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Note: These questions and answers are for discussion purposes only and do not represent a formal interpretation by the Western Section International Association of Electrical Inspectors or any of the code panel participants and their respective organizations. For an interpretation of a particular installation, we refer you to Section 90.4 of the* National Electrical Code® *and recommend that you contact your local Authority Having Jurisdiction.

1. Please explain the difference between listed and approved as addressed in the NEC.

Approval is what the authority having jurisdiction does to an electrical installation. The definition from Article 100 is:

Approved. Acceptable to the authority having jurisdiction. Typically approval of listed equipment will more readily be given by an authority having jurisdiction where the authority accepts the laboratory's listing mark.

Listing is performed by a recognized testing laboratory. The acceptable labs in your jurisdiction may be a state, county, or local decision. Some may use the NRTL program that is run by OSHA. Some have their own certification programs

2. What is the real difference between an Emergency System and a Legally Required Standby System?

The definitions of these are very exact, but the interpretation of what classification some things fall into can be confusing.

Emergency Systems

Emergency Systems are the systems that the NEC mandates as a legally required AND classed as an emergency system by municipal, state, federal and other codes or government agencies. The emergency system automatically supplies lighting, power or both to areas or equipment that the AHJ determines needs power or lighting in the event of a failure of utility power. This classification is applied in areas where an interruption in the normal supply can cause safety risk or cause human life to be put at risk. Emergency systems are usually required in places of use or occupancy by a large number of people such as hotels, office building, theaters, sports arenas, parking garages, health care facilities, etc.

Emergency systems traditionally supply lighting for safely exiting a building upon loss of power. The system can also supply loads like ventilation, elevators, fire pumps, alarm systems, safety communication systems and any other systems that the AHJ rules is needed to protect human life. Some of the emergency loads can be loads that do not necessarily affect life safety, but do create an ideal situation for more efficient fire fighting.

The other important differentiation between emergency and standby power is that in addition to being an automatic system, the emergency system is a totally separate system. It is run as its own free standing supply with its own panels and automatic transfer switches (though it can share power generation from prime mover or UPS). The wiring MUST be run in separate raceways and conduits.

Legally Required Standby Systems

The next level of backup systems is the legally required standby system. These are systems that municipal, state, federal or other codes or governmental agencies legally require for a facility, but they are not required to be on their own dedicated emergency system.

These systems are required to automatically transfer upon the loss of normal system power. These loads are traditionally heating, refrigeration, communications systems, ventilation systems, smoke removal systems or industrial processes that if interrupted could create hazards or hamper rescue or fire-fighting operations. A great example of this is fire pump systems. The NEC does not require back up power for a fire pump (which would make it an emergency system), but many jurisdictions do decide to classify a fire pump as either an emergency system or required standby system. The AHJ will make the determination, and the way these systems are wired will depend on the final classification.

In addition: As you know terminology is always very important. When speaking to contractors and owners many times they use the reference "I'm installing an emergency generator for backup power". This is incorrect in the fact in reality

they are installing a generator for OPTIONAL STANDBY SYSTEMS ARTICLE 702. Anytime I speak to someone about a generator the first thing I do is clarify is this a 700, 701, or 702 system.

3. Are expansion fittings required where a conduit emerges from the ground and runs up a wall to a junction box? For arguments sake, the expansion will exceed ¼ inch. Is the earth considered a "securely mounted item"?

Reference 300.5(J), 300.7, 352.44 (PVC Conduit). For nonmetallic conduit the answer is an expansion fitting shall be required for any expansion of contractions that will exceed ¼ inch per the Article's Section .44 such as 352.44 for PVC Conduit. Metal conduits do not have a ¼ inch requirement stated. For metal conduits you refer to Section 300.7 which states an expansion fitting is required for thermal expansion and contraction, but does not give a distance. This makes it a judgment by the AHJ.

The earth is considered a securely mounting means; however Section 300.5(J) makes us aware that the earth may be subjected to movement because of settlement. Because of this it is very common for expansion fittings to be installed at the meter.

4. Would section 250.56 (2008) 250.54 (2011) apply to parking lot pole bases, traffic signal poles and the roadway lighting pole bases that do not have the electrical service on it? Most of the authorities request a ground rod to be installed at each location and attached to the steel or aluminum parts of the pole.

Yes, this is just for additional lightning protection and is not required by the NEC, although it may be specified by the designer. As stated it cannot be used as a fault return path.

5. Can a dry type transformer be loaded to its full rating (i.e. can a 75 kva transformer be used with 75kva of load) or is the maximum load 80%?

Reference: NEC 450.3 Answer: Yes– OCP typically sized at 125%

6. Could you explain the difference between primary injection testing of Ground-fault protection and secondary injection testing?

The two Code references that require testing of Ground Fault Protection for Equipment (GFPE) are 230.95(C) and 517.17. While neither of these sections detail how to conduct they do specify that the test is to be conducted in accordance with the manufacturer's instructions that are provided with the equipment. Primary injection is completed using a low voltage / high current test source to simulate the ground fault current condition. Where there are external sensors, a cable can be wrapped around the sensor with so many turns and the current source supplies the test current multiplied by the number of turns. For solid state trip breakers where the sensors are internal, then the cables are connected to the line and load side poles, including the neutral sensor, in series to effect a current multiplier and verify sensor polarity is correct. In addition any external control power must be energized. Using the ANSI/NETA Acceptance Testing guidelines, there is usually a "pickup current test" to see the calibration of the relay setting, then some timing test at 200% and 300% or so of the pickup current. The last test required is to open the neutral disconnect link or isolate the load neutral bus and conductors in some manner then test to ensure downstream neutrals are clear of ground. This is typically done with a megger but can be done with a bell and battery continuity tester. Secondary injection is similar except the manufacturer's test set, or in some cases a regular current source, is used and a much smaller current representing the output of the Ground Fault sensors into the electronics is injected. Same as primary injection, the neutral must be testing for improper downstream grounds. The advantage of the primary injection is a more true representation of the operation of all the system, but it does require some bulky equipment and many times a power outage of the utility for safety of the test personnel. The advantage of the secondary inject is that for solid state breakers an utility outage is not required, but in many cases connection or verification of the sensors being connected correctly or being operational is sacrificed.

7. Please explain the electronic ballast FCC47cfr class A and B ratings. How critical is it not to use class A type in residential use?

Let me start off by saying I find the FCC requirements confusing at times.

Class A- Commercial grade

Class B- Residential grade

First of all I want to say there have been no safety issues when using commercial grade ballast in a luminaire that would be installed in a residential setting. I would also mention there has been several proposals submitted to UL to change the ballast standard and several those proposals have been either turned down or the committee couldn't come to a consensus.

As an example when a homeowner goes to a box store and picks out a troffer type lay in florescent luminaire (which could be installed in a commercial building) nothing is stopping the customer from purchasing it and installing it in their home. That is a good example why homeowners may be getting commercial rated ballast in the home. Although, Lowe's does offer homeowners advice on which ballast to buy, but not on which fixture to buy. I will also say that lighting manufacturers would always encourage the use of residential rated (Class B) ballast in any luminaire that would be installed in a residential structure to meet the FCC limits to lower the possibilities of interference with other electronic equipment in the home. However, there haven't been enough instances or evidence to show that electronic ballast was the cause of the problem and that is why little movement has been made with raising the awareness of using commercial grade ballast in a residential building.

8. Does a satellite TV system fall under Section 810 or 820 and should a permit be issued and inspections made on the installation?

A satellite TV system is included in the scope of Article 810 in Section 810.1.
810.1 Scope. This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, and dish and also covers the wiring and cabling that connects them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.
Section 810.3 Other Articles states in the last sentence: … Coaxial cables that connect antennas to equipment shall comply with Article 820.
Should a permit be issued and inspections made? The National Electrical Code does not specify when a permit is required or when inspections shall be made. This is normally in the administrative rules of the municipality or state. It has to comply with the code and in my opinion should be inspected.

9. I have a 3000 amp generator with no main breaker, the conductors from the generator terminals to the first distribution switchboard is over 115% of the nameplate current of the generator. The overcurrent protection is set at 3200 amps. Is this OK?

Main breaker is not required. Section 445.13 requires the conductors from the generator terminals to the first distribution device(s) containing overcurrent protection to have an ampacity of not be less than 115 percent of the nameplate current rating of the generator.

Depending on the voltage of the system, ground fault protection may be required in accordance with 215.10.

10. Can you legally use a roll of NM cable with cord ends installed as an extension cord?

Yes, as long as the "NM Extension Cord" is used in a dry location and on a temporary basis.All the requirements of Article 334 must be observed. Such as:
334.10 Uses Permitted
334.12 Uses Not Permitted
334.15 Exposed Work

We would also need to be sure that the attachment cord caps were indentified for solid wire termination.

11. What is the separation distance for communication conductors in a raceway from power conductors?

Reference: 800.133(A)(1)(d)Exception No. 1. 800.133(A)(1)(d) states that communication conductors from the power conductors are not allowed to be installed in the same raceway unless we comply with Exception Number 1. Pertaining to Exception Number 1, there is not a distance requirement for separating the communication conductors from the power conductors within a raceway as long as the two conductors are separated by a permanent barrier or listed divider.

Multi-Channeled Surface Raceways are commonly used with both power and communication conductors and are designed with a permanent barrier.

12. Can SO cord be dropped from a bar joist to a display shelf (end cap) and hard-wired to a junction box on that display unit or does it have to be installed in conduit?

The answer is NO, but let's look at the code, we know article 400 covers this since 400.1 scope states it covers applications and requirements. Table 400.4 lists Type SO as suitable for portable and pendants. This may not work. 400.7 lists acceptable uses but none would permit the hardwired connection.

13. Can I install GFCI protection on the feeder to a sub-panel for a pool installation instead of the insulated equipment ground conductor in a raceway?

Reference: NEC 680.25(B)
Answer: NO

14. What type of "connection" is required for the anchor bolts on a steel column to the re-enforcing steel in the footing for the column to be considered OK for the structural steel to be an approved grounding electrode conductor?

The reference is found in 250.52(A)(2). The hold down bolts also called the "J" bolts must be in direct contact with the rebar in the footing supporting the structural metal column. The connection can be by welding, exothermic-welding, steel tie wires, or other approved means. The key is that there must be direct contact and not contact that is just through the concrete itself. Note that the electrode is now defined in Article 100 and here as that part in the earth. The steel structure that is above grade is now a grounding electrode conductor covered by 250.68(C).

250.52(A)(2) Metal Frame of the Building or Structure. The metal frame of the building or structure that is connected to the earth by one or more of the following methods:

(1) At least one structural metal member that is in direct contact with the earth for 3.0 m (10 ft) or more, with or without concrete encasement.

(2) Hold-down bolts securing the structural steel column that are connected to a concrete-encased electrode that complies with 250.52(A)(3) and is located in the support footing or foundation. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, the usual steel tie wires, or other approved means.

15. If the data cable manufacturers can make a cable with an acceptable covering for air plenums, why can't the electrical cable manufacturers make a non-metallic electrical cable suitable for ceiling air plenums?

There are several issues that you need to think about:

If the NEC would allow NM-B cable to be installed in commercial buildings in dropped ceilings (plenum) then there would be that type cable available.

334.12 Uses Not Permitted.

The list of uses not permitted for Type NM cable given in 334.12 is not complete. Restrictions exist elsewhere in the code. For example, Type NM, nonmetallic-sheathed cables are not permitted to be installed in ducts, plenums, and other air-handling spaces. See 300.22, which limits the use of materials in ducts, plenums, and other air-handling spaces that may contribute smoke and products of combustion during a fire.

(A) Types NM, NMC, and NMS. Types NM, NMC, and NMS cables shall not be permitted as follows:
(1) In any dwelling or structure not specifically permitted in 334.10(1), (2), and (3)
(2) Exposed in dropped or suspended ceilings in other than one- and two-family and multifamily dwellings

16. How many #12 AWG, 2 conductor w/gnd. NM cables can I bundle before it actually affects the size of the overcurrent protection rating for a 20 amp circuit?

The bundling issue and the ampacity adjustments for fire blocking are the same and located in 334.80.

334.80 Ampacity. The ampacity of Types NM, NMC, and NMS cable shall be determined in accordance with 310.15. The allowable ampacity shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations, provided the final derated ampacity does not exceed that of a 60°C (140°F) rated conductor. The ampacity of Types NM, NMC, and NMS cable installed in cable tray shall be determined in accordance with 392.80(A).

