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1. I installed a 100 ampere 120/240 volt 3-wire feeder from my customer's main facility to a separate storage building. The inspector indicated I need to have a 4-wire feeder to this building. I feel that because there are no parallel metallic paths between the buildings I do not need the equipment grounding conductor and I can bond the grounded conductor at the separate building as I have been doing for years. Who is right?

Ans. The inspector is correct. 250.32(B) All new feeders to a separate building are now required by 250.32(B) to have an equipment grounding conductor installed with the feeder. A grounding electrode is also required to be installed at this building. A meter pedestal installed away from the building with a service disconnect at that location will now require a separate equipment grounding conductor to be installed to the building being supplied.

2. Do I need to GFCI protect a receptacle I installed in a cabinet for a Class 2 transformer to power a touchless faucet in a restaurant bathroom?

Ans. Yes 210.8(B) requires all receptacles in a bathroom to be GFCI protected. Comm 16.20(2)(a) has been deleted.

3. We recently completed a small medical office building in which we used unit equipment to supply the emergency lights we installed on the exterior of each of the exit doors. The normal exterior lighting is accomplished using metal-halide luminaires. The inspector has indicated we can't use unit equipment because of the metal-halide fixtures. What can we use?

Ans. The issue is HID lighting such as metal-halide, high pressure sodium, or mercury vapor lights do not restart when they are warm. 700.16 requires that where this type of lighting is used as the normal source of lighting the emergency system shall operate until the normal system is restored. Unit equipment can be purchased with a timer option to keep it on for a period of time to allow the normal lighting to reignite, install a quartz restrike or the normal lighting at the doors could be changed to a type that will light immediately upon the restoration of normal power.

4. We recently finished a project and when the inspector did the final inspection we were written up for not properly bonding the gas piping which includes some CSST tubing. I feel that we met our obligation by installing the equipment grounding conductor with the circuit that supplies the furnace. He says that is not sufficient. Who is right?

Ans. The inspector. Comm. 16.110 requires equipment to be installed following the manufacturers or listing instructions.

CSST is required to be bonded by specific instructions from the manufacturer.

The instructions are similar for all manufacturers. Generally #4 AWG copper or larger connected to a hard pipe near the entrance to the building. It shall be connected to the grounded conductor, service equipment, grounding electrode conductor or grounding electrode.

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250.104(B) requires bonding of other metal piping. This can be done by the equipment grounding conductor which is run with the circuit feeding the equipment. Orders should be written to the owner or general contractor.

5. Do I need to use a bare grounding electrode conductor or mark it green in some way.

Ans. No NEC 250.62 indicates the grounding electrode conductor shall be insulated, covered or bare, but makes no mention of color requirements

6. I am bidding a new church and was wondering if I can use NM cable? It is being framed with your typical wood frame construction.

Ans. Yes NEC 518.4(B) indicates that NM cable can be used in non-rated construction. A new section Comm. 16.100(1)(c) definitions: non-rated construction is type III, IV & V construction.

7. I ran 8/4 aluminum SER cable to an electric range. The inspector is saying 8 AWG SE cable is only rated for 30 ampere and is inadequate for this installation. We have been wiring ranges with 8 AWG SER for years. What changed?

Ans. The inspector is correct. NEC 338.10(B)(4)(a) indicates interior installations have to comply with part II of Art. 334. Part 2 includes section 334.80 which restricts final ampacity not to exceed 60C. Table 310.16 says 30 amperes at 60C for number 8 AWG AL. You will need to use min. #8 copper or #6 aluminum if the range requires a circuit of more than 30 amperes. You will have to rethink your dryer circuits also for the same reasons.

8. I am wiring a new bank and there is going to be a ground sign located at the driveway. The inspector wants an additional 20 ampere circuit at the front of building. Is this really required?

Ans. No: A 20 ampere outlet is required to be installed at the entrance of all commercial structures and tenant spaces by 600.5(A). This outlet can be used to supply a sign on the building or a ground sign.

9. Do I need to install a disconnect means within sight of a dishwasher?

Ans. Yes: 422.32 indicates where a disconnecting means for a motor driven appliance of more than 1/8 hp consists of a switch or circuit breaker it shall be located within sight of the appliance and comply with Part IX of Art. 430. The exc. allows a unit switch as a disconnect if it had a marked off position and disconnected all power to unit. This option is unlikely as unit switches typically are control circuit devices. 430.102 requires the location of the disconnect

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to be within sight of the controller and 430.109 describes the type of disconnecting means allowed. A legal disconnect must interrupt the all ungrounded supply conductors.

10. We recently had flooding in our community. My question is if electrical equipment was underwater can we just clean and dry it, or does it require replacement?

Ans. Most of the electrical equipment and wiring will require replacement if it has been submerged. The National Electrical Manufacturers Association or NEMA and UL have guidelines. Any NM cable, switches, and receptacles will need to be replaced. Circuit breakers and panelboards will also need to be replaced. Wiring methods approved for wet locations may be able to stay if the ends have not been submerged. Meggaring should be done on these items. Some large equipment may be able to be reconditioned by the manufacturer depending on the length of submersion and contamination of the water.

