

1. The inspector made me add support for all my underground raceways. The dirt holds them in place! Can you please tell them they're wrong?
Answer: No, we cannot. NEC 344.30(A) and others all require the raceways to be securely fastened within 3' of the enclosure or conduit body. Dirt is not a fastener.
2. I did a ceiling inspection yesterday. The ceiling contractor is in a hurry to drop tile. I noticed the lay in fluorescent fixtures are connected with a manufactured wiring system. Each master fixture section has cord that terminates in a "T" connector. The "T" connector is plugged into the home run cable system at a nearby steel bar joist. Is this OK?
Answer: No. NEC 604.3, indicates uses permitted, 604.6(A)(3), allows flexible cord, minimum #12 AWG, and visible for entire length, and 400.8(5) does not allow flexible cord to be located above a suspended ceiling.
3. I recently wired a church and the inspector made me install a dedicated 20A sign circuit to the front of the church. This wasn't on my plan and they have a road sign. Did I really need to install this?
Answer: Yes, NEC 600.5(A) requires a 20A sign outlet (that serves no other load) to be installed at an accessible location at the entrance of all commercial occupancies accessible to pedestrians. This circuit could also supply the ground sign, load permitting
4. We are bidding a 90-unit apartment building. Do we need to use tamper-resistant receptacles for the dishwasher and garbage disposal? The receptacle is located in a cabinet under the sink. What about the receptacles we install on top of the wall cabinets in the kitchen? They are intended to supply low voltage lighting.
Answer: Yes. 406.11 requires all 15&20 ampere 125 volt receptacles specified in 210.52 to be tamper-resistant. These are covered under 210.52-(1) through (4).
5. Do all energized equipment parts in a fire pump room need to be located a min. 12" above the floor or just that equipment associated with the fire pump?
Answer: Associated with the fire pump. 695.1 Scope.
NEC 695.12(D) says "ALL" energized equipment parts shall be located at least 12" above the floor level. The rule applies to all parts that fall under the scope of Article 695.
6. I am sizing a new 15KV service for a factory. The service equipment is a fused switch. We measured the load over a period of a week. The continuous demand load averaged 111-amperes. Must we size the service overcurrent protective device at 125% of the maximum demand?

Answer: No. 230.208(B). The restriction that limits the load to 80% of the protective device rating does not apply to overcurrent devices that operate at over 600-Volts.

7. We are doing a tenant remodel that has the existing branch circuit wiring ran between the roof deck and roof insulation. Can we pull additional branch circuits through the existing raceways?

Answer: Yes. The existing raceways and associated branch circuit wiring are legal non-conforming. The described raceways do not comply with NEC 300.4(E). However, 16.003-(3) permits the continued use of the raceways. Conductors can be replaced or additional conductors added as long as the maximum fill limits are not exceeded. Extensions to the raceways must comply with NEC 300.4(E).

8. In order to help fund our public schools, the school district has rented space on the roof of the high school to a cell tower company. The service equipment for the cell tower is mounted on the ground next to the school. Must the cell tower service utilize the same grounding electrode system as the school service?

Answer: Yes 250.58

9. I have 277/480V circuits using gray neutrals and 120/208V circuits using white neutrals passing through the same wireway above the panels. This is the only place they are together. Do I still need another form of identification?

Answer: Yes, Where there is more than one system in a building identification of the systems are required. 210.5 for branch circuits and 215.12 for feeders. Also NEC 210.5(C) requires ungrounded conductors of branch circuits and NEC 215.12(C) feeder conductors to be identified at the distribution equipment. In addition, NEC 200.6(D)(2) grounded conductors of different systems entering a common raceway or enclosure shall be individually distinguished by 1- system being white or gray and the other system being different, either white or gray, or white or gray with a continuous stripe other than green or by other means with identification labeled at the distribution equipment

10. We have a job that we have installed some communication cables underground in a PVC conduit. The owner's representative will not accept this installation because he says these cables are not UL listed for a wet location installation. The cable manufacturer thinks the cables are OK and sent us the specifications. I am sending it to you. Is this cable permitted for underground use?

[Cable Specification: Belden cable with Halar jacket. Rated as "Excellent" for moisture resistance]

Answer: Not Acceptable under the 2008 NEC, Section 725.179. If the cable was listed and marked "FOR USE IN CONDUIT IN UNDERGROUND APPLICATIONS" the cable is acceptable under the 2008 NEC. Your situation is a bit more complicated. The spec sheet indicates the moisture resistance of the cable is "excellent". NEC 2008, Section 725.179(E) requires specific listing for wet location use or the cable must have an impervious metal sheath. This section is new to the 2008 NEC. If your project was designed and approved under the 2005 NEC, this requirement would not apply. NEC section 110.3(A) would permit the AHJ to accept a cable with excellent moisture resistant ratings. A cable listed for such locations would also be acceptable, of course.

11. I have a 277/480V vehicle mounted generator that is moved from well buildings to lift stations for standby power around a city. The transfer switch is 3-pole and they specified a 4-pole inlet. Do I need an equipment grounding conductor from the generator?

Answer: Yes, the generator is not separately derived and it supplies a building or structure. The neutral is not permitted to be bonded at the generator per 250.34(C) and an equipment bonding conductor is required between the generator and the supplied equipment per 250.35(B). 5-wire cord is needed.