Where more than two NM cables containing two or more current-carrying conductors are installed, without maintaining spacing between the cables, through the same opening in wood framing that is to be sealed with thermal insulation, caulk, or sealing foam, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(3)(a) and the provisions of 310.15(A)(2), Exception, shall not apply.

Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining spacing between cables, the allowable ampacity of each conductor shall be adjusted in accordance with Table 310.15(B)(3)(a).

How many, Four, 2-conductor cables is eight conductors and is in the 70 percent adjustment factors of Table 310.15(B)(3)(a). Adjustment Factors for More Than Three Current-Carrying Conductors 4-6 is 80%, 7-9 70%, and 10-20 50%... The conductors are rated at 90-C for derating purposes and a 12 AWG in the 90-C column is 30 amperes. The 30 amperes times the 70% adjustment factor gives you 21 amperes and a 20 amp breaker will be fine.

17. Why doesn't the Code just do away with allowing non-grounding receptacles and just require replacement with GFCI receptacles and grounding receptacles downstream? Then all the receptacles could be tamper-resistant.

I look forward to your proposal.

There is a major change in 406.4(D) on replacement receptacles. However, Section 406.12, exception (4) does not require nongrounding type replacements to be tamper resistant. I am not aware of any manufacturer that makes nongrounding-type tamper resistant receptacles.

18. A power supplier requires a disconnecting means ahead of the meter (across the line only) for a 277/480 volt service. Can this be considered the service disconnect? Does it have to be used as the service disconnect? What about isolating the neutral from the meter socket enclosure?

(1) Yes, if provided with overcurrent protection. 230.90(A) requires overcurrent protection in series with each ungrounded service conductor.

Meter disconnect switches that have a short-circuit current rating (SCCR) equal to or more than the available short-circuit current can be installed ahead of the service disconnecting means per 230.82(3). A meter disconnect switch must be capable of interrupting the load served. Electric utilities often require a meter disconnect switch for 277/480V services to enhance safety for utility personnel when they install or remove a meter. Overcurrent devices must also be readily accessible [240.24(A)].

(2) No. 230.82(3) permits a meter disconnect switch to be installed on the supply (line) side of a service disconnect. 230.82(2) permits a meter socket enclosure to be installed on the supply (line) side of a service disconnect.

(3) Neutral conductor is not required to be isolated for the meter socket enclosure. The meter socket enclosure is considered part of the service equipment. See 250.24(A)(5) for load-side grounding connections. Not required to be isolated on the load side of the disconnect

It can be used as a service disconnect but is not usually considered as one. A separate disconnecting means is usually installed after the meter. The issue is that the utility company wants to have control and have the ability to lock or seal the meter disconnect which would then not be readily accessible to the user [240.24(A)]. Also look at 250.142(B) Ex. No.2.

230.90 Where Required. Each ungrounded service conductor shall have overload protection.

(A) Ungrounded Conductor. Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the allowable ampacity of the conductor.

230.82 Equipment Connected to the Supply Side of Service Disconnect. Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(2) Meters and meter sockets nominally rated not in excess of 600 volts, provided all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.

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

250.24 Grounding Service-Supplied Alternating-Current Systems.

(A) System Grounding Connections. A premises wiring system supplied by a grounded ac service shall have a grounding electrode conductor connected to the grounded service conductor, at each service, in accordance with 250.24(A)(1) through (A)(5).

(5) Load-Side Grounding Connections. A grounded conductor shall not be connected to normally non–current carrying metal parts of equipment, to equipment grounding conductor(s), or be reconnected to ground on the load side of the service disconnecting means except as otherwise permitted in this article.

19. We are being told that we must GFCI- protect the receptacle for the washing machine if it is located within 6 feet of the laundry sink. Even though we chose to use a single receptacle for the washer, the inspector still won't pass it. Who is correct?

Reference 210.8(A)(7). There was a revision for the 2011 NEC. 210.8(A)(7) refers to all 125 volt, single-phase, 15- and 20 amp receptacles that are located within 6 feet from the edge of a sink are now required to be GFCI protected. It does not matter what kind of sink it is (in previous NEC's it was limited to laundry, utility and wet bars). Since older NECs and the 2011 NEC requires GFCI protect for a 125 volt, single-phase, 15- and 20 amp receptacle located within 6 feet of a laundry sink a GFCI protected receptacle is required to be used. Therefore the inspector is once again correct.

20. Is there a name for the fitting required in 300.4 (G)? Also, what is the identified insulating material?

The UL white book does not list any reference to 300.4(G) but most threadless fittings have a smooth throat or an insulated throat to comply with this section.

21. Can a 120/240 volt breaker be installed with one pole landed on the high leg?

Reference: NEC 240.85
Answer: No – assuming the high leg is greater than 120V to ground.

22. Do we need to drive a ground rod at a backup generator as required by some inspectors in my state? My interpretation is the generator is not a separately derived system if you install 4 wires to the generator AND you do not break the neutral in the transfer switch. Thus this is not a separately derived system. When a grounding electrode is installed at the generator location, does that electrode have to be bonded to the existing grounding electrode system and if so, how?

There is one critical piece of information missing from the question posed. That is if the generator is installed inside the building or structure served or outside the building or structure served. From the description in the question, the transfer switch contains a solidly interconnected neutral from the normal supply, the generator supply and to the loads being served and therefore the generator is definitely not a separately derived system. The question indicates taking 4-wires to the generator from the transfer switch and I am assuming here the questioner means the 3-phases and the neutral, I also have to assume they also are carrying the required equipment grounding conductor and possibly a supply side bonding jumper.

If the generator is installed inside the building, then there is no requirement to supply a grounding electrode (ground rod) at the generator for any purpose, but it would not be prohibited. The grounding electrode conductor would only connect to the generator frame and there would not be any bonding connection between the frame and the Xo terminal or bus. If the generator is installed outside the building, then I would consider that a separate structure with a feeder going to the building being served. In this case 230.30(C) and 250.32 would tell you that a grounding electrode is required, and again the grounding electrode conductor would only go to the generator frame. The purpose of the grounding electrode and grounding electrode conductor is not for system grounding, but to ensure the non-current carrying parts of the generator electrical parts and the frame are at the same earth potential where the generator is setting, as well as for protection in the event of lightning.

23. Is Sect. 400.7 meant to allow flexible cord only for the wiring within a luminaire, or can it also be used for the branch circuit?

Not necessarily to first part of the question. However, I want clarify by saying ask the question where is this flexible cord being used as a branch circuit. If you are trying to use it as a fixed wiring method then I would say no because of 400.8(1) (Uses Not Permitted) where can't be used as a substitute for the fixed wiring of a structure. Then you can look in art 590 Temporary wiring where there would be area's that you could use it.

400.8 Uses Not Permitted.

Unless specifically permitted in 400.7, flexible cords and cables shall not be used for the following:
(1) As a substitute for the fixed wiring of a structure
(2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors
(3) Where run through doorways, windows, or similar openings
(4) Where attached to building surfaces

Exception to (4): Flexible cord and cable shall be permitted to be attached to building surfaces in accordance with the provisions of 368.56(B)

24. Can any portion of a feeder or branch circuit to a hot tub utilize UF cable?

Yes, Part IV Spas and Hot Tubs. 680.40 Comply with Parts I and IV, 680.42 Outdoor Comply with part I and II, 680.43 Indoor Comply with Parts I and II. Yes,
680.42(C) Interior Wiring to Outdoor Installations. In the interior of a one-family dwelling or in the interior of another building or structure associated with a one-family dwelling, any of the wiring methods recognized in Chapter 3 of this Code that contain a copper equipment grounding conductor that is insulated or enclosed within the outer sheath of the wiring method and not smaller than 12 AWG shall be permitted to be used for the connection to motor, heating, and control loads that are part of a self-contained spa or hot tub or a packaged spa or hot tub equipment assembly. Wiring to an underwater luminaire shall comply with 680.23 or 680.33.
680.23(F) regarding branch circuits for underwater luminaires does not permit the use of UF Cable. 680.33 applies to storable pools.

25. Are electrical inspectors required to wear PPE when doing inspections?

NFPA 70E® 90.2 Scope.

(A) Covered. This standard addresses electrical safety-related work practices for employee workplaces that are necessary for the practical safeguarding of employees relative to the hazards associated with electrical energy during activities such as the installation, inspection, operation, maintenance, and demolition of electric conductors, electric equipment, signaling and communications conductors and equipment, and raceways. This standard also includes safe work practices for employees performing other work activities that can expose them to electrical hazards as well as safe work practices for the following: |
(1) Installation of conductors and equipment that connect to the supply of electricity
(2) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings that are not an integral part of a generating plant, substation, or control center

According to Section 130.7(C)(1), when an employee is working within the arc flash protection boundary, he or she shall wear protective clothing and other personal protective equipment in accordance with 130.3. All parts of the body inside the arc flash protection boundary shall be protected.

26. Are there any specific code articles that state that you have to install an expansion fitting on the Rigid Nonmetallic PVC conduit between two slabs that have a one inch expansion joint installed between the slabs? The conduit passes horizontally from one slab to the other.

Yes. 300.4(H).Looking at article 352 for rigid polyvinyl chloride conduit (PVC), we find 352.44 requiring an expansion fitting to compensate for thermal expansion and contraction. This does not seem to cover the installation described in the question.

A new requirement in the 2011 NEC does cover this installation completely. 300.4(H) requires an expansion fitting "where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures."

352.44 Expansion Fittings. Expansion fittings for PVC conduit shall be provided to compensate for thermal expansion and contraction where the length change, in accordance with Table 352.44, is expected to be 6 mm (1/4 in.) or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.

300.4 Protection Against Physical Damage. Where subject to physical damage, conductors, raceways, and cables shall be protected.

(H) Structural Joints. A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

27. Can I run 100-amp SER cable through 2" PVC underground for a main feed to another panel?

Reference 338.12(2). No, Service Entrance Style R (SER) cable shall be installed per Article 338. 338.12(2) states that it is not a permitted use for SE cable to be installed underground with or without a raceway. This was clarified in the 2008 NEC where as the UL White Book always stated that SE cable is not permitted to be used below ground.

28. Can we use Electrical Metallic Tubing in a masonry wall, or must we use Rigid Metal Conduit?

Yes, all EMT manufactured is galvanized steel, 358.10 permits it exposed or concealed.

29. Can a receptacle installed to meet the requirements of 210.52 (E)(1), Outdoor Outlets also be used to meet the requirements of 210.63, Heating, Air-conditioning, and Refrigeration Equipment Outlet if all conditions apply?

Reference: NEC 210.52(E)(1) and NEC 210.63. Answer: Yes

30. For a portable or mobile sign that is cord- and plug-connected, what is required to protect personnel who may touch or contact the sign?

The basic rule is found in 600.7. The sign is provided from a single branch circuit and the cord would be required to have an equipment grounding conductor include with a grounding type cord cap. In this manner protection is through the equipment grounding conductor. Where installed outside in wet locations, the required GFCI protection also adds to the safety aspect for individuals that contact the sign. There is an exception to the basic rule that allows a portable sign that is cord and plug connected not to have an equipment grounding conductor used where the sign is protected by a system of double insulation. If this is the case the exception also requires clear and distinctive marking .

600.7 Grounding and Bonding.
(A) Grounding.
(1) Equipment Grounding. Signs and metal equipment of outline lighting systems shall be grounded by connection to the equipment grounding conductor of the supply branch circuit(s) or feeder using the types of equipment grounding conductors specified in 250.118.

Exception: Portable cord-connected signs shall not be required to be connected to the equipment grounding conductor where protected by a system of double insulation or its equivalent. Double insulated equipment shall be distinctively marked.

31. What is the manufacturing difference between a weather resistant receptacle and a regular receptacle?

Ref: 406.9 The Weather Resistant Receptacle has the following added protection to meet UL498 requirements;

UV rated plastics, Added corrosion protection to the contacts, Added corrosion protection to the mounting strap and screws.

Will be identified by the words "Weather Resistant" or the letters "WR" after the cover is installed.

32. Is there a burial depth for grounding electrode conductors? A local inspector insists that they (Grounding Electrode Conductors) are subject to Table 300.5 burial depths and the minimum is 12 inches. Is the answer the same for a conductor of #8 AWG, #6, #4 or larger?

The grounding electrode conductor installation requirements are covered in Section 250.64 and not in Article 300. Over the years CMP-5 has received proposals to have a minimum burial depth of the grounding electrode conductor from 4" to 12". The panel has stated that the requirements for protecting the grounding electrode conductor are properly covered in 250.64(B).
No there is no burial depth requirement, and the burial depth requirements of Table 300.5 do not apply to grounding electrode conductors.

