of connecting grounding and bonding conductors to equipment are permitted by the NEC?  
**ANS:** Listed pressure connectors exothermic welding process thread-forming machine screws that engage not less than two threads in the enclosure  
250.8 Connection of Grounding and Bonding Equipment  
A) Permitted Methods. Grounding conductors and bonding jumpers shall be connected by one of the following means:  
(1) Listed pressure connectors  
(2) Terminal bars

- (3) Pressure connectors listed as grounding and bonding equipment
- (4) Exothermic welding process
- (5) Machine screw-type fasteners that engage not less than two threads or are secured with a nut
- (6) Thread-forming machine screws that engage not less than two threads in the enclosure
- (7) Connections that are part of a listed assembly
- (8) Other listed means

95) I know we must isolate the neutral conductor from the ground in a sub-panel but since they are both connected together at the main panel anyway I don't understand why. Could you clarify this?

**ANS:** If the neutral bar in any panel other than the main service panel is bonded to the panel enclosure this establishes a parallel path between the grounded (neutral) conductor and the grounding (equipment-grounding) conductor. This would result in some of the neutral current flowing in the equipment-grounding conductor and any electrically conductive material it is connected to. The equipment-grounding conductor may be a grounding conductor run in a cable with the circuit conductors or it may be a metal raceway enclosing the circuit conductors. Yes, the grounded (neutral) conductor and the equipment-grounding conductors are connected together at the main service panel or system panel where the neutral bar and the ground bar are connected together and bonded to the panel enclosure. This connection establishes the ground-fault path required by 250.4(A)(3, 4 & 5). This ground-fault path creates a circuit for the ground-fault current to return to the supply source and open the overcurrent protective device. Fault current will flow on all available paths. If parallel paths exist the fault current may not be enough to clear the overcurrent device.

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

**ANS:** Yes, NEC 250.122(B) requires that where ungrounded conductors are increased in size, equipment-grounding conductors must be increased in size proportionately according to the circular mil area of the ungrounded conductors. If the feeder conductors were increased from 1/0 AWG to 3/0 AWG the circular mil area 105600 of the 1/0 AWG would be increased to 167800 for the 3/0 AWG (See Table 8). Dividing 167800 by 105600 equals an increase of 1.589. The equipment-grounding conductor for a 150A feeder would be a 6 AWG, which has a circular mil area of 26240. Multiply the 26240 by 1.589 to increase the size proportionately to the increase in size of the ungrounded conductors and we find 41695 as the required circular mil area for the equipment-grounding conductor. Table 8 shows that a #4 AWG has a circular mil area of 41740 and should be used for the equipment-grounding conductor.

97) Are open bottom switchboards permitted by the NEC?

**ANS:** Yes, NEC 300.12 Exception 2 tells us that raceways installed in the bottom of open bottom switchboards shall not be required to be secured to the equipment.

98) Is there a limit to the number of nonmetallic sheathed cables that can be pulled through the same drilled or punched hole in a wooden joist?

**ANS:** No, but if the cables are bundled for more than 24 inches their ampacity must be adjusted in accordance with Section 310.15(B)(2)(a) of the NEC. Comm

16. does not require derating for the branch circuits serving an individual dwelling unit.

99) I had the range hood fed from one of the kitchen gfci circuits. Please give me the article in the NEC that prohibits this installation? The electrical inspector could not find it.

**ANS:** if you check Section 210.52(B)(2) titled No Other Outlets, it tells you that the two or more small-appliance branch-circuits specified in 210.52(B)(1) shall have no other outlets. This means you cannot use these circuits to supply any other utilization equipment (equipment that utilizes electric energy). There is an Exception No.2 to this section that reads: Receptacles installed to provide power for supplemental equipment and lighting on gas-fired ranges, ovens, or counter-mounted cooking units. A range hood is considered a fixed appliance. Therefore it is not permitted on the required kitchen appliance circuits.

100) Is a receptacle outlet required in a walk-in pantry consisting of only shelving?

**ANS:** Under the NEC 2005 and 2008 I could not find a code reference that required a receptacle outlet in a walk-in pantry. There is a requirement in 210.52 (B) that if a receptacle is placed in a pantry that the receptacle would have to be part of the small appliance branch circuit. A pantry would be treated similar to a closet. If there was counter space in the pantry, receptacles would be required, otherwise it is treated like a closet in that the NEC does not prohibit nor require receptacles. If a receptacle is installed it shall be on the one or more small appliance branch circuits serving the kitchen.