12. I did a service change on an existing three family in Bay View. 1st question: There is an old existing water pipe that runs under the joists and above the panel. Does it have to be moved. 2nd question: The inspector says the light at the back entry is a common load and the owner needs to add a public panel. The branch circuit for the light is currently fed from one of the tenants circuits. Please advise.

Answer 110.26(F) Move the pipe. Comm 16.003-3 No public panel required at this time.

The water pipe is in the dedicated space above the panel and would have to be moved or disconnected.

You indicated that the other issue is an existing branch circuit that supplies a single lighting outlet at the rear common entry door. You were contracted to change out the service panels. You indicated that the original panels date back to the 1930's to 1950's. I do not think that the owner can be required to add a public panel to supply rear door light. You indicated that you changed out the panels and reconnected the existing branch circuits. My opinion is based upon when the current rule, NEC 210.25, came into effect.

The 1981 edition of the State Code states in 16.14-(2): "A branch circuit shall not supply outlets in more than one apartment of a multi-family building, except hotels and motels." I have not found a similar rule in earlier editions of the Code. Comm 16.003-(3) governs existing installations : "Existing installations shall

conform to the electrical code that applied when the installations were installed." The branch circuit supplying the light was presumably installed prior to 1981. The branch circuit was not changed or altered. You do not have to install a public panel to resupply this existing load.

One additional example to explain this opinion. Say that the original wiring was done in 1944. The 1944 State electrical code required one 20-ampere branch circuit to serve the kitchen loads. You are not required to add a second 20-ampere branch circuit to each tenant's kitchen at the time you change the service panel in 2010.

13. There is PVC installed underground from the transformer changing to steel raceway prior to entering the metering cabinets. Do you see anything wrong with this?

Answers:

NEC 250.92(A)(1) requires metal service raceways to be bonded to the service equipment enclosure with a method prescribed in NEC 250.92(B), generally threaded hubs, bonding type locknuts, or bonding bushings with a bonding jumper installed.

14. We would like to use track lights to provide the required emergency lighting? Any conflict with the Code?

Answer: No, Provided the required illumination levels are met. IBC 1006.3, 1 foot-candle average and minimum .1 FC with no more than a 40/1 ratio along all egress paths.

15. I ran EMT from outlet boxes through pre-punched holes in metal studs. I thought the holes were considered support

Answer: NEC 358.30(A) requires securing within 3' of an enclosure or conduit body.

NEC 358.30(B) Horizontal runs through framing is considered supported when "securely fastened within 3' of termination points".

16. I recently roughed-in a 12-unit apartment. I ran the home run cables through the top plate and caulked each hole. The inspector says I can only run two cables through each hole. I did them all the same and there are a maximum of four cables per hole. I think I'm OK but I forgot what you said last year. Can you review the issue?

Answer: Comm 16.310-(1) Where more than 2 NM cables with 2 or more current carrying conductors are installed in a caulked or fire-stopped hole in a wood member adjustment may be required using Table 310.15(B)(2)(a). Example: 4 cables = 8 current carrying conductors. Table 310.15(B)(2)(a) indicates 70% derating factor. 334.80 allows use of the 90 degree column in Table 310.16 for derating purposes provided the final ampacity does not exceed that for a 60 degree rated conductor. Assuming #12AWG

conductors. $30 \times .70 = 21$ amperes we are more than the 20 amperes allowed by the 60 degree column and the installation is compliant.

17. Who is required to install the physical protection for outdoor electrical equipment?

Answer: Indoors or outdoors NEC 110.26(F)(2) and NEC 110.27(B) require the installation of physical protection where needed. That makes it the electrical equipment installers' responsibility for compliance.

18. We ran several feeders in EMT across the roof of a factory. The inspector says that we have to derate. We think that the new requirement only applies to conduits. But if we have to derate, where do we find the ambient temperature in our area?

Answer: Adjustment required per 310.15(B)(2)(c). Website of Copper Institute

310.15(B)(2)(c) applies to conduit and cables. The NFPA Illustrated Dictionary of Terms includes tubular raceways such as EMT under the definition of conduits. We agree.

This section is new to the 2008 NEC. It indicates that where conduits or cables are exposed to direct sunlight on rooftops to use Table 310.15(B)(2)(c) to determine a temperature adder to the ambient temperature. Then use correction factors found below Table 310.16 to determine the multiplier to adjust the conductor ampereage. Example: A conduit run 3" above the roof would be required to add 40 degrees F to the ambient temperature. We found the temperatures on the Copper Institute's website. We also have some of the handy slide rules left that they provided us. Stop by during break if you want one. Some design temperatures for Wisconsin are Milwaukee 91, Green Bay 87, Eau Claire 89, and La Crosse 91 degrees F.

19. When installing a mast for an overhead Utility service drop who is responsible for the drop clearance crossing the roof?

Answer: The service drop conductors (and sag) are the responsibility of the supplying Utility (which are similar to those of the NEC). NEC 230.24, the electrician must install the mast to provide for proper clearances.

20. I ran across a new transformer in the school addition. The electrician mounted a primary disconnect at the transformer. The secondary disconnect is about 60-feet away. He said the Code allows either a primary or secondary disconnect at the transformer but not both. What do you think?