11. We are wiring a new multi-tenant strip mall. The water service to the building is plastic piping with PEKS tubing used to the various tenant spaces. At each tenant space there are several short pieces of copper tubing supplying faucet and water heaters. Do I need to bond these pieces of metal piping?

Ans. Not if these are less than 10'. 250.104 requires bonding of metal water piping. The states position has been if the pieces are less than 10' they are not required to be bonded. 250.104(A)(1) indicates the water pipe can be bonded to the service equipment, the grounded conductor in the service equipment, or the grounding electrode conductor if sufficient size. Use Table 250.66 for sizing. 250.104(A)(2) allows bonding to tenant panelboard if plastic piping is installed between tenant spaces. When using 250.104(A)(2) you can use Table 250.122 for sizing of the bonding conductor and bond it to the equipment ground in the panel serving the tenant space.

12. We are doing an office remodel project on a single story office building. The roof system consists of bar joists supporting a metal-corrugated roof deck covered with insulation and the roofing material. When the inspector did her initial inspection she indicated we would need to space all of the raceways and MC cables 1 1/2" below the decking. The existing raceways run above the bar joists. Does this mean we cannot reuse them without lowering them?

Ans. The existing raceways could be reused but any new ones would require 1 1/2" spacing. 300.4(E) is new and requires all raceways and cables to be not less than 1 1/2" below the nearest surface or deck. This is to prevent screws from roofers penetrating raceways. Comm. 16.003(3) indicates the code is not retroactive.

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13. We installed a new branch circuit to supply some heat tape on water piping in a barn. The inspector says I have to install a GFPE breaker on the circuit. Do I have to do this? Those things are expensive.

Ans. Yes 427.22 requires ground-fault protection of equipment for heat tracing and heating panels.

GFPE's trip at a higher threshold and are made to protect equipment not provide shock protection. GFPE's trip at + 20milli-amperes, GFCI trip at 4 to 6 milli-amperes. They are not manufactured as a receptacle to prevent confusion with GFCI receptacles.

14. I replaced an existing panelboard that was located on a landing between 2 stairways. The landing is 36"X 36" and the panelboard is a 400 ampere 480/277 volt. The walls are concrete block with metal handrails. The inspector has indicated I need to find a new location for the panel. Why?

Ans. Yes it needs to be moved. Table 110.26 (A)(1) condition 2 requires a 42" working space. Condition 2 is described as exposed live parts on one side and grounded parts on the other side. 240.24(F) does not allow a panelboard to be installed over steps of a stairway. However a landing is acceptable if proper clearances are met.

15. I installed a light fixture that the inspector has indicated needs to be listed. We contacted the supply house and he sent us a UL label to install on the fixture. Is this OK?

Ans. No 410.6 requires the listing of all luminaires. UL does not allow products to be field labeled by others. A UL representative will field install a label when a field inspection is requested.

16. We know that fluorescent luminaires with ballast have to have a disconnecting means either internal or external of the luminaire. Does a Klien side cutter constitute a disconnecting means?

Ans. No 410.130(G)(1)&(3) indicates disconnects are required and where external to the luminaire it shall be a single device. It shall be attached to the luminaire or the luminaire located within sight of the disconnect. For new installations the manufacturers are typically installing quick connect type disconnects. For existing installations it is the state's interpretation that a disconnect would be required to be installed at the time the ballast is changed.

17. I need to bring a 400 ampere 120/208 volt circuit to a separate building for a customer. The main service for the facility is located at the main plant and I don't need to install a

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separate service for the second building. Can I run 2-200 ampere feeders from building 1 to building 2.

Ans. Yes Comm. 16.225(3)(a) amends 225.30. NEC 225.30 permits only one feeder to a building except for certain conditions.

Comm. 16.225(3)(a) amends as follows. Multiple feeders that are supplied from the same distribution point, rated 300 amperes or greater and supply not more than 6 disconnecting means at the same location are considered one supply.

18. Can you explain Sec. 230.72(A) requirements for additional disconnecting means being allowed for fire pumps, to be sufficiently remote from the normal power supply?

Ans. 230.72(A)&(B) are concerned about interruption of the fire pump supply in the event the normal service disconnects are opened. The statement in 230.72(A) Exc. "shall be permitted to be located remote from the other disconnecting means" helps prevent accidental loss of power. No specific distance is stated. The fire pump service disconnect is permitted to be remote from the other grouped 5 disconnecting means.

Remember 695.4(B)(2)(3) prohibits the fire pump disconnecting means from being located within the same enclosure or panelboard assembly or switchboard that supplies other loads.

19. We are wiring a new multi building mini storage facility. We are installing one service with the meter located at building number 1. Can we come directly from the meter to the other buildings with a service disconnect in each building?

Ans. No Comm. 16.230(4) indicates a disconnecting means is required to disconnect utility wiring from the premises wiring at any point where utility wiring terminates and premises wiring extends overhead or underground to more than one building or structure.

20. I have a permanently installed generator located 6' outside of building feeding a transfer switch located inside the building. The neutral is switched in the transfer switch. This is a separately derived system. Do I need to install ground rods at the generator?

Ans. A grounding electrode is required. Art. 100 defines a separately derived system as a system where there is no direct electrical connection between it and the supply conductors of another system. This includes the grounded conductors of other systems.