101) I have a lay-in ceiling in a family room in a residential basement. The space above the ceiling is used for environmental air. Can I use nonmetallic cable above this ceiling?

**ANS:** No, Type NM cable is not permitted to be used as a wiring method in a plenum ceiling. 300.22(B)

102) I have 3-#12 AWG THWN, 4-#10 AWG THW, and 8-#8 AWG THHN conductors. I plan to install them in EMT. What size EMT is required?

**ANS:** Each raceway article in indicates that the number of conductors shall not exceed that permitted based on the percentage of fill specified Table 1, Chapter 9. Table 1 shows that for over 2 conductors the percentage of fill permitted for all conductor types is 40 percent. Step 1. Use Table 5 for area of conductors: This table is based on conductor insulation and size. Find the table section that includes THWN, go down the left hand column to 12 AWG and move across the table to approximate area in square inches. Find .0133. Find the table section that includes THW, go down the left hand column to 10 AWG and move across the table to approximate square inches. Find .0243 Find the table section that includes THHN, go down the left hand column to 8 AWG and move across the table to approximate square inches. Find .0366 Step 2. Total the square inch areas:  $3 \text{ 12THWN } .0133 + 4 \text{ 10THW } .0243 + 8 \text{ 8THWN } .0366 = .2928 = .4299$   
Step 3. Use Table 4 for areas of conduit permitted. Find the table section that includes Electrical Metallic Tubing (EMT). Go down the right hand column (over 2 wires – 40%) to find area for  $.4299 \text{ 1"} = .346$ ,  $1 \frac{1}{4} = .598$   $1 \frac{1}{4}$  “ EMT would be required

- 103) A 400A service is made up of two 200A main breaker panelboards that are connected together by nipples. Can the service conductors pass through one of the cabinets to supply the other panelboard?  
**ANS:** NO see Section 230.7 and since the service conductors are not terminated in the first cabinet they should not be there since it is used as a raceway.
- 104) Can I use 3/8-inch flexible metal conduit to fish in receptacle outlets in an existing building? I used 12-AWG THWN wire with fittings on the outside of the flex and I only put two wires in each run. Now I was told I have to pull in a ground wire. Is this right?  
**ANS:** NEC 348.20 does not permit 3/8 inch FMC to be used to supply receptacle outlets.
- 105) Can I use Type NM cable to connect recessed fluorescent fixtures in a suspended lay-in ceiling in a retail store? Section 334.30(B)(2) seems to permit this. This is very confusing to many of us on the job.  
**ANS:** According to the definition of exposed in Article 100, wiring methods behind panels designed to allow access are considered exposed. According to NEC 334.12(A)(2) Type NM cable is not permitted to be run exposed in dropped or suspended ceilings in other than one or two family or multifamily dwellings. NEC 334.30(B)(2) refers to installations in one and two family and multifamily dwellings and eliminates the requirement for securing the cable within 12 inches of the outlet box within an accessible ceiling. In the State of Wisconsin, Comm 16.327 (Proposed Comm 16.334(2) in 2008) would allow NM cable in suspended ceilings in any occupancy in buildings of Type III, IV, and IV construction. This is based upon a Department of Commerce interpretation of this rule. The cables would have to be supported per their proper Article's rules instead of being run as an unsupported "whip".
- 106) Can I use a 3-wire w/ground NM cable for temporary wiring on a construction site as a multiwire branch circuit if I feed temporary receptacles on one circuit and lighting on the other circuit?  
**ANS:** No, not any more. Prior to the 2008 Code 590.4(D) would permit that type of installation. The only restriction was that receptacles on construction sites shall not be connected to the same ungrounded conductors of multiwire circuits that supply temporary lighting. The reason for that requirement was that if a fault trips the receptacle GFCI protection required by 590.6(A), the lighting would not be affected. The new requirement in 210.4(B) requiring simultaneous disconnection of all ungrounded conductors of a multiwire circuit requires using a 2-pole circuit breaker which in case of a fault on the receptacle circuit would also open the lighting circuit.
- 107) Do I have to derate NM cable where three cables are run through the same hole in the upper plate?  
**ANS:** NEC 334.80 requires that where more than two cables are installed without maintaining spacing between the cables, through the same opening in wood framing, that is to be fire or draft stopped using thermal insulation, caulk or sealing foam, the allowable ampacity of each conductor must be adjusted according to 310.15(B)(2)(a). NEC 300.21 shows the requirements for containing the spread of fire or products of combustion. The Fine Print Note refers you to locations where further information can be found. The State of Wisconsin does not normally derate for "bundling" of branch circuits for dwelling units per Comm 16.30(1) – 2005

NEC – but proposed 2008 Comm 16.310 Exception 6 to this code section would require derating for two or more cables bundled in upper plates or in insulation.