Answer: Electrician is confusing requirements for disconnects and overcurrent protection. 450.3(B) and 240.21(C)

21. Where in the code does it say a breaker supplying a fire alarm panel has to be lockable and marked red?

Answer: Locking the breaker into an "ON" position comes from NEC 700.9(C) and NFPA 72-10.5.5.2.4 to restrict tampering and unauthorized access (the

photo shows the wrong type of lock). NEC 700.9(A) & NFPA 72-10.5.5.2.2 each require circuit identification and NFPA 72-10.5.5.2.3 requires the red marking.

22. The addition to the school has rebar in the concrete footing. Does this have to be connected to the rebar in the existing footing? If so, how? To the other electrodes in the building? If so where?

Answer: No. Yes. 250.50

23. Is a farm considered commercial wiring or is a 1&2 Family Inspector permitted to inspect farm wiring?

Answer: A 1 & 2 Family Dwelling Code Inspector may inspect the wiring associated with a 1980 or newer 1 & 2 Family Dwelling or manufactured home located on a farm. At present Comm 16.920 only permits the Department to inspect farm wiring.

24. We installed a new panel for a restaurant. The existing service for the tenant space was too small. The existing branch circuits are 3-wire 240/120-volt for most of the receptacle and lighting loads. We installed single pole breakers for these branch circuits. When the electrical inspector inspected the panel, he indicated we are required to use 3-pole breakers. Who is right?

Ans. 210.4(B) does not apply to existing branch circuits. Comm 16.003-(3)

This requirement is new to the 2008 NEC. Each multi-wire branch circuit is now required to be provided with a means to simultaneously disconnect all ungrounded conductors at its supply point. This can be done with a 2 pole breaker for single phase or a 3 pole breaker for 3 phase systems or 2 or 3 single pole breakers with approved handle ties. This requirement does not apply to existing branch circuits per Comm 16.003-(3)

25. Are all elevators in a building with 4 or more floors located above the grade level floor required to have generators for standby power?

Answer: No, high-rise buildings (75'+ above grade) shall have generator for standby per IBC 403.10.2 while others may have a legally required power source per 701.11 (such as a second service).

26. We recently installed a new 200 ampere 277/480 volt overhead service on a small machine shop. We used EMT conduit from the service drop to the service disconnect. The inspector red tagged us for improper bonding of service raceways. We used standard EMT connectors with a steel locknut. What's the problem?

Ans. All metal raceways containing service conductors are required to be bonded to the grounded service conductor. 250.92

NEC 250.92 requires all metal raceways, gutters, wire-ways, or enclosures containing service conductors to be bonded together and to the grounded conductor. These would include threaded couplings, threaded hubs, threadless couplings and connectors, or other listed devices. These would include bonding-type locknuts, bushings, or bushings with bonding jumpers. Bonding around concentric or eccentric knockouts required and standard locknuts or bushings are not allowed for bonding required by this section.

27. I will be wiring a 100% steel frame building for livestock. There will be a feeder panel installed at this building supplied from a remote free standing service. Is an equipotential plane required throughout this building?

Answer: Yes, in other than precast slotted floors, NEC 547.10(A)(1) requires an EQ plane in the concrete floors in part due to NEC 250.32(A) and 250.104(C) where the feeder is required to connect to electrodes present and bond to the exposed structural steel.

28. We are presently wiring a new dental clinic. Each of the exam rooms has a computer that is only used to enter information into the patient's file. Does the receptacle supplying this computer need to be wired using a metal raceway system or metal armor and a separate equipment grounding conductor?

Ans. Yes 517.2, 517.13

NEC 517.2 definition of "patient care vicinity" is the space with surfaces likely to be contacted by the patient or an attendant who can touch the patient. Typically this is an area not less than 6' beyond the perimeter of the bed and not less than 7'6" above the floor. Also 517.13 requires branch circuits serving patient care areas to be installed in a metal raceway system or a cable having a metallic armor. The metallic raceway or cable sheath shall qualify as an equipment grounding conductor by itself. An insulated copper equipment grounding conductor sized using Table 250.122 is also required in the raceway or cable and connected to a receptacle or the non-current carrying metal surfaces of all fixed electrical equipment likely to become energized.

29. Why is it that every time I open a parking lot lighting pole cover I see random conductors taped green. I thought only conductors #4 and larger could be re-identified?

Answer: NEC 250.119(A), You are correct that unless it is a multiconductor cable only #4 and larger conductors may be re-identified. We primarily see this happening where there is no commercial inspection present. Wet location wire connectors are also required.

30. A recent project we were involved with required the installation of a new 225 ampere 120/208 3 phase feeder and panel-board to supply an addition to the facility. We used 2" EMT with 4-4/0 XHHW conductors. We installed one

standard LB and the inspector red tagged it saying the LB is not large enough. Annex C, Table C.1 allows 4-4/0 XHHW in 2" EMT. Can he make use change this?

Ans. Yes. 314.28(A)(2)&(3)

NEC 314.28(A)(2) indicates that for an angle pull with conductors #4 AWG or larger a distance of not less than 6 times the largest raceway is required between each raceway and the opposite side of the box. 314.28(3) allows a smaller dimension provided the conduit body has been listed for and is marked with the maximum number and size of conductors permitted.

31. On an apartment building with only a 3' x 6' balcony is a receptacle outlet required to serve that balcony?

Answer: NEC 210.52(E)(3), No, only balconies, decks, and porches of 20SF or more are required to be provided with GFCI protected (210.8(A)(3) tamper-resistant (406.11) and weather resistant (406.8) receptacle outlets.