33. Should you count the clamp when calculating box fill for 2-gang or larger plastic boxes?

According to 314.16(B) The allowance must be made.
(B) Box Fill Calculations. The volumes in paragraphs
314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings.
(2) Clamp Fill. Where one or more internal cable clamps, whether factory or field supplied, are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest conductor present in the box. No allowance shall be required for a cable connector with its clamping mechanism outside the box.

34. I have a customer who insists on using motor starters and panelboards as a raceway. I can't seem to find the code section that allows or does not allow this. Also they continue to put 2 or more conductors under the load side lugs of 400 and 200 amp fused switches and the extra conductors are #12. Where can I find the code section(s) that address these problems?

(1) Motor starters and panelboards as a raceway.
Motor starters: 430.10(A) &(B), 312.8, Table 430.10(B). Panelboards: 408.3(G), 312.6, 312.8
Motor control centers: 430.97(C), 312.6, 312.8.
(2) 2 or more conductors under the load side lugs.

110.14(A) will prohibit more than one conductor under the same lug unless the lug is so identified. For terminals or lugs identified for more than one conductor, most terminal manufactures would limit the multiple conductor termination to conductors within a wire gauge or two of each other.

430.10 Wiring Space in Enclosures.
(A) General. Enclosures for motor controllers and disconnecting means shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to the other apparatus unless designs are employed that provide adequate space for this purpose.
Informational Note: See 312.8 for switch and overcurrent device enclosures.

312.8 Switch and Overcurrent Device Enclosures with Splices, Taps, and Feed-Through Conductors. (see NEC text)

408.3 Support and Arrangement of Busbars and Conductors.

(G) Minimum Wire-Bending Space. The minimum wire bending space at terminals and minimum gutter space provided in panelboards and switchboards shall be as required in 312.6.

312.6 Deflection of Conductors. (See NEC text)

430.97(C) Minimum Wire-Bending Space. The minimum wire-bending space at the motor control center terminals and minimum gutter space shall be as required in Article 312.

110.14(A) Terminals. Connection of conductors to terminal parts shall ensure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors (including set-screw type), solder lugs, or splices to flexible leads. Connection by means of wire-binding screws or studs and nuts that have upturned lugs or the equivalent shall be permitted for 10 AWG or smaller conductors.

Terminals for more than one conductor and terminals used to connect aluminum shall be so identified.

35. Is it permissible to use NM cable in an Assembly Occupancy of non-rated construction?

Reference 518.4(B). Yes, Section 518.4(B) permits the use of NM Cable in an Assembly Occupancy when these buildings or portions of are not required to be "fire-rated" construction per the applicable building code.

36. We installed a raceway that ended up 22 inches below grade. Can we install an additional 2 inches of dirt or concrete to get the required 24 inch depth? The inspector said we cannot add dirt or concrete over the raceway, so he had us dig it up and lower it 2 inches.

300.5 (A) requires it to be installed per Table 300.5 which lists the "minimum cover" and note one defines what this means. I would interpret this as finished grade. Which would include concrete or asphalt. I would not go for a mound of dirt.

37. Can Square D single pole circuit breakers have two conductors terminated on them? According to the manufacturer, if their breaker has a so- called double groove in the plate that holds the wire in place, you can place one wire under each groove and as long as you don't exceed the wire size for the amperage of the breaker then it is acceptable to place two conductors under the screw on the circuit breaker. Is this correct?

Not Exactly. Reference: NEC 110.14(A) Answer: The breaker must be marked. "Terminals for more than one conductor and terminals used to connect aluminum shall be so identified."

38. Is the grounding conductor for a TV antenna sized the same as a grounding conductor for a satellite dish?

Section 810.21establishes the requirement for grounding of antennas. There is no specific definition of the antenna and there is not a definition of satellite dish that would indicated it is different for the requirements covered by the term antenna. The sizing requirements for all television antennas (no matter what type or technology) is covered in 810.21(H) which specifies a 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

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

39. Can we terminate Type AC or Type MC cables in a nonmetallic box?

Maybe.

Look at 300.10 and 250.4 requirements. Also QCMZ identifies types of clamps when clamps are provided; the carton is marked to indicate the type of wiring system or combination of systems for which they have been tested. The clamps are marked with the following letters or combinations thereof to indicate that they are suitable for use with nonmetallic sheathed cable "N" or flexible tubing (loom) "T." There are nonmetallic boxes suitable for use with rigid nonmetallic conduit that are provided with a marking on the carton to indicate the intended use, such as "For [Specific Type] Conduit." Such boxes, when so marked on the box or carton and provided with installation instructions. I would also mention 300.10 (Electrical Continuity of Metal Raceways and Enclosures) Where it mentions that "conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings and cabinets so as to provide

effective electrical continuity. In 330.40 it talks about “Fittings used for connecting Type MC cable to boxes, cabinets, or other equipment shall be listed and identified for such use.

40. Is it permissible to use a grounding receptacle w/ a pigtail from the ground screw on the receptacle to the box on an old 2 wire armored cable in a 1920's house?

Yes, Armored Cable was listed as a grounding means back in the 1920’s. Armored cable (AC) was first listed in 1899 for the Sprague Electric Co. of New York, and was originally called “Greenfield Flexible Steel-Armored Conductors,” after one of its inventors, Harry Greenfield. There were originally two experimental versions of this product, one called “AX” and the other “BX,” with the “X” standing for “experimental.” The “BX” version became the one that eventually got produced, and hence the name “BX” stuck, which also became the registered trade name of armored cable for General Electric, who later acquired Sprague Electric. Armored Cable was first added into the NEC in 1903 and became popular in the 1930’s replacing knob and tube and in 1959 they added the bonding strip to increase the reliability of the sheath as an equipment ground. http://www.nacmaonline.com 25 years 1986-2011

Even though the AC/BX cable did not have a bonding conductor in the 1920’s it was still an acceptable equipment grounding conductor.

41. Why can I not splice 3#12 THWN conductors in a 1” LB condulet? The code says I can put 26 number twelve in one inch GRC conduit at 40% fill? What does 10.5 cu. In. stamped inside mean?

314.16(B)(3)-Short radius conduit body. Space is still required for 6 in of free conductor 300.14. (This installation would not provide enough room)

42. Is it necessary to run a 4-wire lateral to a 3-phase fire pump?

Yes.
Because the word “lateral” is used here, I’m going to assume that this is a service lateral feeding this 3-phase fire pump. 695.3(A) permits an individual or electric utility service connection. There are no provisions in Article 695 to treat this service any different than any other service. Therefore, 250.24(C) would require the grounded (neutral) conductor to be brought to the service equipment and bonded to the enclosure (typically through the main bonding jumper).

250.24 Grounding Service-Supplied Alternating-Current Systems.
(C) Grounded Conductor Brought to Service Equipment.
Where an AC system operating at less than 1000 volts is grounded at any point, the grounded conductor(s) shall be routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with 250.24(C)(1) through (C)(4).

43. Do non-grounding replacement outlets need to be tamper- resistant?

Reference 406.4(D)(5) and 406.12 Exception No. 4. New for the 2011 NEC, 406.4(D)(5) states that receptacles shall be replaced with tamperproof receptacles if required to be tamperproof per 406.12 (which also was revised for the 2011 NEC to make exceptions to several locations). For non-grounded type of receptacles, see 406.12 Exception No. 4, this exception states that it is not required to replace a non-grounded receptacles with a tamper resistant receptacle.

Tamper resistant non-grounding receptacles are not available.

44. Does NEC Section 250.64(E) require a grounding electrode conductor that is installed in a ferrous metal raceway to be bonded to the raceway “at each end”? Does the connection of the metal raceway to the enclosure where the GEC is terminated constitute this bonding or must a separate, direct connection from the conduit termination to the conductor be made using a grounding bushing or a special fitting? Is there any difference between a utility supplied system or a separately derived system with regard to this requirement?

Yes 250.64(E)---- it may if the GEC is terminated in the enclosure and the raceway is terminated to the enclosure**--- then only the GE end would need bonding together, no difference 250.30(A)(7) refers you to 250.64**

45. What written warnings are needed for the flash protection requirement of NEC 110.16 and how will the electrician know the correct PPE to be worn?

Reference: NEC 110.16 and NFPA 70E
110.16 Arc-Flash Hazard Warning. Electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Answer: The Arc-Flash hazard warning requirement found in NEC 110.16 is simply a warning that marking. Most equipment manufacturers have addressed the NEC 110.16 label requirement or See T&B for good warning label.

The electrician needs to utilize NFPA 70E in order to determine the correct PPE to be worn.

46. When I have too many equipment grounding conductors inside a junction box, I usually install a ground bar with at least 12 screws/spaces or more. This ground bar is just the same as the one that you see inside a panelboard. Is this acceptable?

Section 250.148 could require all the equipment grounding conductors entering a junction box to be connected together and if it is a metal box, these conductors bonded to the box. The mean of connection would go back to the general methods for connection of equipment grounding conductors found in 250.8. There are many possible means of doing this, the most common probably being with pressure wire connectors that are used within their listed ratings for number and size of conductors. Alternatively, 250.8(2) indicated that "terminal bars" are an acceptable means. Terminal bars are not specifically defined so I believe the typical terminal bar that can could be used as an accessory in a panelboard could be used to serve this purpose, again as long as it is being used within its rating for conductor material, size and number. In the absence of any information otherwise the default number of conductors would be 1 per terminal per 110.14(A) and Category Code AALZ found on page 46 of the 2011 UL White Book.

47. What wiring methods may be used for the wiring in escalators, moving walkways, platform lifts, stairway chairlift runways, machinery spaces, control spaces, or machine/control rooms (not including the traveling cables connecting the car, or counterweight and hoistway wiring)?

620.21
90.3 Code Arrangement. This Code is divided into the introduction and nine chapters, as shown in Figure 90.3. Chapters 1, 2, 3, and 4 apply generally; Chapters 5, 6, and 7 apply to special occupancies, special equipment, or other special conditions. These latter chapters supplement or modify the general rules. Chapters 1 through 4 apply except as amended by Chapters 5, 6, and 7 for the particular conditions.

620.21 Wiring Methods. (Changed From 2008)

• 620.21(A)(1)(c) Exception: Added new provision exempting flexible raceways from length restrictions under specific conditions of use.

Conductors and optical fibers located in hoistways, in escalator and moving walk wellways, in platform lifts, stairway chairlift runways, machinery spaces, control spaces, in or on cars, in machine rooms and control rooms, not including the traveling cables connecting the car or counterweight and hoistway wiring, shall be installed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, rigid nonmetallic conduit, or wireways, or shall be Type MC, MI, or AC cable unless otherwise permitted in 620.21(A) through (C).

(A) Elevators.
(1) Hoistways.

(a) Cables used in Class 2 power-limited circuits shall be permitted to be installed between risers and signal equipment and operating devices, provided the cables are supported and protected from physical damage and are of a jacketed and flame-retardant type. See related UL

(b) Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted in lengths not to exceed 1.8 m (6 ft), provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type. See related UL

(c) The following wiring methods shall be permitted in the hoistway in lengths not to exceed 1.8 m (6 ft):
(1) Flexible metal conduit See related UL
(2) Liquidtight flexible metal conduit See related UL
(3) Liquidtight flexible nonmetallic conduit See related UL
(4) Flexible cords and cables, or conductors grouped together and taped or corded, shall be permitted to be installed without a raceway. They shall be located to be protected from physical damage and shall be of a flame-retardant type and shall be part of the following: See related UL
a. Listed equipment
b. A driving machine, or
c. A driving machine brake

48. A service is installed using (6) 100-ampere disconnecting means in separate enclosures in accordance with the provisions on 230.71(A) and 230.40 Exception No. 2. The service is an underground arrangement with (2) parallel 300 kcmil copper conductors (for each ungrounded phase conductor and the grounded conductor) supplying an auxiliary gutter to which the service disconnecting means are connected. The size of the service-entrance conductor from the auxiliary gutter to each 100-ampere service disconnect is 1/0 copper. The grounding electrode for the building is structural steel in accordance with 250.25(A)(2). What is the minimum size required for a common grounding electrode conductor for a service that is made up of six individual service disconnects in separate enclosures with grounding electrode conductor taps installed from the common grounding electrode conductor to each service disconnect?

Section 250.64(D) applies to a service with multiple Service Disconnects. When this occurs 250.64(D) gives you three options on how to provide the grounding electrode connections for these installations. The question asks about sizing of the common grounding electrode for these service disconnects and that requirement is found in 250.64(D)(1).
250.64(1) Common Grounding Electrode Conductor and Taps. A common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded service-entrance conductor(s). If the service-entrance conductors connect directly to a service drop or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, Note 1.