250.35(A) tells us the requirements of 250.30 shall apply. 250.30(A)(1) requires an unspliced system bonding conductor connecting the equipment grounding conductors to the grounded conductor.

250.30(A)(3) indicates a grounding electrode conductor sized using Table 250.66 be installed to connect the grounded conductor to a grounding electrode. The grounding electrode could be rods installed at the generator or for this installation the building grounding electrode would be acceptable.

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21. The local garden center is building an unheated addition to their store to be used for summer display of flowers and other items. It is totally enclosed but does have several large overhead doors on each end that will be opened when they have the display open to the public. Can I use unit equipment to light the means of egress?

Ans. Yes IBC 1006.1 requires the means of egress as well as the exit discharge be illuminated at all times the building is occupied.

1006.2 requires the illumination level to be a minimum of 1 foot-candle. 1006.4 requires the emergency system to light the means of egress at an average of 1 foot-candle and a minimum of 0.1 foot-candle with a min. to max. of 40 to 1 ratio.

Locating unit equipment in unheated space may be a problem. Table 63.0302 indicates design temperature for different counties in Wisconsin. It varies from -25 deg. to -10 deg. min. to 86 deg. to 89 deg. max. Comm 16.18 requires listed equipment to be installed to instructions. The battery units could be located in heated area and wiring to remote heads using raceways or MC cable.

22. We are using Type NM cable to wire a small office building which is being built slab on grade. We installed PVC conduit under the floor to install our NM cable to receptacles that will be located at some of the work areas located in the center of several rooms. The inspector red tagged us on the final inspection. I know you can't direct bury NM cable but what's the problem if it's in a conduit?

Ans. Type NM cable cannot be used in a wet location. 334.10(A)(1).

300.5(B) indicates the interior of raceways installed underground are considered a wet location. Also 300.9 is new and indicates the interior of raceways installed in wet locations above grade are also considered wet locations.

23. We have a generator located 75' from the building it is supplying. The supply voltage is 120/208 3 phase. It is supplying a 3-pole transfer switch located in the electrical room in the building. My question is do I need to install a grounding electrode at the generator?

Ans. Yes 250.32 requires an electrical system at a structure to be connected to a grounding electrode. We would consider the generator to be a separate structure and it would be required to have a grounding electrode installed at the generator.

The grounding electrode would be connected to the equipment grounding terminal at the generator. This is not a separately derived system 250.24(A)(5) indicates the grounded conductor can not be bonded to the generator frame. Def. Art. 100.

24. I have a 10' long 1200 ampere 480/277 volt switchboard installed in an electrical equipment room. One end of the switchboard is against the wall on the far end of the room from the door. There is 45" from the front of the switchboard to a concrete block wall. The inspector says that I

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need a door at each end of the working space; however I feel we have a clear unobstructed path from the front of the switchboard to the door. Who is right?

Ans. The inspector is correct. NEC 110.26(C)(2) applies to equipment 1200 amperes or more and over 6' wide. The general requirement for this installation is that there is one entrance not less than 24" wide 6.5' high at each end of the working space.

The single unobstructed exit in 110.26(C)(2)(a) or (C)(2)(b) would not apply to this installation. "Unobstructed exit" means that the electrical worker can exit the work space without a need to travel along the entire length of the equipment in order to reach the exit. A new rule modifies the requirements for door hardware. Any door meant for entrance or egress within 25' shall to open in the direction of egress and has "panic-type" hardware.

25. We recently finished wiring a large new sports bar in town. There are a number of flat screen TV's installed throughout, with the power cord and cable connection run through the ceiling tile to receptacles located above the ceiling tile. When the fire inspector did his walk through he indicated this was a violation. Is he correct?

Ans. Yes, the fire inspector is correct. NEC 400.8 covers the addresses of flexible cords. This section:

- (1) Does not allow flexible cord to be used as a substitute for fixed wiring of a structure.
- (2) Does not allow flexible cord to be run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings or floors.

The receptacles would need to be located below or in the ceiling tile. The coaxial cable would be allowed to be installed above the suspended ceiling. It is required to be listed and of the proper type such as CATV. If the area above the ceiling is being used as a plenum it would be required to have a P in the designation such as CATVP.

26. We are wiring a new retail shopping center. We plan on using unit equipment to provide egress lighting. On the last job we had to add 12 more units and many remote heads to the outside of exit doors in order to satisfy the inspector. We also used metal halide for the normal lighting on the outside of the building and this created another problem. How can I avoid this on this job?

Ans. Emergency egress illumination is required by the International Building Code and installed to meet Article 700 of the National Electric Code. The starting point should be a photometric study. The fixture manufacturer should be able to provide you with the photo metrics for that fixture. IBC 1006.4 requires an illumination level of an average of 1 foot-candle along the egress path. The minimum at any point is 0.1 foot-candle with a maximum to minimum ratio of 40 to 1.

Emergency illumination is also required at "exit discharge". This is the exterior side of exit doors. Since the normal lighting outside of the building is metal halide, the emergency lighting must remain on once power is restored at least until the normal lighting is at full brightness. This is required by 700.16.

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27. I just roughed-in a new 12 family condominium building. A 100-ampere panelboard is located in each unit. A separate 200 amp panel supplies public loads. I bundled the home run cables as they run up the wall, through the top plate for some distance through the attic. I am being told it is a commercial building and thus bundled cables require “derating”. Is this correct?