32. A customer is installing a new piece of equipment in an accessory building at his facility. The building presently is supplied with a 200 ampere feeder from the main facility, which with the present load will not be large enough. We have proposed adding another 200 ampere feeder and disconnect however the inspector says we can have only a single feeder to the building. I know we could parallel the new feeder with the old but we would need to change the breaker in the main facility to 400 ampere and either change the panel in the accessory building to 400 ampere or splice the conductors and then supply the 2 disconnects. Either way it is becoming more costly. Do we have any other options?

Ans. Comm 16 provides an alternative. 225.30, Comm. 16.225(3)(a)

225.30 indicates a building is allowed to be supplied by only 1 feeder or branch circuit. However Comm. 16.225(3)(a) allows multiple feeders that are supplied from the same distribution point, rated 300 amperes or more and supply not more than 6 disconnecting means grouped at the same location are considered one supply. If you install the new feeder from and to the same location as the existing one it would be compliant.

33. As an inspector why do I keep seeing side lights installed by electricians on surfaces that don't provide a weatherproof seal?

Answer: Most will blame it on the siding installer when in fact 410.10(A) requires the luminaire to be installed to prevent the entry of water into the wiring compartment. Arlington Industries is one who has product to correct this problem.

34. I bought an old warehouse. The existing lighting circuits were run with EMT and located on the top of the steel trusses and just under the metal roof deck. Focus on Energy did an energy audit and helped us design a new lighting system. I asked my local inspector if we can we extend these conduits to the new lighting locations. He said "call the state." Is this OK if the new conduit and boxes comply with the current electrical code?

Answer: Yes Comm 16.003-(3)

Point out that 300-4(E) now prohibits this practice. Note that all new conduit must be installed at least 1-1/2 from the nearest surface of the decking.

Extension boxes may be required to meet this requirement. An alternative is using IMC or IMC into the existing box and switching to EMT once the raceway is 1-1/2 inch from the nearest surface of the roof deck.

35. In a building where legally required standby power is required for elevators must every elevator be provided with this power?

Answer: Ultimately yes IBC 303.1.3 Where there are multiple cars at one location each car is required to recall to a designated level keeping one elevator in operation from legally required standby power and should that car fail power must automatically transfer to the next designated car.

36. When installing paralleled 3/0 THHW copper conductors in separate raceways for a 400 ampere feeder we installed a #6 AWG equipment grounding conductor in each raceway. The inspector has now told us we need a minimum #3AWG copper conductor. I say a 3/0 THHW conductor is only good for 200 amperes so why do we need such a large equipment grounding conductor?

Ans. The inspector is correct. 300.3(B)(1), 250.122(F), Table 250.122

300.3(B)(1) and 250.122 indicate that where conductors run in parallel in separate raceways or cables an equipment grounding conductor be installed in each raceway or cable and it be sized using Table 250.122 for the overcurrent device protecting the circuit. Remember if you were using MC cable you may have to special order it to have a large enough equipment grounding conductor in each cable.

37. The inspector wants me to replace my 6x6 wireway with one that is 6 x 24 because of my 2" raceway entries. What is he talking about? All my conductors pass straight through in line with the nipples above!

Answer: NEC 376.23(B) says when wireways are used as pull boxes, the distance between raceway entries must comply with 314.28(A)(1) for straight pulls and 314.28(A)(2) for angle pulls. These rules apply to 4 AWG and larger conductors. If this is the case, the space between raceway entries is 8x the largest raceway diameter for straight pulls and 6x for angle pulls.

38. Section 700.16 requires emergency egress lighting systems be designed using at least 2 lamps to light the area. Would a 2-lamp, two ballast fluorescent fixture meet this requirement?

Ans. Yes 700.16

700.16 states, "Emergency lighting systems shall be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency lighting. This requires the use of 2 lamps with two ballasts in a space illuminated by only one fixture. This situation is unusual inside of the building. Normally egress route are designed such that multiple fixtures provide the required illumination. It may occur outside of the building such as at exit discharge.

39. Many times we have to make our own knockout openings into equipment. When measuring for wire-bending radius do we measure from the conductor entry or the nearest part of the raceway or auxiliary gutter?

Answer: In the present arrangement NEC 312.6(B)(2) applies and the measurement is taken from each terminal to the side of the enclosure where the conductors enter. If parallel 3/0 conductors the space from each terminal to the side of the enclosure shall be a minimum of 6 1/2".

40. The lights in a new "big-box" discount store are connected with a manufactured wiring system. The overhead lighting fixtures have a cord that terminates in a "T" connector. The "T" connector is plugged into wiring system at the nearest steel truss. The truss is located above and about four feet off to one side of the light fixture. Is this OK?

Answer: No. NEC 410.62(C)(1) page 272. "The luminaire is located directly below the outlet".

41. I have a free standing 400A meter pedestal containing a 200A circuit breaker for the house and a 100A circuit breaker for the wind co-generation. Is this meter socket required to have an arc flash warning label?

Answer: Yes NEC 110.16. These are listed as panelboards with metering. The Code requires application of an arc flash hazard warning label.