A grounding electrode conductor tap shall extend to the inside of each service disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance conductor serving the individual enclosure. The tap conductors shall be connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:

The common grounding electrode conductor is sized based on the 2 parallel 300 kcmil conductors, which is 600 kcmils. Table 250.66 indicated for copper conductors over 350 through 600 kcmil the grounding electrode conductor would need to be a minimum of a 1/0.

The grounding electrode conductor taps are sized based on the service conductors for each disconnect. In this instance those conductors are a 1/0 and using Table 250.66 the tap conductor would need to be minimum of a 6 AWG copper conductor.

49. Should carbon monoxide detectors be installed near the floor or the ceiling?

Section 9.4.1.2* of NFPA 720 requires Each alarm or detector to be located on the wall, ceiling, or other location as specified in the manufacturer's published instructions that accompany the unit.

Carbon monoxide is neutrally buoyant. At this point, we rely on the manufacturer's instructions.

50. Are the side screws of a receptacle required to be tightened when the conductors are stabbed in the back of the receptacle? The untightened screws decrease the clearance to the sides of metal boxes and also may cause a shock hazard.

No. Follow manufacturer's specifications. Some receptacles (screw-actuated clamp type) do require side screws to be tightened, but not typical convenience receptacles.

UL White Book: RECEPTACLES FOR PLUGS AND ATTACHMENT PLUGS (RTRT)

Terminals of 15 and 20 A receptacles not marked "CO/ALR" are for use with copper and copper-clad aluminum conductors only. Terminals marked "CO/ALR" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals of receptacles rated 30 A and above not marked "AL-CU" are for use with copper conductors only. Terminals of receptacles rated 30 A and above marked "AL-CU" are for use with aluminum, copper and copper-clad aluminum conductors.

Terminals marked "75 C" may be wired using the ampacities for conductors rated 75ºC as well as conductors rated 60ºC in Table 310.16 of the NEC.

Terminals of the wire-binding screw, setscrew, or screw-actuated back-wired clamping types are suitable for use with both solid and stranded building wires.

Screwless terminal connectors of the conductor push-in type (also known as "push-in-terminals") are restricted to 15 A branch circuits and are for connection with 14 AWG solid copper wire only. They are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG stranded copper wire, or 12 AWG solid or stranded copper wire.

Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

Back-wire (screw-actuated clamp type) terminations with multiple wire-access holes used concurrently to terminate more than one conductor

Side-wire (binding screw) terminals used concurrently with their respective push-in (screwless) terminations to terminate more than one conductor

Single and duplex receptacles rated 15 and 20 A that are provided with more than one set of terminals for the connection of line and neutral conductors have not been investigated to feed branch-circuit conductors connected to other outlets on a multi-outlet branch circuit, as follows:

Side-wire (binding screw) terminal with its associated back-wire (screw-actuated clamp type) terminal

Multiple conductors under a single binding screw

Multiple conductors in a single back-wire hole

Duplex receptacles rated 15 and 20 A that are provided with break-off tabs may have those tabs removed so that the two receptacles may be wired in a multi-wire branch circuit or multiple branch circuits.

51. Is a standard wire-nut approved for a wet location as in an outside j-box? Is there a listed wet location wire-nut other than the ones approved for direct burial or in below grade j-boxes?

Reference: UL White Book (ZMWQ), No, a standard wire connector (Wire Nut is a register trade name for Ideal) is not approved for a "Wet Location". Manufactures obtain additional listings for a "Wet Location". (See the UL White Book ZMWQ). Wire Connectors that are listed for direct burial may not be approved for "exposed" wet locations where the sun is present. Yes there are wire connectors that are approved for a wet location when used above grade.

I know this is a loaded question and we visited it during last year's meeting. The big question is the inside of a junction box a "wet location"? Examining 300.9 it tells us that the interior of an exposed raceway above grade is considered a wet location, without mention of enclosures or boxes. So the real question is "Is it required for a wire connector to be listed for a wet location when used in an outside junction box?" Since it is not defined in the Code then it is up to the AHJ to insure that the installation is safe.

52. A foundation wall having the necessary steel rods in it to qualify it as a grounding electrode has Styrofoam on its exterior. May the wall be used as a grounding electrode?

250.52(A)(3) and informational note makes it clear if the concrete is not in direct contact with earth it does not qualify however this may be a judgment since the Styrofoam may not cover the bottom or all the foundation it may be on the outside only.

53. An industrial control panel is being designed for a pallet-handling conveyor system. Motors for the system are ½ hp, 460V motors, whose full-load current is 0.9 A. Feeder breakers for the system are rated 15 Amperes. The most economical system will include the most motors possible on one feeder breaker. Starters are included with properly-sized heaters.
Disregarding operational characteristics of the conveyor system (whether all motors operate simultaneously or individually) what is the maximum number of motors that may be applied to one feeder breaker?

Reference: NEC 430.53. Locked Rotor for ½ hp is 10A – non issue for instantaneous tripping
Is the load continuous? If so, 80% of 15A = 12A
FLC = .9A
12/.9 = 12 motors

Answer: 12 motors permitted for continuous load

54. Is it necessary to group the PV system AC-disconnect with the service disconnect?

The reference is 690.14(C). When one takes into account all the parts in 690.14(C)(1),(C)(4) and (C)(5), then an AC disconnect is required at the connection point (service entrance) of the supply AC system and the location must be with the service equipment disconnects and grouped. If the utility interactive inverter is remote from the service as allowed in 690.14(D), there may in fact be two disconnects required to be in series, one at the inverter and one at the service connection point.

690.14(C) Requirements for Disconnecting Means. Means shall be provided to disconnect all conductors in a building or other structure from the photovoltaic system conductors.

(1) Location. The photovoltaic disconnecting means shall be installed at a readily accessible location either on the outside of a building or structure or inside nearest the point of entrance of the system conductors.

Exception: Installations that comply with 690.31(E) shall be permitted to have the disconnecting means located remote from the point of entry of the system conductors.

The photovoltaic system disconnecting means shall not be installed in bathrooms.

(2) Marking. Each photovoltaic system disconnecting means shall be permanently marked to identify it as a photovoltaic system disconnect.

(3) Suitable for Use. Each photovoltaic system disconnecting means shall be suitable for the prevailing conditions. Equipment installed in hazardous (classified) locations shall comply with the requirements of Articles 500 through 517.

(4) Maximum Number of Disconnects. The photovoltaic system disconnecting means shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard.

(5) Grouping. The photovoltaic system disconnecting means shall be grouped with other disconnecting means for the system to comply with 690.14(C)(4). A photovoltaic disconnecting means shall not be required at the photovoltaic module or array location.

55. I have heard that AFCI breakers provide GFCI protection. Is this true that they also provide GFCI protection?

Not really. Inside most AFCI breakers there is a GFCI component installed inside the breaker but isn't there for people protection. The GFCI component is an added component to help detect ground faults in the wiring circuit. UL 1699 standard doesn't require the GFCI component to be installed as part of the listing.

56. The GEC from a PV array is run to a separate ground rod. How can the interconnection to the main GEC system be accomplished? Can the equipment grounding system be used?

Do we have to ground one of the conductors of the PV system? 690.41, generally yes but exception for 690.35 would permit ungrounded.
So, do I need a dc grounding system? The exposed metal parts must be bonded to ground for the same reasons as any other application. 690.47 provides requirements based on PV system type and apply for both grounded and grounded systems.
690.47(C) covers the most common PV systems which have both dc and ac systems. Most PV inverters have transformer isolation between the dc input from the array and the ac output. There is no direct connection between the dc grounded conductor and the ac grounded conductor.
(C)(1) through (C)(3) provide requirements to ensure bonding between the systems.

57. Is it permissible to connect a standby generator to a load center in a home by back-feeding a circuit breaker? The circuit breaker is not interlocked with the main breaker.

NO! A listed transfer switch in accordance with Section 702.5.

58. Cable is needed for a switchboard with 800A main circuit breaker. It is equipped with two mechanical lugs per phase; conductor sizes accommodated by the lugs are #4-500 kcmil. The equipment is not marked for temperature rating for the conductors or the lugs. The contractor looked on the web site for the lug manufacture to that the lugs are rated for 900 C.
The contractor wants to use copper cable rated for 900 C. What size cable can be used?

Conductors need must be rated for 800 amperes. Looking at Table 310.15(B)(16) in the 90°C column, 400 kcmil copper is rated at 380 amperes. 500 kcmil copper is rated at 430 amperes.
430 amperes X 2 = 860 amperes.

(2) 500 kcmil copper conductors per phase is required (with a 90°C temperature insulation rating).

The equipment should be marked with a temperature rating. Referring to the UL white book under switchboards (WEIR) and field terminations: "unless the equipment is marked otherwise, the termination provisions are based on 60 degree C for sizes 14-1 AWG, and 75 degree C for wire sizes 1/0 and larger…." 110.41(C)(1) basically says the same thing.

Always remember that a conductor has TWO ends. If these same conductors terminate on a device or equipment on the other end of this switchboard with 75° C terminations, then 75° C conductors would have to be used.

59. What rating is needed for a disconnect switch for a long-time rated X-ray machine?

Reference: 517.72 and 660.5: A disconnecting means of adequate capacity for at least 50 percent of the input required for the momentary rating, or 100 percent of the input is required for the long-time rating, of the X-ray equipment, whichever is greater, shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the X-ray control.

517 addresses Health Care X-Rays whereas 660 addresses commercial x-ray machines for the inspection of products.
Long-Time Rating: A rating based on an operating interval of 5 minutes or longer.
Momentary Rating: A rating based on an operating interval that does not exceed 5 seconds.

60. Does the NEC require an equipotential grid for a new hot tub installation placed on an existing stamped concrete pad? (Will it need to be torn out and re-poured)?

No, although 680. 42 requires compliance with Parts l & ll. This may be a packaged unit setting on the slab and 680.42 (B) allows bonding to the base by metal to metal contact

61. What is the "service factor" that is required to be marked on Fire Pumps?

Service Factor, or SF, defines the periodical overload capacity at which a given motor can operate without damage or overload. A typical Service Factor of fire pump motors is 1.15.

62. Could the GEC connected to the PV roof arrays possibly draw lightning to the PV arrays?

The path that lightning will actually take is very unpredictable and lighting protections systems are provided so that an external low impedance path is provided to dissipate the energy into the earth when lighting does strike. Only where there are very tall metal structures, such as high rise buildings or very high TV or other transmission towers relative to other structures in the area is lighting actually "attracted" to that structure. It has been demonstrated that lighting could just as likely strike the earth directly where there is a 20 foot or so metal lighting pole just 50 feet away. So the fact that metal frames PV modules are on a roof could be a strike point, just like metal vent piping, metal roof structures, flashings, or metal chimney, it is not likely this metal presents a high attraction point. If there is not a readily available path for the lightning current to flow, it will find a path, and that can cause extensive damage to whatever structure is used as the path. The connection of the PV modules metal frame accomplishes two things. First if a lightning strike were to occur, then there is that path provides external to the structure and directly to the earth. Second, if there is a near strike, during the build-up the ground potential rise for all those areas bonded or connected to the earth will rise approximately equally and minimize the chances of side flash occurrences due to extreme potential differences of metal objects that are close to each other.

63. Are electronic ballasts considered non-linear loads?

Non-linear loads such as electronic ballasts create harmonics. In some cases when using 120/208Y system (as an example) the installer may need to oversize the neutral conductor.

Nonlinear loads such as electric-discharge lighting, including fluorescent and HID are covered in NEC commentary of section 220.61(C), prohibited reduction of the neutral or grounded conductor capacity.
Electronic equipment, electronic/electric-discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

Article 100 Definition:
Nonlinear Load. A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage.
Informational Note: Electronic equipment, electronic/electric discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

64. What is an acceptable means of securing NMB cable to the bottom of metal floor joists above a T-grid ceiling in a residence?

The securing and supporting requirements are found in Section 334.30.
Section 334.30 Securing and Supporting. Nonmetallic-sheathed cable shall be supported and secured by staples, cable ties, straps, hangers, or similar fittings designed and installed so as not to damage the cable, at intervals not exceeding 1.4 m (4½ ft) and within 300 mm (12 in.) of every outlet box, junction box, cabinet, or fitting.
Securing the NM Cable to the metal floor joist with cable ties or to an independent ceiling support wire would be acceptable.

65. A kitchen island has a 4' long framed and drywall backside facing the family room. Can the small appliance circuit serving the countertop also serve the receptacle located on this wall?