Ans. Based on the information provided you will have to derate or change your cable layout. NEC 310.15(B)(2)(a) requires cables to be derated when bundled together. Comm 16.310 adds a 6th exc. to the exceptions in the NEC. Branch circuits supplying individual dwelling units generally do not have to be “derated”. However there is a change in the 2008 NEC. The key to avoiding derating is to avoid bundling in locations where the cables are firestopped or are installed in contact with insulation. Three or more cables run through the same opening that is firestopped or in contact with insulation now require “derating”.

28. I will be wiring a commercial property that has pond which was built for storm water retention. The owner installed submersible pumps to circulate the water over a waterfall and also to be used for lawn sprinkling. How do I provide power for the pumps and any other concerns?

Ans. The wiring for the pond is addressed by NEC Article 682, Natural and Artificially Made Bodies of Water. 682.11 pertains to the location of service equipment. The minimum separation from the water is 5-feet horizontally from shoreline and at least 12-inches above electrical datum plane. 682.14 requires the disconnecting means for a feeder or branch circuit be located the same as services. 682.31(A) requires that equipment grounding conductors to be insulated copper and sized in accordance with 250.122 and not be smaller than 12 AWG. 682.32 covers bonding of non-current carrying metal parts in contact with the water to the grounding bus in the panelboard. 682.32(B) all circuits rated not more than 60 amperes at 120 thru 250 volts, single phase, shall have GFCI protection.

29. I am installing a service for a new fire pump in an existing building. The fire pump controller will be located well inside the building. Am I required to install a service disconnect ahead of the controller? How do I size the service disconnect? How do I size the meter cabinet?

Ans. No more than 8-feet of service conductors or cable is permitted inside of the building per Comm 16.230-(3). NEC 230.70(A) requires service disconnect to be located outside or inside nearest the point of entry. 695.4(B)(1) is used to size the fuse or circuit breaker. The overcurrent protective device shall be rated or set to carry the locked rotor current of the fire pump motor indefinitely. This requirement does not apply to the service conductors, feeder conductors or the meter cabinet. The meter cabinet and fire

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pump circuit conductors shall be sized at not less the 125% of the full load of the fire pump motor. They also must be sized to meet the voltage drop requirements of 695.7

30. A bank wants me to install a generator to back up their computers. I understand that all standby generators are required to be located more then 20' from normal utility distribution equipment. Is this correct?

Ans. No. You are referring to Comm 16.700-(2) and 16.701-(1). Comm 16.700 applies only to required emergency systems. Comm 16.701 applies only to legally required systems. A generator that supplies only optional loads is addressed in Art. 702 and does not have to be separated from outdoor electrical equipment. A generator that only supplies computers or normal lighting and power loads does not have to meet the separation requirements.

Several changes have been made to these rules. A properly sized barrier can now be used to reduce the separation. With a barrier, no minimum separation distance is required. Generators required to comply with either rule must also be at least 10 foot horizontally from buildings of Type III, IV or V construction.

31. Are UFER grounds still optional? If a UFER ground is installed, is a supplemental electrode required?

Ans. 250.50 indicates that all grounding electrodes described in 250.52 (A)(1) through (A)(6) be bonded together to form the grounding electrode system. If the UFER ground is present in the footings of the building you are working on, you must use it an electrode for the service. UFER grounds are now required. A concrete encased electrode is commonly referred to as a UFER ground after H.G. UFER who spent many years documenting the effectiveness of a concrete-encased electrode.

250.52 (A)(3) describes a concrete encased electrode to be a minimum of 20-feet of ½-inch minimum steel reinforcing rods or 20-feet of 4 AWG copper conductor encased by 2-inches of concrete. 250.50 Exception indicates that concrete encased electrodes of existing building are not required to be used if they only available by disturbing the concrete.

No supplemental electrode is required for a UFER ground. Only metal water piping system require a supplemental electrode per NEC 250.53(D)(2).

32. Can Type USE cable be installed to a service disconnect located inside a building?

Ans. NEC 338.12 has been revised. Cables marked USE only cannot be used inside of buildings. Type USE cable does not have a flame retardant insulation and is not allowed

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to emerge above ground except to terminate in meter bases or other enclosures. Type USE/RHW or USE/XHHW single conductor cable would be allowed to enter a building in a raceway since the additional "RHW" or XHHW" marking indicates the cable insulation is manufactured with a flame retardant rating. Such dual marked cables are available. You may have to request your supply house order it for you.

33. I am wiring a new multi-story office building. It has 4 stair towers. I know I will need to install emergency egress lighting in the stair towers since they are part of the egress path. Can I dim or turn off the emergency lights in the stair towers when they are not occupied? How can I do this?

Ans. There are controls available to allow you to accomplish this. 700.20 Indicates emergency lighting can be switched only if arranged so that only authorized persons have control.

Commerce has an official interpretation on the website on this issue.

UL-FTBR and 924 are standards used to list controls for emergency lighting. Look for relays and controls that are listed to UL 924. This type of device will automatically bypass any switches and restore emergency illumination levels upon the loss of power.