42. I am confused about the meaning of 310.4(E). Can you please explain?

Ans. This allows the use of several smaller equipment grounding conductors laid under the outer sheathing of cables. 310.4(E), 250.122

This type of construction is called a "segmented equipment grounding conductor". It is typically found in larger sized multi-conductor flexible cord. It involves using smaller equipment grounding conductors that lay under the outer covering and between the insulated conductors. The total of these multiple conductors must combine to meet the requirements of 250.122 for sizing of equipment grounding conductors.

43. Many communities have had their commercial and other wiring submerged from flooding. The Utility disconnects the power from the submerged area then re-energizes it when the water subsides. Who inherits the liability for this flood damaged wiring since it was never replaced?

Answer: Utilities usually require an inspection of the wiring prior to re-energizing. We aren't legal consultants. The Utility and property owners are probably jointly responsible unless someone provided an inspection and approved the re-energizing. This equipment is required to be replaced. Comm 16.010 and NEC 110.12(B). See www.NEMA.org for a position paper.

44. We are installing a new circuit about 20' across a roof top to supply a new air conditioning unit and am concerned about the possible high ambient temperatures. Do you think will need an expansion joint in this conduit? We are using PVC conduit exiting the building from a step wall and entering the bottom of the disconnecting means.

Ans. Yes 352.44, Comm. Table 63.0302

NEC 352.44 indicates that in accordance with Table 352.44 it is determined an expansion of 1/4" or greater will be achieved an expansion joint is required to be installed. Comm. Table 63.0302 of the energy code indicates a temperature range between -15 to 87 degrees F in Green Bay for a change of 102 degrees. Using Table 352.44 Example: 105 degree change = 4.26" per 100'. $4.26/100 = .0426$, $.0426 \times 20 = .852$ " of expansion.

45. I have an emergency generator that is installed less than 20' from a Utility transformer. Are there any options other than moving these further apart?

Answer: Comm 16.700(2) requires 20' separation or a noncombustible wall may be constructed between them. The wall must extend a minimum 3' past the width of the generator and transformer and a minimum of 1' above the highest piece of equipment.

46. The utility gave us a 200-ampere, 480-volt, 4-wire service for the fire pump. We used 4/0 copper conductors for the phase legs to meet the voltage drop requirement. Do we have to bring the neutral from the CT cabinet to the fire pump controller? If so, how do we size it since it will not carry any load.

Answer: Yes. 250.24(C)(1) and 310.4(A)

When supplied by a grounded service a grounded service conductor is required to be brought to each service disconnect. Based upon the 4/0 phase conductors, a 2 AWG grounded neutral conductor is required. Table 250.66 was used to size the neutral.

47. I have gasoline and diesel above-ground storage tanks located adjacent to each other with a concrete wall across the back of them. Please explain the classified boundaries for this installation.

Answer: The gasoline creates the hazard. NEC 515.3 says there is a 10' Class 1 area extending out from the gasoline tank (except where blocked by the concrete wall), tank vent, and fill opening. NEC 514.3(B) says there is a Class 1 area from grade up 18" extending a 20' radius from the dispenser.

48. We recently finished a 24-unit apartment building. We mounted a 24-inch fluorescent fixture over the sink in each of the bathrooms. The fixture is mounted to a plastic box we roughed into the wall. The inspector wants us to drill out the opening in the fixture over the box. We think that will violate the listing of the fixture. What do you think?

Answer: Opening required per 410.24(B)

49. I recently requested a short circuit study for a emergency system. The electrical contractor faxed me a one page statement with several pages of time-current curves. I think they forgot the curves for the breakers on the normal side of the transfer switch. The statement indicated that the emergency overcurrent devices would be selectively coordinated for most faults. Is this acceptable evidence that the emergency system meets the Code?

Answer: No. 700.27.

You need a one line diagram to verify all devices included in the study. 700.27 requires emergency overcurrent devices be coordinated with all side devices. The overcurrent devices in the emergency system must be coordinated with upstream normal supply devices. The upstream normal side devices do not have to be selectively coordinated with each other. Any overlap between devices on the time-current-curves must be justified. Examples of justification are devices of the same rating in series, devices on the primary and secondary of transformers, and devices tested with each other for selectivity.

50. I installed two combination starters across from the air handlers that they controlled. The tinner ran the ducts directly over the starters. There is about

five foot of headroom so the starters are still readily accessible. I just wear my hard hat so I don't ground out my skull when I'm trouble shooting the air handlers. Is this OK?

Answer: No. 6-1/2 feet of headroom required per 110.26(A)(3) and 110.26(E). basic trouble-shooting tasks include testing for voltage, current measurements, replacing fuses. Since the electrical worker is exposed to voltage while performing these tasks, Section 110.26(A) applies.

51. We just finished a PV system on the roof of a local natural food co-op in Thorp, WI. We were surprised when the state inspector climbed a 30-foot extension ladder to inspect the array. We were also surprised when the inspector ordered all of the wiring between the modules and the combiner box to be run in conduit. Is the conduit required?

Answer: No. 690.31(A) Definition of "Readily Accessible"

52. I did a rough-in for a new warehouse. The lighting circuits were run with EMT and located on the top of the metal roof deck. I would not approve the installation and pointed out that 300-4(E) now prohibits this practice. You told us last year that the intent is to protect the EMT and conductors from damage from the screws used to hold down the roof insulation. The contractor responded that 300.4(E) only applies to cables and raceways under the roof deck. Who's right?