Section 210.52(B)(2) No Other Outlets does not permit small appliance branch circuits to have any other outlets.

66. How could the calculations of the selective coordination, required by NEC 700.27, be verified by the electrical plan review?

The plan reviewer must examine the one-line drawing included in the plan review package. The one-line drawing must have the fault current listed for each O/C device as well as trip setting. The plan reviewer should have enough data to determine which device will interrupt a fault for each feeder circuit. He also has the right to ask for additional data. Many good engineers provide calculations and manufacturers time/base curves to evaluate protective device performance. A stamped dated performance certificate from the engineering firm should be kept on file for each project.

Selective coordination can be defined as "The act of isolating a faulted circuit from the remainder of the electrical system, thereby eliminating unnecessary power outages. The faulted circuit is isolated by the selective operation of only that overcurrent protective device closest to the overcurrent condition."

67. A kitchen counter has a 60" window behind it in lieu of a wall. There is no backsplash high enough to install a receptacle within the 24" rule. Would a receptacle installed at each end of the glass be sufficient?

Reference: 210.52(C): This is a problem. Section 210.52(A) addresses broken wall space for general provision receptacles however we do not find that same language for countertops. I believe it is intentional that the Code Making Panel wants receptacles along the countertop for safety reason dealing with small appliances. There are products on the market such as T&B's Pop Up Counter Top Receptacle that could address this problem. Also, dog house receptacles could be used.

68. Are general-use Rigid Metal Conduit compression-type fittings allowed in a Class 1 Division 2 location?

Yes, these are listed fittings and 501.10(B)(4) does not require fittings to be explosion proof.

69. Is Ground Fault Protection required for service equipment rated at 1000 amps but fused at 800 amps? The service is a 3-phase, 4-wire, 277/480 volt.

Reference: NEC 230.95

230.95 Ground-Fault Protection of Equipment. Ground-fault protection of equipment shall be provided for solidly grounded wye electric services of more than 150 volts to ground but not exceeding 600 volts phase-to-phase for each service disconnect rated 1000 amperes or more. The grounded conductor for the solidly grounded wye system shall be connected directly to ground through a grounding electrode system, as specified in 250.50, without inserting any resistor or impedance device.

The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed or the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.

Answer: Yes

70. Why does the equipment grounding conductor in a feeder to a mobile home have to be insulated?

The requirement is found in Article 550 and specifically sections 550.10(A) and (I) and 550.16(B). Where the mobile home feeder is the flexible cord, then the 4th conductor is required to be insulated and the insulation to have the color green or green with one or more yellow stripes. This is standard construction for flexible cords from the UL standard for these mobile home feeder cord sets. The cord is limited to 50 Amps and if more, then a permanent feeder is required and that can be overhead or underground. The feeder requirements for both overhead and underground still require an insulated equipment grounding conductor with the proper identification. The best reason for this is to ensure in whatever environment this conductor is installed, the insulation will provide protection from the elements, sun, rain, water underground etc. and minimize the effects of deterioration, and the subsequent loss in safety, of the equipment grounding conductor. Remember, this is the only ground fault current path and due to the typical construction of mobile homes on metal frames, a ground fault in the mobile home where the equipment grounding conductor has failed, can cause the mobile home metal frame to now be energized at phase to ground potential.

550.10(I) Mast Weatherhead or Raceway. Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of either of the following:

(1) One mast weatherhead installation, installed in accordance with Article 230, containing four continuous, insulated, color-coded feeder conductors, one of which shall be an equipment grounding conductor

(2) A metal raceway or rigid nonmetallic conduit from the disconnecting means in the mobile home to the underside of the mobile home, with provisions for the attachment to a suitable junction box or fitting to the raceway on the underside of the mobile home [with or without conductors as in 550.10(I)(1)]. The manufacturer shall provide written installation instructions stating the proper feeder conductor sizes for the raceway and the size of the junction box to be used.

550.16(B) Equipment Grounding Means.

(1) Supply Cord or Permanent Feeder. The green-colored insulated grounding wire in the supply cord or permanent feeder wiring shall be connected to the grounding bus in the distribution panelboard or disconnecting means.

71. Is it permissible to run non-metallic cable through kitchen cabinets at peninsulas and islands where it is not subject to damage or does it always have to be sleeved?

It should be protected.

334.15 Exposed Work.

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

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

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

72. I have a store being constructed in our city. All of the footings are over-dug and then rock is brought in and compacted. All of the exterior footings are poured on a rock base. Does the concrete-encased electrode function in this situation? Do we need to bond the rebar?

The requirements for the concrete-encased electrodes are found in 250.52(A)(3).

250.52(A)(3) Concrete-Encased Electrode. A concrete-encased electrode shall consist of at least 6.0 m (20 ft) of either (1) or (2):

(1) One or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (½ in.) in diameter, installed in one continuous 6.0 m (20 ft) length, or if in multiple pieces connected together by the usual steel tie wires, exothermic welding, welding, or other effective means to create a 6.0 m (20 ft) or greater length; or

(2) Bare copper conductor not smaller than 4 AWG

Metallic components shall be encased by at least 50 mm (2 in.) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with the earth. If multiple concrete-encased electrodes are present at a building or structure, it shall be permissible to bond only one into the grounding electrode system.

Informational Note: Concrete installed with insulation, vapor barriers, films or similar items separating the concrete from the earth is not considered to be in "direct contact" with the earth.

Code-Making Panel 5 is graced with a couple of engineers so I asked this question to one of them and here is his response. The concrete encased electrode should still function in this situation. My personal opinion is Concrete encased electrodes will always work better than any made electrodes due to sheer mass of steel laid out in a grid pattern. So yes, they will work very well. I am not a structural engineer but to the best of my knowledge, dirt or sand is normally be poured under the concrete foundation for stabilization or the concrete will crack due to settlement. We are depending on the hygroscopic nature of the concrete, it absorbs water very quickly and releases out very slowly. So surface under and along the concrete is always conductive. The footing is still making direct contact with the earth as referenced in 250.52(A)(3). It does not reference that it needs to be in direct contact with the soil as it does for ground rods in 250.53(G). It is the length of the electrode that assists in dissipation of electricity more than anything else.
Do we need to bond the rebar? Yes the rebar used in this situation would need to be connected as a concrete encased electrode.

73. Can you cut the plug end from the cord on a sump pump and wire it directly through the switch so you don't have to GFCI- protect the sump pump? If this violates the listing on the pump could you get it field approved?

I am not sure what you mean by wiring it directly through the switch. However, if you cut the plug off and then rewire the pump you have modified a Listed product and UL no longer knows if that product still complies with UL's requirements unless we reevaluate it under a Field Evaluation. UL's Field Modification policy can be found on page 41 of the 2011 UL White Book. It could be cheaper to buy a hard wired sump pump than get a Field Evaluation on the pump. Whether or not that gets you out of GFCI protection on the pump is up to the AHJ.

74. I want to wire a 75 KVA, 3-phase, 480-volt primary, 208-volt secondary transformer, with both sets of the wiring in the same conduit from a large junction box. There is overcurrent protection on the primary conductors. Is this a NEC violation?

No this is not a violation-see 300.3(C)(1) Conductors of Different Systems. (1) 600 Volts, Nominal, or Less. Conductors of ac and dc circuits, rated 600 volts, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.

NEC Section 300.3(C)

75. Is there any means in the Code to restrict the placement of chlorinators in the same room as the electrical panels associated with the pool? There is a definite deleterious effect to the panels.

YES Ref: 300.6 Protection Against Corrosion and Deterioration.

76. Is there any code section that would prohibit reducing the size of the grounded circuit conductor on manufactured home service conductors?

NO 550.32 Service Equipment. B (2) The installation of the service shall comply with Part I through Part VII of Article 230.

230.31 Size and Rating. (A) General. Underground service conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Article 220 and shall have adequate mechanical strength.
(C) Grounded Conductors. The grounded conductor shall not be less than the minimum size required by 250.24(C).
230.23 Size and Rating. (A) General. Conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Article 220 and shall have adequate mechanical strength.
(C) Grounded Conductors. The grounded conductor shall not be less than the minimum size as required by 250.24(C)
220.61 Feeder or Service Neutral Load. (A) Basic Calculation. The feeder or service neutral load shall be the maximum unbalance of the load determined by this article. The maximum unbalanced load shall be the maximum net calculated load between the neutral conductor and any one ungrounded conductor.
(B) Permitted Reductions. A service or feeder supplying the following loads shall be permitted to have an additional demand factor of 70 percent applied to the amount in 220.61(B)(1) or portion of the amount in 220.61(B)(2) determined by the basic calculation:

(1) A feeder or service supplying household electric ranges, wall-mounted ovens, counter-mounted cooking units, and electric dryers, where the maximum unbalanced load has been determined in accordance with Table 220.55 for ranges and Table 220.54 for dryers.

77. In a shopping mall, does a medical office used primarily for diagnosing colds and flu and CDL exams need hospital -grade receptacles?

No. While the area is most definitely within the scope of Article a 517, hospital grade receptacles are only required patient sleeping bed locations, per 517.13.

The definition is extracted from NFPA 99: Sect. 3.3.137

Patient Bed Location. The location of a patient sleeping bed, or the bed or procedure table of a critical care area.

78. On occasion I find a fourth (equipment grounding) conductor run from the meter base to the main panel. The electrician states some inspectors require this. I require this 4th conductor to be removed, is this correct? Also, if there is an overcurrent device at the meter base location then is the 4th wire (ground) required?

Assume the service is 120/240 V, 1-phase, 3-wire. The equipment grounding conductor is not required with the service lateral or underground service conductors. The grounded (neutral) conductor serves as the ground-fault return path from the service to the utility transformer.

The equipment grounding conductor should be removed or disconnected. If connected to the neutral at both ends, the parallel conductor rules of 310.10(H) would apply and require the conductors to be the same size.

Also keep in mind, the conductor is really a supply-side bonding jumper and not an equipment grounding conductor. See the definition in 250.2 and the sizing rules in 250.102(C). To establish an equipment grounding conductor and use Table 250.122, an overcurrent device must be located where the conductor originates. See 250.102(D) for the sizing rules.

If an overcurrent device is located at the meter base, it would no doubt qualify as the service disconnecting means. The conductors on the load side are a feeder and the equipment grounding conductor is required. See 215.6.

79. Should the inspector require that all fixtures be lamped- out before a final inspection in order to make sure the fixtures are equipped with the correct type and wattage bulb?

Yes, the authority having jurisdiction accepts full responsibility that the original installation has been properly done in accordance with the requirements of the ordinances of the municipality issuing the permit to the installer.

80. Can countertop receptacles be placed underneath the upper cabinets (not in the backsplash) and still meet the requirements of 210.52(C)(5)?

As we know, NEC 210.52(C) is the section which has the requirements for countertops which are located in mainly kitchens of dwelling units, but also applies to countertop spaces in dining rooms, pantries, breakfast rooms, and similar area in dwelling units. 210.52(C)(5) indicates the receptacles installed for the specific countertop spaces as described in (C)(1) thru (C)(4) shall be located on or above, but not more than 20" above the countertop.
The 2nd sentence in 210.52(C)(5) is new in the 2011 NEC and states " receptacle outlet assemblies listed for the application shall be permitted to be installed in countertops" .Pop up receptacle assemblies are acceptable, but must be hard-wired, cord connected pop up receptacles are typically only supplied with a #14 gauge cord and are listed as relocatable power taps under the UL category XBYS

Also remember the exception to (5) which states: To comply with the conditions specified in (1) or (2), receptacle outlets shall be permitted to be mounted not more than 300 mm (12 in.) below the countertop. Receptacles mounted below a countertop in accordance with this exception shall not be located where the countertop extends more than 150 mm (6 in.) beyond its support base.
(1) Construction for the physically impaired

(2) On island and peninsular countertops where the countertop is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop, such as an overhead cabinet.
Short answer to question, Yes it is acceptable to install countertop receptacles under the upper cabinets, provided the receptacle outlets are no more 20" above the countertop surface. Code section 210.52(C)(5).

81. Is Allied the only company manufacturing boxes with a reduced horizontal clearance requirement in a fire rated assembly?

No, there are other manufacturers that have reduced horizontal spacings (less than 24 in.) from box to box on opposite sides of a fire rated assembly. Some of them you may need to use mineral wool insulation or other insulation in the stud cavities. The spacing and the limitations on the installation are detailed in the UL Classification of the boxes. These nonmetallic boxes for this use are classified under the product category Outlet Boxes and Fittings Classified for Fire Resistance (CEYY) or (QBWY) located on pages 88 and 302 in the 2011 White Book. They are the same product category under 2 different category codes. (Because one is for the Fire Directories and the other is for the electrical directories).