34. I recently did an office building rough in using Type AC cable for some of the receptacle circuits. The inspector is requiring anti-short bushings be installed on the cable. The cable actually came with a package of them but I lost them so I used connectors that have an insulated throat and are listed for Type AC/MC cable. Now I will have to remove all cables from the boxes to install them. Can he require this?

Ans. Yes. 320.40 indicates that all terminations of AC cables shall have a termination that protects the wires from abrasion. In addition it requires an insulating bushing be installed between the armor and the conductors. The connector needs to be of such design so the insulating bushing or its equivalent be visible for inspection.

35. The new manufacturing facility we are wiring is going to have a 480/277 volt service. We will be installing transformers to provide 208/120 volt loads. Are we required to use specific color coding on our branch circuits?

Ans. NEC 210.5 has been revised. It requires the ungrounded conductors of multi-wire branch circuits be uniquely identified. The identification must identify both the system and the phase that supplies the conductor. Color-coding is one method that can be used to

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identify the ungrounded conductors. The recommended colors are found in Comm 16.210. Once the method of identification is selected, the method must be permanently posted at the distribution system. The revised code now permits “documentation in a manner that is readily available” as an alternative.

36. A large HMO is building “Urgent Care” clinics. The staff can take a person’s temperature, prescribe medications, and give injections. There are no operating rooms, no overnight stay, and patients that are really sick are told to go to a hospital. There is a waiting area and several “exam rooms”. Would the receptacle outlets in these “exam rooms” require redundant grounding per Article 517? What about “Hospital Grade” receptacles?

Ans. Yes, the receptacles must be wired to meet 517.13(A) & (B). No “Hospital Grade” receptacles are no required. 517.2 Definitions, describes a Health Care Facility as:

“Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical or surgical care are provided.” Health care facilities include hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

NEC 517.13(A) applies to wiring methods for all branch circuits supplying lighting, receptacles, and electrical equipment in the exam rooms. These circuits are required to be run in a metal raceway or metallic cable armor that is in itself an equipment grounding conductor. 517.13(B) also requires an insulated equipment grounding conductor sized in accordance to 250.122 for the size of the overcurrent protection of the circuit.

Article 517 does not require Hospital Grade receptacles in this type of facility. The HMO has indicated that there are no critical care areas and no patient bed locations in the facility. The requirement for “hospital grade” receptacles is in 517.18(B) and 517.19(B). A patient bed location is defined as a patient sleeping bed or the bed or procedure table in a critical care area.

However hospital grade receptacles may be required through the listing of cord and plug connected portable medical equipment which will be present in this facility. Comm 16.18 requires the following of listing instructions.

37. We are installing a new hot tub on an existing concrete patio. The 2008 NEC requires “Equipotential Bonding” plane around outdoor pool and hot tubs. How can I meet this requirement?

Ans. NEC 680.26(C)(2) indicates that an equipotential bonding grid is required under perimeter surfaces. The perimeter surface extends 3-feet horizontally beyond the inside walls of the pools or hot tub. It includes paved and unpaved walking surfaces.

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The grid can consist of reinforcing steel rods connected together with tie wires. Or an alternative means is a minimum 8 AWG bare solid copper conductor. The conductor(s) shall follow the contour of the perimeter surface and be located 18 to 24-inches from the walls of the pool or tub. The conductor shall be located 4 to 6-inches below the surface. Only listed splices are permitted. The 8 AWG conductor shall be bonded to the hot tub or pool.

Comm. 16.680 indicates this requirement does not apply to listed, self-contained spas or hot tubs as long as the unit walls are nonmetallic, it also indicates the new requirement to bond the water in 680.26(C) does not apply to this type of listed self-contained unit.

38. We used listed “hospital grade” Type AC cable to supply receptacles on the critical branch in a hospital. The inspector indicated we could not use AC cable for this application. Why?

Ans. All patient care areas in health care facilities must meet NEC 517.13(A) and (B). This requirement applies to wiring methods for branch circuits supplying lighting, receptacles, and electrical equipment in the patient care area. These branch circuits are required to be run in a metal raceway or metallic cable armor that is in itself an equipment grounding conductor. There are types of AC and MC that are approved for this purpose. In addition, 517.13(B) also requires an insulated equipment grounding conductor sized in accordance to 250.122 for the size of the overcurrent protection of the circuit.

517.30(C)(3) wiring methods that provide increased mechanical protection for the emergency circuits in a hospital. Only non-flexible metal raceways, Type MI cable or Schedule 80 PVC conduit are permitted. Of course, nonmetallic raceways are not permitted to supply patient care areas.

517.30(C)(3)(3) allows limited use of flexible raceways and listed metal sheathed cable assemblies. The use of flexible wiring methods is limited to:

- a. Where used in listed prefabricated headboards.
- b. In listed office furnishings.
- c. Where fished into existing walls or ceilings, that are not otherwise accessible and not subject to physical damage.
- d. Where necessary for flexible connection to equipment.

39. We supplied several RTU's through a conduit rack run across the surface of the roof. Each RTU was supplied through its own conduit. The nameplate rating was 37.8 amperes at 480-volts, 3-phase. The top of the “uni-strut” rack is 3- inches above the roof. The plan says to use 8 AWG THWN-2 conductors. What do you say?