Answer: You are. 300.4 and 358.12(1). Probability of severe physical damage is high. 358.12(1) prohibits use of EMT "Where, during installation or afterward, it will be subject to severe physical damage." Protection required. Alternative acceptable wiring methods are RMC or IMC without protection.

53. I am bidding on a 5 story building. The lower levels are parking, the first floor is retail, and the upper 4 floors are residential. The above ground portion of the building is Type VA construction. The lower levels are Type II. Is Type NM cable and Type SER cable restricted to the residential areas only?

Answer: Permitted throughout. NEC 334.10(2), Comm 334-(1) and Commerce interpretation on Type of Construction.

Commerce Building Code officials have indicated that the lowest rated class of construction can be used to determine acceptable wiring methods. The lowest rated class of construction is the highest number. So this building would be treated as a Type VB construction for the purpose of acceptable wiring methods.

54. Our local hospital is building an new addition. The upgraded generators supply new transfer switches for the life safety, critical care and equipment branches. I requested and received a coordination study. The new feeders are protected by circuit breakers set to trip after 6 cycles in order to achieve coordination. Is this a problem?

Answer: Yes. Comm 16.110-(1). Transfer switches have marked short circuit ratings. The ratings often vary as the transfer switches are tested with developed with specific breakers and fuses. The label on the transfer switch will give both the short-circuit current and the type of permitted devices. These ratings are developed through testing. The protective device operates within 3 cycles or 1/20 of a second. Consult with the transfer switch manufacturer to verify. Some manufacturers have begun to make transfer switches that have been successfully tested with protective devices with longer clearing times. Electrical products must be used in a manner consistent with the testing, listing and manufacturer's instructions.

55. When the inspector completed the final inspection on a small office building he indicated we needed to provide emergency egress lighting on the exterior side of all required exits. We installed a two lamp fixture and supplied it from the battery of unit equipment located inside the building. We used Type NM cable for the circuit from the battery to the light fixture because we had to fish it down the wall. Now he has indicated it is required to be in a raceway which is going to be difficult to install in the existing wall. Any other ideas?

Ans. Flexible wiring methods are allowed. Comm. 16.700(a)

Comm. 16.700(a) indicates emergency wiring is required to be installed in listed raceways, Type AC and MC cable. Raceways would include flexible metal conduit, ENT or smurf tubing, liquidtight etc.

56. We recently finished wiring a new nursing home. There is a small store room next to a kitchen that has a sink and 2 refrigerators. We did not install GFCI protection for the refrigerators and now the inspector has indicated it is required for all receptacles in this room because it is a kitchen. Is this correct?

Ans. No Art. 100, 210.8(B)(2)

Art. 100 defines a kitchen as "An area with a sink and permanent facilities for food preparation and cooking." 210.8(B)(2) requires GFCI protection for all receptacles in a kitchen. Remember 210.8(B)(5) requires GFCI protection for receptacles within 6' of a sink.

57. When supplying battery back up exit lights can I run a separate circuit and supply all of the units for this building on the same circuit?

Ans. No NEC 700.12(F)

When supplying unit equipment 700.12(F) requires them to be supplied from the branch circuit supplying the normal lighting in the area. The exc. in a

separate uninterrupted area with a minimum of 3 normal lighting circuits allows a separate circuit where it originates in the same panelboard as the normal lighting circuits and is locked on.

58. A customer is constructing a second building and we would like to supply it from the existing 800 ampere 120/240 volt service. Presently there are 3-200 ampere service disconnects located in the equipment room of the existing building. We are planning to add a 200 ampere service disconnect on the outside of the building and install a feeder to the new building. Will this be OK?

Ans. No 230.71

Up to 6 service disconnects for each service permitted by 230.2 are allowed to be installed at the same location. The new switch would need to be located inside, grouped with the existing switches, or install a single 800 ampere switch for the service disconnect. Also Comm. 16.230(4) requires a disconnecting means where utility wiring terminates and premises wiring extends to more than one structure.

59. We are installing some new equipment in an existing feed mill. They grind, mix, and store feed at the mill. What would be the proper Class of wiring for the installation?

Ans. Class II requirements would apply in some areas. 500.4, 500.5(C), 502.10

500.4(A) indicates documentation shall be provided designating the hazardous locations. Class II locations are locations where there is a presence of combustible dusts which would include most grain dusts. Division 1 locations are locations where dusts are present under normal operating conditions in quantities sufficient to ignite or produce an explosion. Div. 2 locations where dusts are not normally present in sufficient quantities to ignite. 502.10 indicates the wiring methods allowed. If Div 1 generally rigid or intermediate steel conduit if Div 2 any of the wiring methods allowed in Div 1 as well as EMT or dust-tight wireways.

60. We are doing a condo project in Door County and used ground rods for our grounding electrode. The rock up here is 2' to 3' down at best so we laid the rods end to end in a ditch. When the inspector did the service inspection he red tagged it and indicated the rods could not be installed this way. What else can we do?

Ans. Ground rods are allowed if properly installed. 250.53(G), 250.56, Comm. 16.250(1)

Ground rods are allowed to be laid in a trench 30" deep where they cannot be installed vertically or at a 45 degree angle. 250.56 requires that where 2 rods are installed they shall be installed not less than 6' apart. Comm. 16.250(1) indicates 2 ground rods are always required. You could also install a ground ring of a minimum 2 AWG bare copper conductor encircling the building as allowed in 250.52(A)(4).