- 108) I'm running UF cable to a metal post light in the front yard of a residence. How deep must I bury the cable and do I have to provide any special protection for the buried cable? What is the burial depth if we park cars in the front yard?  
**ANS:** NEC Table 300.5 in Column 4 requires where the branch circuit is rated 120 volts, GFCI protection is provided (at the source of the underground run) and the circuit is not rated over 20-amperes, the minimum burial depth is 12 inches. NEC 300.5(F) contains the requirements for backfill and 300.5(J) has requirements for earth movement. Be sure to protect the cable where it enters the metal post.
- 109) Is an outlet box required on a metal post light at a residence?  
**ANS:** an outlet box or handhole is not required in a pole 8 ft. or less where the supply wiring method continues without splice to the splice at the post lantern (luminaire). You can pull the UF cable through a hole drilled in the pole and up to the splice to the post head. 410.30(B) and it's Exception No.1. Exception No. 2 allows this a pole without a handhole if the pole is 20 feet or less and has a hinged base.
- 110) When installing a metal post and lantern in a residential yard using UF cable is it required that the post be grounded?  
**ANS:** Yes, grounding of the metal pole is required (250.4(A)(4). If an ungrounded (hot) conductor were to come in contact with and energize the metal pole, an equipment-grounding conductor attached to the metal pole would carry the fault current back to the source and open the overcurrent device for that circuit. If the metal pole were not grounded by an equipment-grounding conductor the fault current energizing the metal pole would have to return to the source through the earth. Due to the high resistance of the earth, enough current would not flow through the earth to open the overcurrent device in that circuit (250.4(A)(5). UF cable is permitted to have an insulated or bare equipment-grounding conductor.
- 111) How far away from a diesel fuel-dispensing tank must the non-explosion proof equipment be located?  
**ANS:** Diesel fuel isn't a "combustible" liquid. Therefore, diesel dispensing equipment and associated wiring isn't required to comply with the hazardous locations requirements of Article 514. {514.1 & 514.3(A)} Please note that certain rules in Article 514 apply to any motor fuel dispenser including those for pumping diesel fuel, such as the requirements regarding "Circuit Disconnects" in 514.11 and servicing of this equipment in 514.13.
- 112) With a 90 degree cable, what table column should we start with for derating ampacity with a 75 degree termination?  
**ANS:** When terminating a cable rated 90°C to a terminal with a 75°C rating, you are not permitted to use the 90°C column of Table 310.16 and must not exceed the 75°C column ampacities permitted. However, when derating conductors in accordance with 310.15(B)(2), the ampacities shown in the 90°C column may be used for 90° rated conductors.
- 113) Is a metal cover on a concrete handhole box required to be grounded to the electrical ground system?  
**ANS:** 314.30(D) requires that metal covers shall be bonded in accordance with

250.96(A), which requires that the covers be effectively bonded to safely conduct any fault current likely to be imposed on them. This is a new section that was accepted into the 2005 NEC after some devastating substantiation was brought out showing the need for bonding metal covers and other exposed conductive surfaces.

- 114) Is the sheath of Type NM cable permitted to extend more than ¼ in. inside the box? I've seen boxes with 2 or 3 cable sheaths going into the box about 2 or 3 inches making it almost impossible to install a device into the box without really jamming the cables back into the box. The boxes are so narrow and deep that after the drywall is up you can't get into the box to cut back the sheath.

**ANS:** The NEC in 314.17(C) requires not less than ¼ in. of sheath inside the box and beyond any cable clamp but does not specify a maximum length inside the box. However the box fill may have to be calculated to prevent over-crowding the conductors due to the increased cross-sectional area of the cable with sheath (see Table One, Note 9).

- 115) Is welding cable allowed to be installed in a raceway? Or in a junction box? I ask this because there are times when a large size wire (like 500 MCM) simply cannot be bent enough to get into a lug due to placement of equipment/ conduit entry.

**ANS:** I think your question really is asking whether or not you can use welding cable as a conductor for general wiring (such as a feeder conductor) as covered in Article 310. The answer is no. Welding cable is not addressed in Table 310.13 or in Table 400.4. According to the UL White Book, welding cable is a single-conductor cable intended for use in the secondary circuit of electric welders in accordance with Article 630, Part IV. The conductors are flexible-stranded copper, 8 AWG through 250 kcmil. NEC 312.6(A) & (B) cover the width of wiring gutters and wire-bending space at terminals