82. Can the laundry circuit go to more than one room?

Maybe-210.11(C)(2) requires at least one additional 20-ampere branch circuit to supply the laundry receptacle outlet(s) required by 210.52(F)(2). This section further prohibits outlets other than those designated for laundry on this required circuit. 210.52 provides the requirements for dwelling unit receptacle outlets. 210.52(F) requires at least one receptacle outlet to be installed for the laundry (circuit specific for a washer/gas dryer). (see also the two exceptions)This section does not limit the installation to one receptacle outlet; therefore, the branch circuit required by 210.11(C)(2) is permitted to have more than one laundry receptacle outlet on the circuit. In response to the question of whether or not this can be extended to more than one room would be dependent upon whether the other room is designed as a laundry "area" too. Note-the title of 210.52(F) is "Laundry Areas" and not room. While not common to see more than one laundry area in a dwelling unit, we cannot rule out the possibility of having two laundry areas in two separate rooms. Accordingly, in this scenario the laundry circuit would be permitted to extend beyond one room if the dwelling is designed with two laundry areas. Question sizing for load? i.e., two washing machines

83. Section 240.4 (F) allows delta/delta transformers to be installed without secondary transformer protection. Why can't this be applied to wye/wye or delta/wye transformers?

The fundamental requirement of 240.4 specifies that conductors are to be protected against overcurrent in accordance with their ampacity, and 240.21 require that the protection be provided at the point the conductor receives its supply. Section 240.4(F) permits the secondary circuit conductors from a transformer to be protected by overcurrent devices in the primary circuit conductors of the transformer only in the following two special cases:

1. A transformer with a 2-wire primary and a 2-wire secondary, provided the transformer primary is protected in accordance with 450.3

2. A 3-phase, delta-delta-connected transformer having a 3-wire, single-voltage secondary, provided its primary is protected in accordance with 450.3

Except for those two special cases, transformer secondary conductors must be protected by the use of overcurrent devices, because the primary overcurrent devices do not provide such protection. As an example, consider a single-phase transformer with a 2-wire secondary that is provided with primary overcurrent protection rated at 50 amperes. The transformer is rated 480/240 volts. Conductors supplied by the secondary have an ampacity of 100 amperes. Is the 50-ampere overcurrent protection allowed to protect the conductors that are connected to the secondary?

The secondary-to-primary voltage ratio in this example is 240 ÷ 480, a ratio of 0.5. Multiplying the secondary conductor ampacity of 100 amperes by 0.5 yields 50 amperes. Thus, the maximum rating of the overcurrent device allowed on the primary of the transformer that will also provide overcurrent protection for the secondary conductors is 50 amperes. These secondary conductors are not tap conductors, are not limited in length, and do not require overcurrent protection where they receive their supply, which is at the transformer secondary terminals.

However, if the secondary consisted of a 3-wire, 240/120-volt system, and a 120-volt line-to-neutral load could draw up to 200 amperes before the overcurrent device in the primary actuated. That would be the result of the 1:4 secondary-to-primary voltage ratio of the 120-volt winding of the transformer secondary, which can cause dangerous overloading of the secondary conductors.

84. Can you run flexible cord between permanently installed strip fluorescent fixtures if it is not attached to the building surface?

400.7 (2)does allow flexible cord for the wiring of luminaires but have to meet the requirements of 410.62 there are no provisions that would allow flexible cord between fixtures as stated in this question.

85. Are there any requirements in the NEC that address the openings created in walls when wiring methods run from the interior to the exterior?

Not at this time. There are requirements in the building code, fire code, energy code that apply in areas that adopt and enforce them.

The NEC addresses raceways that are exposed to different temperatures, such as outside to the inside of a building, and requires that the raceway be sealed. This is also addressed in 368.434 for busways

300.7 Raceways Exposed to Different Temperatures.
(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway or sleeve shall be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway or sleeve.

225.27 and 230.8 Raceway Seal. Where a service raceway enters a building or structure from an underground distribution system, it shall be sealed in accordance with 300.5(G). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, shield, or other components.

300.5G Raceway Seals. Conduits or raceways through which moisture may contact live parts shall be sealed or plugged at either or both ends.

368.234 Barriers and Seals. (A) Vapor Seals. Busway runs that have sections located both inside and outside of buildings shall have a vapor seal at the building wall to prevent interchange of air between indoor and outdoor sections.

86. Can a 20ft run of copper pipe buried in the ground be used as a grounding electrode for a temporary service?

There are no provisions or requirements in the NEC for grounding electrodes for "temporary services." The grounding electrodes that are recognized are included in 250.52(A). 10 ft of underground metal water pipe is included in 250.52(A)(1). No burial depth is given.

If the water pipe mentioned in the question is an isolated piece of pipe, the AHJ would need to determine that the water pipe makes an earth connection.

87. I have a kitchenette in a commercial occupancy. There is a sink in the 6' countertop, a refrigerator at the end of the counter and a microwave above the countertop. Do I need GFCI protection for the fridge and the microwave?

NEC 210.8(B)(2) requires all 15 and 20-ampere, 125-volt receptacles installed in non-dwelling type kitchens to be ground-fault protected, whether or not the receptacle serves countertop areas.

88. Can you use the remote control provided with a ceiling fan/ light combination unit as the required wall switch when entering the room?

NEC 210.70(A) thru (C) specifies where lighting outlets are required. 210.70(A) contains the requirements for dwelling units, (B) has the requirements for guest rooms or guest suites of motels, hotels and similar occupancies, and (C) is for attics and under floor spaces, typically referred to as "crawl spaces" for other than dwelling units where such spaces have equipment which requires servicing, such as HVAC equipment.

If this ceiling fan/light unit is installed within a dwelling unit, then this installation would require a wall switch for controlling the lighting portion of the ceiling fan/light combination at a minimum in accordance with the requirements in NEC 210.70(A(1)), the remote control would be acceptable for operating the fan portion of the fan/light only as there is requirement to have a wall switch for a ceiling fan.

That being said, Exception #1 to 210.70(A)(1) does not require a wall switch controlled lighting outlet in other than kitchens and bathrooms if there are one or more receptacles in the room which are controlled by a wall mounted switch. So if there are receptacle outlets controlled by a wall switch in the room, the remote control would be acceptable.

The 2nd exception to 210.70(A)(1) allows lighting outlets to be controlled by occupancy sensors if they are in addition to the wall switch or are installed where the wall mounted switch would normally be placed and the occupancy sensor has a manual override to act as atypical wall switch.

If this fan/light unit was to be installed in an occupancy other than a dwelling unit, a wall switch would not be required by the NEC, in fact many commercial buildings now install ceiling mounted occupancy sensors in order to comply with Energy Codes such as the International Energy Conservation Code (IECC) for automatic shut off control requirements.

Short Answer: Remote control cannot be used if this is the only lighting in room of a dwelling unit. If switched receptacles are provided in room in addition to the paddle fan/light, then remote would be acceptable for switching the light at the ceiling fan. Code section 210.70(A)(1).

89. Can the circuit conductors for a fire pump be installed where they are outside the building and routed to go over the roof?

Yes, NEC 695.6(A)(1) requires the supply conductors for a fire pump be routed outside of the building and shall be installed as service-entrance conductors in accordance with 230.6, 230.9, and Parts III and IV of Article 230.

90. I have a code question regarding multiple services in one building. I understand the issues with services in a building served by the same utility but what about multiple utilities. We have a territorial agreement with the City of Arcadia and an existing grain company is within the city territory and is served by the city utility. The grain company is expanding and is now adding additional grain bins which will be located in the co-op territory. There will be elevator legs connecting the new and existing facilities. Does an elevator leg connecting the two structures make this one building? Common sense aside, is there anything in the code preventing the co-op from serving the new addition. If the city serves this addition, they plan on adding an additional new three-phase service.

I understand the question to revolve around 2 issues:
Does an elevator leg connected between 2 buildings/structures make this one building?
Does the Code allow buildings or structures to be served by more than one utility?
Look first to Article 100:

Building. A structure that stands alone or that is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors. HB: A building is generally considered to be a roofed or walled structure that may be used or intended for supporting or sheltering any use or occupancy. However, it may also be a separate structure such as a pole, billboard sign, or water tower.

Structure. That which is built or constructed.

Equipment. A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

Therefore, if the grain bins are considered one building, we then look at the second part of the question: how we would apply multiple services to a building fed from two utilities:

The total number of services permitted to a structure or building is governed by 230.2. As a general rule, 230.2 limits buildings or other structure served, to be supplied by only one service unless permitted in 230.2(A) through (D). Referring to the first part of the question, does the NEC permit multiple services to a building that are fed from different utilities- the answer may be yes-provided one of the conditions specified in (A) through (D) of 230.2 are met. 230.2(D) allows additional services for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules, therefore, may qualify under this provision. I'm not aware of any provision of the NEC that would prohibit two utility companies to provide a separate service to a building or structure, as long as those services meet the requirements of 230.2.

NEC Section: Article 100 & 230.2

91. A motor nameplate does not state "thermally protected", but has a winding embedded motor thermostat. Can you consider that this thermostat provides the thermal protection for the motor?

Yes. Reference 430.32(A) for More than one HP or (B) for one HP or less and 430.37. Both state: A thermal protector integral with the motor, approved for use with the motor it protects on the basis that it will prevent dangerous overheating of the motor due to overload and failure to start.

For a motor more than one hp The ultimate trip current of a thermally protected motor shall not exceed the percentage shown based on the motor full-load current given in Tables 430.248, .249, and 250:

(B) One Horsepower or Less, Automatically Started. Any motor of 1 hp or less that is started automatically shall be protected against overload by one of the following means. (2) Thermal Protector. A thermal protector integral with the motor, approved for use with the motor that it protects on the basis that it will prevent dangerous overheating of the motor due to overload and failure to start. Where the motor current-interrupting device is separate from the motor and its control circuit is operated by a protective device integral with the motor, it shall be arranged so that the opening of the control circuit results in interruption of current to the motor.

430.37 Devices Other Than Fuses — In Which Conductor states:

Where devices other than fuses are used for motor overload protection, Table 430.37 shall govern the minimum allowable number and location of overload units such as trip coils or relays.

If the motor current-interrupting device is separate from the motor and its control circuit is operated by a protective device integral with the motor, it shall be arranged so that the opening of the control circuit will result in interruption of current to the motor.

92. What type of sealing compound can be used for the conduit seals at the boundaries of a Class 1 Division 2 location where they are not required to be explosion-proof?

the question addressed conduits passing from a classified area into an unclassified area where a sealing fitting is not required to be explosion-proof but must be identified for the purpose of minimizing the passage of gases-501.15(B)(2). There are no products Listed for this application. Only listed compounds are approved for this purpose. Some sealing fittings are approved for a classified area only if they use the manufacturers sealing compound. The authority having jurisdiction would have to make the final decision.

93. Is a chiropractor business considered a health care facility? Is an optometry office considered a health care facility?

Yes, the scope of Article 517 is "health care facilities that provide services to human beings." The term health care facility is defined as "buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided."

A person who practices optometry is a doctor of optometry and one who practices chiropractic is considered a doctor of alternative medicine so both occupancies would be considered a health care facility, per the definition.

The greater question for the electrical contractor, however, is whether or not there are patient care areas in either of those offices. It is possible there are treatment rooms that would fit the definition of a general care area, definition extracted from NFPA 99.

Article 517 also states that it is the governing body of the facility that makes the decision based on the definition and the type of patient care anticipated. Some chiropractic practices include only massage and manipulation; some optometric practices are limited to eye exercises, and their clients are patients, those rooms would not meet the definition.

517.1 Scope. The provisions of this article shall apply to electrical construction and installation criteria in health care facilities that provide services to human beings.

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

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

94. As defined in Art. 604, manufactured wiring systems (also known as prefabricated assemblies by UL) may incorporate multi-pole connectors, AC cable, MC cable, flexible metal conduit, hard usage cord, outlet boxes, splitter assemblies, remote control switching assemblies, and devices. Where exactly can these types of systems be installed?

See 604.4 for Uses Permitted and 604.5 for Uses Not Permitted. Basically, the wiring method used in the Manufactured Wiring System determines where the wiring can be used. For example, refer to 330.10 for uses permitted for Type MC cable and 330.12 for uses not permitted. For flexible cord, see 400.7 for uses permitted and 400.8 for uses not permitted. In addition, the occupancy articles such as 517, 518 and 520 contain specific wiring methods for all or portions of an occupancy.