NEC 250.52(A)(3) requires connection to the rebar if installed in the footing. No rods are then required.

61. The new Pick' N' Spend store has all of the store lighting on the stand-by generator. The generator also supplies power to the computers and point-of-sale terminals. There is only one transfer switch. They also have some battery power emergency lighting down the main aisle. Is this legal?
Answer: No. 700.9(B), 700.1, 701.1, IBC 1006.3, 1006.2 Emergency egress lighting is required for all egress paths. Unit equipment could be installed for all paths or a separate transfer switch and wiring system for the emergency lighting would be required.

62. I did a rough-in inspection for a new brew-pub up north. I questioned the use of Type AC cable because it did not contain an equipment grounding conductor. The electrician seemed knowledgeable. She told me that AC cable is permitted in assembly occupancies of Type II construction. She also indicated that the state inspector had recently stopped by and would have had to be blind as a bat to have missed this. What do you think?
Answer: Permitted. NEC 518.4(A)

63. I wired a 800-ampere single phase service. Two PVC conduits connect the CT cabinet and the service equipment enclosure. The phase conductors are 750 kcmil aluminum in parallel. Do I need an equipment ground between the two enclosures?
Answer: Yes. 250.102(C). Several options permitted. 1) Bond in CT and use neutral. Calculate minimum size based upon Table 250.66 or 12-1/2 % of phase conductor size. Minimum size in this case is 2/0 copper or 4/0 aluminum 2) Pull bonding jumper back from bonded SE enclosure. One bonding jumper in each conduit. Calculate minimum size based upon Table 250.66 or 12-1/2 % of phase conductor size. Minimum size in this case is 1/0 copper or 3/0 aluminum. One bonding jumper required in each conduit.

Point out that 4 AWG is always too small for services rated above 200-ampères.

64. The owner of a chain store specified a manufactured wiring system for the overhead lighting. The wiring system is pulled through open-web, steel

trusses. Can the cables be secured to the trusses with cable ties? If so how often? Can the excess be rolled up at each light?

Answer Yes. It depends on the wiring method. Yes. NEC 338.20(A) & (C), 330.30(A) & (C). AC cable shall be support every 4-1/2 feet. MC cable shall be support every 6 feet. The coil of the excess cable is similar to "bundling". A couple of coils are probably OK. Use NEC Table 310.15(B)(2)(a) and the exceptions as a guide.

65. 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. There are some limited exceptions. 517.30(C)(3)(a),(b),(c), or (d)

517.30(C)(3) requires mechanical protection for emergency circuits in a hospital. MC cable is only allowed in listed prefabricated medical headwalls, listed office furnishings, or where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage, or where necessary for flexible connection to equipment. such as to supplying fixtures in a suspended ceiling. Unless the installation meets the list of examples the installation is limited to nonflexible metal raceways in (1). First comply with 517.30 and the list of permitted installations in (3) and if they are acceptable they also must comply with the redundant grounding requirement of 517.13.

66. We are involved in a remodel on a condo unit. We will be extending an existing non-AFCI protected circuit for a few additional receptacles. Do we need to provide AFCI protection for these new receptacles?

Ans. No 210.12, Comm. 16.003(3)

AFCI protection is required for branch circuits in dwelling unit rooms indicated in 210.12. These rooms include family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunroom, recreation rooms, closets, hallways, or similar rooms. If you are installing a new circuit to one of these rooms AFCI protection would be required however if you are only extending an existing circuit you would not be required to protect it. Comm. 16.003(3)

67. A project we are working on has a separate room for computer equipment. It has a raised floor and we will be installing receptacles under a raised floor to supply the equipment. I believe we should be meeting the requirements in 645.10 for disconnecting means however the owner does not want a

disconnect which could accidentally be turned off. Valuable data might be lost. What do you think?

Ans. Using 645 is the owner's choice.

If you want to call it an Information Technology Room it would need to meet all of the requirements in 645.4.

- (1) Disconnecting means is required complying with 645.10.
- (2) Required to have an HVAC system dedicated to the room or if supplied by an HVAC system serving other areas would require smoke and fire dampers, operated by smoke detectors and the disconnecting means.
- (3) Listed IT equipment in room.
- (4) The room is occupied only by personnel needed for maintenance and operation of equipment.
- (5) The room is constructed of fire resistant walls, ceilings, floors and protected openings. NFPA 75 indicates this is 1 hr construction.

645.10 requires the disconnecting means shall disconnect all of the electronic equipment in the room, all of the HVAC equipment and close all required fire/smoke dampers, and it shall be located in a readily accessible location at the principle exits.

If you do not meet all of these requirements you would not be allowed to use the receptacles located under the raised floor as 645.5 allows. Instead you would be required to meet 400.8 which does not allow flexible cord to be run through holes in floors.

68. We recently wired a large grain storage bin. It consists of a large steel structure with several blowers located at different locations to blow air through the corn to dry it. Our service is located at the bin and we ran PVC conduit with separate branch circuits to each motor controller which is located at each motor. Do we need a disconnecting means at each location?

Ans. Yes 430.102

A disconnect is required within sight of a motor controller by 430.102(A). Also 430.102(B) requires a disconnecting means within sight of a motor. If the disconnect for the controller is also within sight of the motor it would be permitted to also serve the motor. The exception allowing the use of a locking means at the controller disconnect location to eliminate the motor disconnect now is only allowed where it is impracticable to locate a disconnect at the motor such as a submersible pump.