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Ans. We think the electrical engineer took into account the new requirement in 310.15(B)(2)(c). This section requires additional “derating” for conduits exposed to sunlight on rooftops. Adjustment factors have been a requirement for ambient temperature. This new requirement adds an additional correction factor to take into account the reflected heat from the roof.

The temperature adder in Table 310.15(B)(2)(c) shall be added to the average outdoor temperature to determine the proper temperature correction factors in Table 310.16. The adder in this case is 40 F. We added this to an average ambient temperature of 90 F for a total of 130 F. The correction factor is taken to be 0.82 based upon the 90 C rating of the insulation. The Table ampacity of a 8 THWN-2 is 55 amperes at 90 C. The adjusted value is 45-amperes. The conductor is still adequate for the load without considering voltage drop.

40. I am bidding on a multi-family project to start in mid-2009. Do I include arc-fault protection and tamper resistant receptacles?

Ans. No and No. Comm. 16.20(a) Exc. The requirements regarding arc-fault circuit interrupter protection and tamper resistant receptacles shall take effect on January 1, 2010.

NEC 210.12 requires arc-fault protection for 125-volt, 15- and 20-amperes branch circuit located in family, dining, and living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, and similar rooms and areas. The general requirement is to protect the entire branch circuit through a listed combination device. An exception permits the AFCI device to be located in the first outlet. Metal boxes and wiring methods must be used between first outlet and the branch-circuit protective device. Comm 16.210-(4) adds Type MC cable to the list of permitted metallic wiring methods.

Comm.16.406 indicates the requirements in 406.11 will not become effective until 1/1/10.

41. We wired several kitchen exhaust fans for a new chain restaurant. We provided a combination motor controller and disconnect for each fan. The “starter” units are in the electrical room. The motors are on the roof. We understand that since we can lock each starter off, we have met Code. The inspector disagrees. What do you think?

Ans. Comm 16 no longer modifies the requirements for motor disconnects . 430.102(A) requires a disconnecting means to be located within site of the controller. Each controller must be capable of being individually disconnected. You have met this requirement by the use of the combination controller-disconnect. 430.102(B) requires a disconnecting means to be located within site of the motor. You have not met this requirement. There is an exception to 430.102(B). We do not think your installation meets the conditions in the exception. If it is impracticable to locate a disconnecting means at the

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motor, you are permitted to use a lockable disconnect at the controller. Such would be the case for a submersible well-pump motor.

42. On a new farm project we are working on there are 2-480 volt 3ph well pumps. The pump installer furnished and mounted the motor controllers above the piping manifolds connecting the 2 systems together. He indicated they had to be located at that location by his codes. I feel that if they stay there we cannot comply with 110.26 for working clearance of equipment that may require servicing while energized. What do I do?

Ans. The controllers will need to be moved or the piping system redone to give the clearances required. Equipment that may require servicing or maintenance while energized is required to meet the requirements of 110.26(A)(1), (A)(2), and (A)(3). Table 110.26(A)(1) would require the depth of the space to be 3' feet if you meet Condition 1, exposed live parts on one side and no live or grounded parts on the other. Condition 2 requires 3.5' if you have exposed live parts on one side and grounded parts on the other. Condition 3 requires 4' if you have exposed live parts on both sides. 110.26(A)(2) requires a minimum of 30" or the width of the equipment and 110.26(E) requires a minimum headroom of 6.5'.

43. We are relighting an existing indoor pool with low bay metal-halide fixtures. The old fixtures were fluorescent mounted directly over the outlet boxes. We plan on using flexible cord and connecting them directly into the existing boxes because of the possibility of corrosion. Is this ok?

Ans. No. 410.62(C) allows the use of flexible cord to connect luminaires where the fixture is located directly below the outlet box where the cord is entirely visible, not subject to strain or damage, and the cord terminates in a grounding type attachment plug cap. An alternative to the cord and plug installation is a listed cord and canopy assembly. If you don't want to use a receptacle and plug you could use a flexible wiring method such as liquid tight and hard wire them.

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

Ans. No NEC 210.4 has been revised. This new section will now require a "disconnecting" means for each phase leg of a multi-wire branch circuit. This requirement applies even if a single voltage is used in the building. The disconnecting means may consist of a multi-pole circuit breaker or single-pole breakers with handle-ties.

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

Ans. A grounding electrode conductor is to be sized in accordance with Table 250.66 based on the size of the largest ungrounded service-entrance conductor(s) or equivalent area for parallel conductors. Table 250.66 Note 2 addresses the conductor sizing issue where there are no service-entrance conductors. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served. For example if the calculated load requires a conductor of 350-500 kcmil a 1/0 would be required. See also Article 100 for definition of service point, service lateral and service entrance conductor.

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

Ans. No. These cables are not listed or marked for direct burial. This cable has four single conductors without an overall covering. Our second favorite book the famous UL White Book includes the Wire and Cable Marking Guide. A cable that is marked "Pump Cable" or "Submersible Pump Cable" is evaluated for use in wiring of pumps and/or submersible pumps. These cables have not been evaluated for direct burial based on the marking guide.