95. What is the ampacity of three #8 XHHW conductors installed in a wet location with an ambient temperature of 45 deg. C?

NEC Table 310.15(B)(16) formerly Table 310.16, shows the ampacity of an 8 AWG XHHW conductor to be 50-amperes based on a temperature termination rating of 75° and an ambient temperature of 30°C . The temperature correction factors are found in Table 310.15(B)(2)(A). For an ambient temperature or 40° multiply the ampere-carrying capacity by .95 in accordance with 110.14(C) resulting in 47.5 amperes or 48 amperes according to 220.4(B).

96. A kitchen counter has the required number of receptacles. After the counter ends, there is a two foot wall space. Does this wall space also require a receptacle?

In some jurisdictions, this has been required, and in some jurisdictions the wall receptacle was not required due to the countertop receptacle being located within 6' of the end of the wall. The 2011 NEC now clarifies this question in the new subsection (4) under 210.52(A). 210.52(A) has the requirements for wall receptacle spacing, the new 210.52(A)(4) on page 56 of the 2011 NEC indicates that receptacles installed for countertop surfaces as specified in 210.52(C)for countertop receptacle spacing requirements shall not be considered as the receptacles required by 210.52(A).

ROP LANGUAGE: ROP 2-228 TCC Action: It was the action of the Technical Correlating Committee that this action be rewritten to comply with the NEC Style Manual.
The panel action did not include a title for the new subdivision (4).
This proposal will be considered by the panel as a public comment.
Submitter: Michael Dempsey, Municipal Code Inspections
Recommendation: Revise text as follows:
Receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(3) and shall be in addition to 210.52(C).
Substantiation: Required countertop receptacles cannot be used to comply with wall space requirements, an example is a 3 ft wall space between the end of a counter and a door, that wall space needs a receptacle and cannot use a countertop receptacle to comply.

Panel Meeting Action: Accept in Principle
Add a new item (4) to 210.52(A) to read as follows:
(4) Receptacles installed for countertop surfaces as specified in 210.52(C) shall not be considered as the receptacles required by 210.52(A).
Panel Statement: The panel has accepted the concept and added a new item (4) to specifically note that countertop receptacles are not permitted to be counted as meeting the surfaces as provisions of 210.52(A).
Number Eligible to Vote: 12
Ballot Results: Affirmative: 12

Short Answer: The 2011 NEC has clarified this issue by adding new subsection (4) to 210.52(A). New subsection (4) specifically states the receptacles installed for countertop spacing are not to be counted for the wall spacing requirements. If there is a wall space 2' or more in length adjacent to or at the end of the countertop, there shall be a receptacle outlet in this wall space in addition to any receptacles installed on the countertop surface.

97. Are we required to use anti-short bushings when we terminate Type MC (metal clad) cable?

No, Section 330.40 only requires fittings used for connecting Type MC cable to boxes, cabinets, or other equipment shall be listed and identified for such use. Fittings Listed for use with Type MC Cable are Listed under the product category Metal Clad Cable Connectors (PJOX), located on page 281 in the 2011 UL White Book.

For armored cable Type AC cable, on the other hand is required by NEC 320.40 to use an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.

98. We install a lot of generators for residences, and only recently have been getting written up on our transfer switches. The inspectors are saying that if I use the transfer switch to transfer the entire house — and I put it between the meter and the service disconnect — then the transfer switch must be "service rated." Did something change recently that is now causing the "red tags"?

The inspector is correct: Look at definitions in Article 100: Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply. Next, we look at the definition of Service: Service. The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served. Service Equipment: The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

230.66 Marking. Service equipment rated at 600 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed. Individual meter socket enclosures shall not be considered service equipment.

Note: In addition to the requirement for the disconnect to be service rated, it is also required to have overcurrent protection as an integral part or immediately adjacent thereto in accordance with 230.91

NEC Section: Article 100 & 230.70

99. On an kitchen island that is six feet from a sink does the receptacle outlet on the side of the island have to be GFCI protected?

Probably Ref: 210.8(A)(6) If the receptacle is installed to serve the counter top as is required in 210.52(C)(2).

100. We have a heat tape system installed on a metal roof. The heat tape has arced against the metal before, and we are concerned we will burn the place to the ground. Someone told us to use a GFCI on the circuit, and someone else told us not to. What does the NEC say about this? How about manufacturer's instructions or listing requirements?

GFPE is required in 426.28 CIRCUIT BREAKERS WITH EQUIPMENT GROUND-FAULT PROTECTION Are covered in the white book under (DIYA) and EQUIPMENT GROUND-FAULT PROTECTIVE DEVICES under(FTTE)

426.28 Ground-Fault Protection of Equipment. Groundfault protection of equipment shall be provided for fixed outdoor electric deicing and snow-melting equipment

101. I have 2 new operating rooms each with a duplex isolation panel serving 120 volt loads. Each operating room also has a 208 Volt receptacle for a portable laser unit. I have a separate isolation panel to serve both these receptacles. Can this panel serve both operating room laser receptacles even if the panel is located in one of the two rooms?

Yes. An allowance found in NFPA 99:13.4.1.2.6.6 is also in 517.160(A)(4)(b)(2) permitting special receptacle is a special receptacle configuration, such as 208-volt laser. Per the exception, these would not be interchangeable with the 120-volt receptacles supplied from the other IPS.

(4) Isolation Transformers. An isolation transformer shall not serve more than one operating room except as covered in (A)(4)(a) and (A)(4)(b).
For purposes of this section, anesthetic induction rooms are considered part of the operating room or rooms served by the induction rooms.

(a) Induction Rooms. Where an induction room serves more than one operating room, the isolated circuits of the induction room shall be permitted to be supplied from the isolation transformer of any one of the operating rooms served by that induction room.

(b) Higher Voltages. Isolation transformers shall be permitted to serve single receptacles in several patient areas where the following apply:

(1) The receptacles are reserved for supplying power to equipment requiring 150 volts or higher, such as portable X-ray units.
(2) The receptacles and mating plugs are not interchangeable with the receptacles on the local isolated power system.

102. Can we install a 3-wire feeder (no equipment ground) to a pool house and bond the neutral and ground at the new panel?

No, an insulated equipment grounding conductor installed in accordance with 250.32(B) is required. See 680.25(B).

103. Are tamper-resistant receptacles required if the receptacle is higher than 51/2 feet above the floor in a dwelling? How about if a receptacle is installed in a cabinet? Finally, what if a receptacle is part of a listed luminaire?

NEC 406.12 requires tamper-resistant receptacles in all areas specified in 210.52 with the following exceptions:
1. Receptacles located more than 5 ½ ft. above the floor
2. Receptacles that are a part of a luminaire or appliance

210.52(1) also exempts the requirement for the installation of receptacle outlets in cabinets or cupboards as well as part of a luminaire, located or located more than 5½ ft above the floor.

104. If the tab is removed from a duplex receptacle so you are switching half of the duplex receptacle, will the remaining half, that is energized all the time, meet the requirement for receptacles in Section 210.52 (A)? There is only one circuit to the receptacle.

210.52(A) requires under the General Provisions, that in every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(3).

The definition of "receptacle" in Article 100 is a" receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke".

The definition of "receptacle outlet" in Article 100 on page 31 of the 2011 NEC says " An outlet where one or more receptacles are installed". The NEC handbook illustrates a single, a duplex and a multiple receptacle are all considered receptacle outlets.

So based on the definitions in Article 100, The Code language in 210.52(A) only mentions "receptacle", so if the one half is switched, the 2nd half is then left for any portable loads to be plugged into, and complies with the requirement to have a "receptacle" for the wall spacing. So in reality, if an electrician chose to, he or she could install single receptacles to comply with the wall spacing requirements, but would be required to install a duplex receptacle for the described installation in the question due to one half of the receptacle being switched, this is required due to the language in 210.52(2) on page 55 of the 2011 NEC. 210.52 Dwelling Unit Receptacle Outlets.

2011 NEC CODE: 210.52 This section provides requirements for 125-volt, 15- and 20-ampere receptacle outlets. The receptacles required by this section shall be in addition to any receptacle that is:

(2) Controlled by a wall switch in accordance with 210.70(A)(1), Exception No. 1

2011 NEC CODE: 210.70 Lighting Outlets Required.
Lighting outlets shall be installed where specified in 210.70(A), (B), and (C).
(A) Dwelling Units. In dwelling units, lighting outlets shall be installed in accordance with 210.70(A)(1), (A)(2), and (A)(3).
(1) Habitable Rooms. At least one wall switch–controlled lighting outlet shall be installed in every habitable room and bathroom.
Exception No. 1: In other than kitchens and bathrooms, one or more receptacles controlled by a wall switch shall be permitted in lieu of lighting outlets.
Short answer: Based on the definition of "receptacle outlet" in Article 100, and the requirements in 210.52(A), a receptacle is required to be installed at the proper 6' and 12' spacing, this can be accomplished with only one half of the receptacle energized at all times. By the definition of "receptacle", there only needs to be 1 receptacle energized, while the other half can be switched to meet the requirements of 210.70(A)(1) for a switched lighting outlet in habitable rooms. The above installation would be acceptable.

105. The pedestal panel at the RV parking lot is a 60A, 120/240 volt panel fed by a 400 Ampere service. There are 2 ungrounded conductors, one grounded conductor and an equipment-grounding conductor sized for 60 A breakers. Do I need to install a ground rod for this service?

First of all this is not a service, this is a feeder to RV site supply equipment, and yes, you would need to install a ground rod at each pedestal.
NEC 551.75 requires that the all equipment and installations in a RV parks be grounded per Article 250. Per the 2008 ROP, CMP-19 considers the pedestal as a structure. NEC 250.32(A) requires a structure to be provided with a grounding electrode. Most of the time, They have feeders that feed more than 1 site so the feeder is larger than #4. So that equipment ground has to be sized per 551.76(A) which requires the equipment ground to be sized by the overcurrent device feeding per 250.122.

106. When we rewire apartments we can't always re-use all the receptacles and we would like to install grounded receptacles in place of the non-grounding ones. Much of the existing wiring does not have an equipment grounding conductor. Should we install an arc fault breaker or a ground fault breaker to be code compliant?

Section 406.4(D) Provides the requirements for replacement receptacles (D)(2)(b) & (c) addresses the use of a GFCI, where no equipment grounding conductor exists:

(D) Replacements. Replacement of receptacles shall comply with 406.4(D)(1) through (D)(6), as applicable.

(2) Non-Grounding-Type Receptacles. Where attachment to an equipment grounding conductor does not exist in the receptacle enclosure, the installation shall comply with (D)(2)(a), (D)(2)(b), or (D)(2)(c).

(a) A non–grounding-type receptacle(s) shall be permitted to be replaced with another non–grounding-type receptacle(s).

(b) A non–grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter type of receptacle(s). These receptacles shall be marked "No Equipment Ground." An equipment grounding conductor shall not be connected from the ground-fault circuit interrupter- type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle.

(c) A non–grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit interrupter. Grounding-type receptacles supplied through the ground fault circuit interrupter shall be marked "GFCI Protected" and "No Equipment Ground." An equipment grounding conductor shall not be connected between the grounding type receptacles

However, per new section 406.4(D)(4) (effective 1/1/14), replacement receptacles located where a receptacle outlet is supplied by a branch circuit that requires arc-fault circuit interrupter protection as specified elsewhere in the Code, will be required to have AFCI protection meeting 406.4(D)(1), (2) or (3).

NEC Section 406.4

107. On the roof of a school we have 8 exhaust fans from science classrooms. Is a receptacle for maintenance in accordance with Section 210.63 of the NEC required for these fans? If so, could 1 receptacle cover all the fans assuming it is within 25 feet of all of them?

NO Ref: 210.63 An exhaust fan is not considered to be heating, air conditioning or refrigeration equipment and therefore would not be required.

108. Will the wiring methods for a Kerosene Dispensing Unit fall under the requirements of Art.514? There are Gasoline dispensing pumps located nearby (40-50 ft.) but the kerosene unit would be away from any classified area. Kerosene is considered a combustible liquid and not flammable, because of the higher flashpoint, will the area inside the pump enclosure be considered Class 1 Division 1, the same for gasoline, or could it be a Class 1 Division 2 location or maybe not classified at all.