69. On a new office building job we installed 4-wire 120/208 volt networks for most of the receptacle and lighting branch circuits. We installed single pole breakers because none the circuits were terminated on the same device. When the electrical inspector did the final inspection he indicated we are

required to use 3-pole breakers for each network. I say if we don't terminate more than one circuit on a receptacle we can use single pole breakers. Who is right?

Ans. The inspector 210.4(B)

This changed with the 2008 NEC. Each multi-wire branch circuit is now required to be provided with a means to simultaneously disconnect all ungrounded conductors at its supply whether or not it terminates on the same device. This can be done with a 2 pole breaker for single phase or a 3 pole breaker for 3 phase systems or 2 or 3 single pole breakers with approved handle ties.

70. We are a mid-size electrical contractor doing a design/build of a new ambulatory surgical center up north. To save the owner some money, we bid the job with a single generator supplying an emergency panelboard. One feeder supplies the life safety transfer switch. The life safety loads are mainly emergency lighting. The second feeder supplies the critical loads. These are a couple of circuits for the operating room lights, ventilation, and receptacles. The third feeder supplies some optional loads including the computers used to register patients and send them bills. The state building inspector said it did not look right and is calling in the state electrical inspector. What do we need to do before he gets up here?

Answer: Get out your Code book. 700.9(B). Several options available that permit taking a single feeder from an emergency source. None permit the feeder to supply a panelboard.

71. We are debating the use of Type NM cable in a new dentist's office. The office will be in one of the existing tenant spaces in a shopping center. The whole place is wired with Romex now. There will be no oral surgery. They will only do fillings, cleanings, and teeth whitening. They also have a tanning bed. Our debate is on 517.10. We don't think Part II applies since the dentist does not do surgery. What do you think?

Answer: Part II applies. 517.2, 517.10(A), (B), 517.13. Comm 16.334-(1).

72. Our company does a lot of farm work. We often come across barn panels with a three-wire, single phase supply. We know that this is not longer legal. We also see sub-feeds in the barn that are wired with type SE cable. We tell the farmer that this causes "stray voltage". Was this ever legal?

Answer: No. Order 13-2523, Volume No. 2 of the 1944 Wisconsin Electrical Code. Comm 16.003-(3) does not apply.

"No connection to a grounding electrode shall be made to the grounded circuit conductor on the load side of the service disconnecting means, except as provided for in Order 13-2524. Order 13-2524 is "Two or More Buildings Served by a Single Service".

73. Would you explain the requirements in 210.5(C) for the identification of ungrounded conductors.

Ans. Separate identification required for each system. 210.5(C)

When you have more than one voltage system in a building you are required to separately identify each phase or line and system at each termination, connection, or splice point. This can be done by color coding, tagging or other approved means. The means of identification is also required to be posted at each panelboard or otherwise documented and made readily available.

Comm. 16.210(1) has a Note recommending colors of brown, orange, and yellow for 277/480 volt systems and black, red, blue for 120/208 systems. Remember FPN are not enforceable. Also if you had a single phase 120/240 volt system in this building you would need a 3rd method of identification.

74. I am replacing several existing receptacles in an older apartment building because they no longer hold the plug securely. Do I need to install tamper resistant receptacles?

Ans. No 406.11, 210.52, Comm. 16.003(4)

The requirement for the installation of tamper resistant receptacles became effective Jan. 1, 2010. 406.11 indicates all 15 and 20 ampere 120 volt receptacles specified in 210.52 shall be listed tamper resistant receptacles. 210.52 indicates the requirements for receptacle locations in dwelling units and would require all of the 15 & 20 amp 120 volt receptacles installed in the dwelling unit, garage, basement, outside etc. to be tamper resistant. Comm. 16.003(4) indicates repairs made to existing installations to comply with the code that applied at the time of installation.

75. 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 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.

76. 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.

1) 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.

2) 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.

3) Where 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.

4) You may have difficulty finding suitable lugs to accommodate multiple conductors in the transformer.

77. By the time we were hired to wire a small condo project the footings were already poured. The mason told us there was no rebar in the footings. What do we use now for an electrode?

Ans. Install one of the other grounding electrodes allowed. NEC 250.50, 250.52

NEC 250.50 requires all of the grounding electrodes described by 250.52 that are present to be used and bonded together. 250.52 lists the items permitted to be used as grounding electrodes. These are a metal underground water pipe, the structural metal frame of a building, a concrete encased electrode, a ground ring, rod or pipe electrodes, plate electrodes, or other metal underground systems or

structures. You do not have to install a concrete encased electrode. However, if re-bar is installed you are required to use it.

78. I see Article 680 requires GFCI protection for pool pump receptacles. Is GFCI protection also required for hardwired pool pumps installed more than 20 feet from the pool?

Answer: Yes. 680.22.(B). 680.22(B) requires GFCI protection for certain branch circuits supplying pool pump motors. It applies to branch circuits rated 15- or 20 amperes that supply receptacles that are rated 125- or 250-volt, single phase.

The 2008 NEC extended this requirement to permanently connected pool pump motor regardless of proximity to the pool. However, the requirement still applies only to pump motors that rated at 125-or 250-volts, single phase.

79.