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

Ans. Yes 210.25(B), Comm. 16.210(5) In general where power is needed for common lighting, central alarm, signal, communications or other needs for public or common areas cannot be supplied from an individual dwelling unit. The lighting or other loads that are associated with each unit would apply to 210.25(A) an example would be a four family apartment with switched hallway lighting for each unit. Comm. 16.210(5) indicates for service upgrades on existing 2-family dwellings only separation of common area branch circuits is not required.

48. I recently told an electrician he needed to put extensions on his electrical boxes that were mounted in wood covered (paneled) walls because I determined them not to be mounted flush. He called back and said the first few boxes he was putting extensions on were only set 1/8 inch back. It sounded like he was having a hard time with the type of extensions that he had purchased. He feels that it was too much work to do for only a 1/8 inch set back. Is there a distance the box could be set back and by code still be considered to be flush, thus not needing the box moved or installing a box extension?

Ans. No 314.20 It clearly states that a box needs to be flush with the finished surface when installed in a walls or ceilings constructed of wood or other combustible surface materials. If the walls are concrete, gypsum, tile, or plaster they are allowed to be set back no more than 1/4".

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49. Can an incandescent light be installed above a gas dispensing tank? If so, at what height? Do I need to seal off, since I am leaving the classified location?

Ans. Yes 514.8, 514.7, 511.7(A)(1) & (B)(1)(b). The area 18" above grade and 20' horizontally from any edge of the dispenser is considered a Class I Div 2 location. 514.8 indicates the type of wiring methods allowed under this area and it also requires sealing fittings be installed within 10' of emergence with no fittings between emergence and the seal. This would apply to the raceway emerging in the hazardous area as well as the end emerging outside of the area.

514.7 indicates we go to 511.7 for wiring and equipment located above the Class I area.

511.7(A)(1) indicates the type of wiring methods allowed above a Class I area. 511.7(B)(1)(b) requires fixed lighting be located not less than 12' above the ground unless it is totally enclosed.

Also the area within 3' of a vent is Class I Div. 1 and between 3' and 5" is Class I Div. 2 extending in all directions.

An incandescent light can be installed at a fuel tank if properly located and the wiring methods to it meet these requirements are installed properly.

50. If you have a two-speed, three-phase motor, and all 6 "current-carrying" conductors are in the same raceway, do you have to de-rate the conductors to 80% according to 310.15(B)(2)(a)?

Ans. No. While I find no specific exception, common sense would seem to be why would we have to derate if only 3 conductors can be current carrying at a time. 725.51(A) allows you to ignore the derating factors where Class 1 circuit conductors carry continuous loads of 10% or less of the ampacity of the conductor. 725.51(B) also allows this to apply even if they are in the same raceway as power-supply conductors. Although these are not Class 1 circuits if it's allowed there with 10% or less it should be alright in your installation where there is 0% of the ampacity of the conductor.

51. We recently installed a 60 ampere feeder to a small outbuilding. The owner only wanted 1 lighting circuit and 1 receptacle circuit in the building. I installed a small main lug panelboard and 2 circuit breakers. The inspector is telling me I have to install a main breaker. I feel I can use the 6 disconnect rule. Who is right?

Ans. The inspector 225.31, 225.36, Comm. 16.18, 408.36(F)

225.31 requires a disconnecting means at the second building and 225.36 requires it to be suitable for use as service equipment. Comm. 16.18 tells us equipment needs to be installed following listing and labeling instructions. Most panelboard instructions indicate they are suitable for use as service equipment when a main breaker is installed. When breakers are backfed they are required to be secured to the panel 408.36(F).

52. One of our customers has asked us to move several pieces of equipment in his shop. Presently they are cord and plug connected using cord drops from the ceiling. I would like to

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avoid moving the existing outlet boxes that are supplying the cord drops however I want the cords to drop straight down to the machines. I would like to attach a Chinese finger type support away from the outlet box to accomplish this. Do you see any problem with that?

Ans. It depends on how far away from the outlet box. Comm. 16.400, NEC 386.56(B), 400.8(4) Comm. 16.400 adds an exception to the exception in 400.8(4). It indicates flexible cords permitted by 400.7(A) and connected to sources other than busways are allowed to be attached to the building surface provided they comply with 368.56(B). This allows you to attach the cord to the building surface not more than 6' from the outlet box with an approved means.

53. On a recent project we were red tagged for not providing a bonding point for the telephone and cable providers. They have always tapped on to our grounding electrode conductor above the panel before and it is available on this job so what's the problem?

Ans. A set of terminals or a bonding bar is now required. 250.94
A new requirement in 250.94 now requires a bonding bar or set of terminals be installed external to the service equipment. It is required to have provisions for not less than 3 intersystem bonding conductors. It can be a terminal strip located near the service equipment enclosure, or meter enclosure, and connected to an equipment grounding conductor in the equipment with a minimum #6 AWG copper conductor. It can also be tapped to the grounding electrode conductor. Or it can be securely fastened to the meter enclosure. However, most utilities prohibit bonding connections in or on metering equipment.

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

Ans. There is no antioxidant compound requirement in the NEC. Comm. 16.18
The general rule is that electrical connectors are tested by UL without antioxidant, however you will find antioxidant already installed in lugs from the factory or lug manufacturer, that is likely because it is necessary to pass the UL testing with it. The use of it is not mandatory however it might be classed as a good work practice if done correctly, it will enhance the performance of the connection over time. Many of the wire manufacturers recommend it. Comm. 16.18 requires you follow the listing or manufacturers instructions.

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

Ans. Yes 210.8(B)(2)
210.8(B)(2) requires all 125-volt, single-phase, 15- and 20-ampere receptacles installed in kitchens to have ground-fault circuit-interrupter protection for personnel. There are no exceptions for a twist lock connector. Comm.16.20(2) has been deleted and all 15 and 20 ampere 125 volt receptacles in a commercial kitchen are now required to have GFCI protection.

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56. I am inspecting a building addition. They have a 150 KVA transformer with two 200 amp 120/208 volt 3 ph. panels being fed from it, but now have more circuits than these two panelboards can handle. I have calculated the load and the transformer is large enough. Can they tap an additional 100 ampere panel off of this transformer?

Ans. Yes provided the requirements of 240.21(C) are met Table 450.3(B) Notes 1&2, 240.6 Table 450.3(B) A set of conductors feeding a single load, or each set of conductors feeding separate loads, shall be permitted to be connected to a transformer secondary. How you go about doing this are found in the tap rules 240.21(C)(2), the ten foot tap rule. (4) the outside tap rule, and (6) the 25' tap rule.

Some additional requirements to keep in mind. First; you can't round up when using tap conductors. For example 240.4(B) permits you to round up to the next standard size overcurrent device for a feeder rated less than 800 amperes. For a feeder you would be allowed to use a 4/0 Al. conductor for a 200 ampere feeder. For a 200 ampere panel connected to a transformer secondary 250 Al. kcmil would be the minimum size.

The second condition 240.21 indicates you cannot tap a tap. In this case each one of the taps would be required to meet one of the tap rules. here secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location.

Third; you may difficulty finding suitable lugs to accommodate multiple conductors in the transformer.

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

Ans. No 210.8 (B)(2)&(5)

A typical convenience store has a self serve area and may have a kitchen. Article 100 defines Kitchen as " An area with a sink and permanent facilities for food preparation and cooking." The question has to be asked if the self serve area has permanent facilities for cooking, meaning a stove or in counter top range unit and not just an appliance that sits on the counter top. If it has permanent cooking facilities then the answer is yes all 125 volt 15& 20 ampere receptacles shall have GFCI protection. If the answer is no then (5) sinks, states that where receptacles are installed within (6ft.) of the outside edge of the sink they must be GFCI protected.

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

Ans. Yes, UL White Book OOKH

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

The question is dealing with the proliferation of what the industry calls compact fluorescent lamps. UL Lists these as Self Ballasted Lamps and Lamp Adapters, (OOKH), located on page 232 in the 2008 White Book.

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

59. At the local pharmacy they have a machine where you sit down, put you arm into a sleeve which inflates and checks your blood pressure. Is this a vending machine that would require GFCI protection?

Ans. No 422.51

This is not a vending machine because you do not need to pay for the product or service. Cord and plug connected vending machines manufactured or remanufactured after January 1, 2005 are required to have GFCI protection as an integral part of the attachment plug. Older vending machines shall be connected to a GFCI protected outlet. Note a new section 422.52 requires electric drinking fountains to be GFCI protected whether cord and plug connected or hard wired.

60. We are installing a 200 ampere feeder to an outbuilding on a farm. Because of the distance we determined we would need to increase the conductors from 3/0 copper to 300 kcml copper to compensate for the voltage drop. Do we also need to increase the size of the equipment grounding conductor?

Ans. Yes 250.122(B)

The equipment grounding conductor is required to be increased proportionately to the ungrounded conductors by 250.122(B). Chapter 9 Table 8 indicates a 3/0 is 167800 cm. increased size to 300 kcml. $300000/167800=1.7878$. A #6 AWG is 26240 cm. $26240 \times 1.7878=46911$ cm. Chapter 9 Table 8 #4 AWG 41740 cm this would require a #3 AWG copper.

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

Ans. No and yes. 514.3(A) & 514.11(C)

The diesel flashpoint is above 100 degrees F and therefore not covered by 514.3(A). 514.11(C) would require an emergency shut off to be located more then 20' and less then 100' from the dispenser.

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62. A 2" PVC rigid conduit extends from an electrical disconnect into a trench. The entire run is in conduit. The inspector is requiring a slip fitting in case of soil expansion and possible damage to the electrical disconnect. Is this a NEC requirement?

Ans. Yes, 300.7 (B), 300.5 (D) & (J) & 352.44

300.5(D) requires protection for conductors emerging from the earth. 300.5(J) requires that direct-buried conductors shall be arranged to prevent damage from movement of the soil by settlement or frost. Expansion fittings are required to compensate for thermal expansion and contraction by 300.7(B). Also consider 352.44 which requires expansion joints where it is determined by Table 352.44 that there is an expected expansion of 1/4" or greater.

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

Ans. They are required to be secured but no specific requirement. 800.24, 300.11

Communications wiring above a suspended ceiling is required to be secured to the building structure.

All though there is no specific supporting and securing interval requirements listed in the National Electrical Code, Section 800.24 which is Mechanical Execution of Work states: Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable.

The installation shall also conform to 300.11 which does not allow the ceiling support wires to support the cables. It doesn't allow cable to support other cables either.