Subsection 8.3.6 of NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, states: The storage, handling, and dispensing of Class II or Class III liquids shall not cause an area to be designated as a hazardous (classified) location. Kerosene is a Class II combustible liquid; therefore, the kerosene dispenser is not designated a hazardous (classified) location and the area classification shown in Figure 8.3.2(a) of NFPA 30A, for gasoline dispensers, is not applicable.
The gasoline dispensers mentioned in the description you provided are stated as being at least 40 feet from the kerosene dispenser. As shown in Figure 8.3.2(a), the Class I, Division 2 area around the gasoline dispenser extends out to 20 feet from the side of the dispenser. The kerosene dispenser is at least twice as far away an does not encroach into the classified area around the gasoline dispenser; therefore, again, area classification is not applicable to the kerosene dispenser.

109. When are two or more control circuits for permanent amusement attractions permitted to occupy the same cable, cable tray, enclosure, or raceway, without regard to whether the individual circuits are alternating current or direct current?

Section 522.24 addresses that question:

522.24 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway.
Control circuits shall be permitted to be installed with other circuits as specified in 522.24(A) and (B). (A) Two or More Control Circuits. Control circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the cable, cable tray, enclosure, or raceway

110. If we utilize a qualified electrician and he/she complies with the job assessment and wears the required Personal Protective Equipment (PPE) as described in Table 130.7(C)(10) of NFPA 70E, will that person be allowed to install circuit breakers in a 208/120-volt panel for a computer room without shutting down the entire panel?

A qualified "Yes" answer provided that NFPA 70E Section 130.2(A) Energized Work is complied with.

(1) Greater Hazard. Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.

Changed From 2009

• 130.2(A)(1): Revised “increased or additional hazards” to “additional hazards or increased risks” for consistency with similar changes made to provisions covering hazard identification and risk assessment.

(2) Infeasibility. Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.

A Hazard/Risk Analysis would be required that would support the hot work. Then, an Energized Work Permit would be required. The Energized Work Permit would detail the level of PPE required.

111. What is the required working space for a storage battery installation in accordance with the 2011National Electrical Code? The depth of the battery rack supporting the batteries is 12 inches extending from a wall. Directly across from the battery rack is electrical switchgear with an operating voltage of 480V. Based on this information, what is the required minimum depth of the working space?

NEC 480.9(C) requires the working space about batteries to be in compliance with 110.26. Working clearance must be measured from the edge of the battery rack. The same working clearances are required for the switchgear. This does not mean the clearance must be doubled.

112. A question has been raised on how to measure wall space in accordance with Section 210.52 (A)(2)(1) of the NEC. In this case a dwelling basement is turned into living space and the round steel posts supporting the beam were boxed out providing a square column that is greater than 6 inches per side. The wall space is now more than 24 inches. Is a receptacle required?

Answer: YES, this area of wall is just that, wall space. This is no different than a duct chase being boxed out with studs and drywall, this area is then to be measured as a wall, and if the length is greater than 2’ in length a receptacle is required to be installed for this wall space in accordance with 210.52(A)(2).
210.52(A)(2) indicates that wall space as used in this Code section, wall space shall include the following:
(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways, fireplaces, and similar openings
(2) The space occupied by fixed panels in exterior walls, excluding sliding panels
(3) The space afforded by fixed room dividers such as freestanding bar-type counters or railings.
The other question is that if the steel post is not boxed out, is then considered wall space, I would say not, this is just a structural support member. Remember if it looks like a duck it probably is a duck!!! If it looks like a wall, treat it as a wall.
Short answer: YES, this area of wall is just that, wall space. This is no different than a duct chase being boxed out in the room with studs and drywall, this area is then to be measured as a wall, and if the length is greater than 2’ in length a receptacle is required to be installed for this wall space in accordance with 210.52(A)(2).

113. Can CFL or LED lamps be used in luminaries that are not listed for their use?

Yes as long as they physically fit, are not rated a higher wattage than marked on the luminaire and they are installed in accordance with any markings on the lamp itself.

UL Lists CFL’s under the category Lamps, Self Ballasted and Lamp Adapters (OOLR) on page 269 in the 2011 White Book and LED lamps are Listed under the category Lamps, Self Ballasted Light emitting diode type (OOLV), also located on page 269 in the 2011 White Book.

These products are generally for use in indoor, dry locations unless additionally investigated and marked for applications such as damp locations (not directly exposed to water). Products investigated and marked for wet locations may have additional restrictions regarding use or orientation.

These products have been investigated for use in the smaller of a 6- or 8-in. diameter, totally enclosed, recessed luminaire, if they will physically fit, unless marked not for use in a totally-enclosed luminaire.

114. Can three single-pole breakers be used for multi-wire branch circuits?

Yes-210.4(B) requires each multiwire branch circuit to be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates. The purpose of this section is to provide a disconnecting means to ensure when servicing a multiwire branch circuit, all conductors sharing a neutral are simultaneously disconnects as well. This has no relation to a common trip requirement in accordance with 240.15. 240.15(B)(1) permits handle ties for Individual single-pole circuit breakers, for multiwire branch circuits that serve only single-phase line-to neutral loads.

NEC Section 240.15(B)(1)

115. I have run into an interpretation issue on one our construction projects regarding junction box accessibility above gypsum board ceilings. The building is predominately acoustical lay-in tile ceilings except in restrooms and storage room areas. In the restrooms and storage areas, it has been a common practice to lift out the 2x4 fluorescent light fixture to gain access to any junction boxes installed above the ceiling. Section 314.29 would seem to further restrict the code definition of "Accessible," but, if taken to that literal extreme, then would removing a ceiling tile to gain access to a junction box also be a violation?

YES; Reference 314.2, 410.30 and UL Category IEVV.

I assume the submitter of the question is asking if it would be permissible in a hard ceiling to access the box as required in 314.29 by lifting out the lay-in luminaire. 314.29 Requires that the junction box to be accessible. Boxes, conduit bodies, and handhole enclosures shall be installed so that the wiring contained in them can be rendered accessible without removing any part of the building Section 410.30(A) requires luminaires to be securely supported this would undoubtedly mean the support method would be above the ceiling and prohibit the removal of the lay-in for access to the box.

116. What is the minimum size for an equipment bonding jumper on the supply side of a service with 5-parallel 500 kcmil copper conductors?

500 x 5 =2500 x12.5% = 312.5 not less 350 mcm; 1/0 for separate raceway
250.102 (c) 2 Bonding Conductors and Jumpers.
(C) Size — Supply-Side Bonding Jumper.
(1) Size for Supply Conductors in a Single Raceway or Cable. The supply-side bonding jumper shall not be smaller than the sizes shown in Table 250.66 for grounding electrode conductors. Where the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the supply-side bonding jumper shall have an area not less than 121⁄2 percent of the area of the largest set of ungrounded supply conductors.

(2) Size for Parallel Conductor Installations. Where the ungrounded supply conductors are paralleled in two or more raceways or cables, and an individual supply-side bonding jumper is used for bonding these raceways or cables, the size of the supply-side bonding jumper for each raceway or cable shall be selected from Table 250.66 based on the size of the ungrounded supply conductors in each raceway or cable. A single supply-side bonding jumper installed for bonding two or more raceways or cables shall be sized in accordance with 250.102(C)(1).

117. We are installing operating rooms in a group B (business) occupancy. Would the electrical system in the rooms be required to meet the wiring requirements for critical care areas in accordance with Article 517 of the NEC? The building is classed as B for business and not I for institutional such as a hospital.

Yes. Regardless of the building code classification, the electrical requirements apply.

517.1 Scope. The requirements in Parts II and III not only apply to single-function buildings but are also intended to be individually applied to their respective forms of occupancy within a multifunction building (e.g., a doctor's examining room located within a limited care facility would be required to meet the provisions of 517.10).

118. Is a grounding electrode system required for a fire pump service?

A grounding electrode system is required for both grounded and ungrounded electrical services. See 250.24(A) for premises wiring systems supplied by a grounded electrical system and 250.24(E) for ungrounded systems. Also, if an additional grounding electrode system is installed, it must be connected to any other grounding electrode system. See 250.58.

119. Is there any code requirement to connect all equipment grounding conductors together before connecting to the devices such as a switch or outlet? Does this requirement change if there are multiple circuits in one box?

I'm assuming you mean switch outlet or receptacle outlet. Too often the term outlet is used instead of receptacle. NEC 250.148(B) requires that removal of a device does not interrupt the grounding continuity. Thr requirement is the same for multiple circuits in one box.

120. I am seeking some clarification on the new requirements of the "additional receptacle outlet in the basement" as specified in 210.52 (G). I am under the assumption that this would require a second box and receptacle if one of the receptacles in a duplex receptacle is used. Is an additional receptacle required or is the unused portion of the duplex acceptable to meet the requirement?

It Depends!!!!! This requirement was inserted into the 1999 edition of the NEC. A 2nd sentence was added to 210.52(G) clarify to that all unfinished areas of a basement were to have a receptacle outlet installed to discourage the use of extension cords through doorways and have appliances and other electrical items plugged into non GFCI protected outlets in finished portions of the basement.

210.52(G) Basements and Garages. For a one-family dwelling, the following provisions shall apply:

(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage with electric power.

(2) Where a portion of the basement is finished into one or more habitable rooms, each separate unfinished portion shall have a receptacle outlet installed in accordance with this section.
NEC COMMENTARY: In a one-family dwelling, a receptacle must be installed in the basement (in addition to the laundry receptacle), in each attached garage, and in each detached garage with electric power.

210.11(C)(2) requires a additional branch circuit for the laundry, the last sentence indicates there shall be no other outlets connected to this circuit, therefore if the laundry consists of an 220 volt electric dryer and a 120 volt clothes washing machine with only the clothes washer plugged into the 120 volt duplex receptacle, then there would be a need for an additional receptacle, either single or duplex installed in that unfinished portion of the basement where the laundry was located. On the other hand if there was a water softener installed in this same unfinished basement, and the softener was plugged into a duplex receptacle, the other ½ of the receptacle would be open and be in compliance with the requirement to have an "additional receptacle outlet" in that unfinished basement .

In article 100 of the NEC, page 31 "receptacle outlet" is defined as "an outlet where one or more receptacles are installed". "Receptacle" is also defined in Article 100, as " a receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

If you had a central vacuum system plugged into a duplex receptacle in the unfinished basement, the vacuum system were to draw 15 amperes and was on a 15 ampere branch circuit, the other half of the duplex receptacle could not be used, this is because 210.23(A) requires 15 and 20 ampere branch circuits to meet certain maximum load capacities. 210.23(A)(2)on page 54 does not allow the circuit be loaded to more than 50% if the circuit is to also be used for cord and plug connected equipment.

Short answer: NEC 210.52(G) requires a receptacle outlet installed in each unfinished area of a basement. Based on the definition of receptacle outlet in Article 100, a duplex receptacle would be acceptable even if ½ of the duplex receptacle was being utilized for another electrical appliance, such as a water softener. This would not be allowed though, if the duplex receptacle was supplied by an individual branch circuit. An example such as the 120 volt individual branch circuit as defined in Article 100, supplying the furnace (NEC 422.12) if this circuit has a duplex receptacle installed for the condensate pump as allowed by Exception#1 to 422.12, then the remaining open part of the receptacle could not be used in order to meet the requirement in 210.52(G).

121. Are there any "open splice connectors" listed for new work that can be buried in a wall or ceiling?

I am not sure what an open splice connector is, I assume one that doesn't have to be in a box as permitted in 300.15(H) and 334.40(B) which states (B) Devices of Insulating Material. Switch, outlet, and tap devices of insulating material shall be permitted to be used without boxes in exposed cable wiring and for rewiring in existing buildings where the cable is concealed and fished.

Openings in such devices shall form a close fit around the outer covering of the cable, and the device shall fully enclose the part of the cable from which any part of the covering has been removed. Where connections to conductors are by binding-screw terminals, there shall be available as many terminals as conductors.

These devices are Listed as Non metallic Cable Interconnectors (QAAV), located on page 294 in the 2011 White Book. The guide information states These interconnectors are intended for use in exposed or concealed locations in accordance with the following Articles of ANSI/NFPA 70, ''National Electrical Code'':

Article 545, Manufactured Buildings
Article 550, Mobile Homes, Manufactured Homes, and Mobile Home Parks
Article 551, Recreational Vehicles and Recreational Vehicle Parks
Article 334, Nonmetallic-Sheathed Cable: Types NM, NMC, and NMS (for tap devices)

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

122. The electrical service on a residential property is installed on the exterior of the detached garage. Can the feeder from this service to the house be sized by table 310.15(B)(6)?

Yes-since this feeder will be supplying all loads to the dwelling unit. With the reorganization of Article 310, Section 310.15(B)(6) is now 310.15(B)(7).

310.15(B)(6) 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For individual dwelling units of one family, two-family, and multifamily dwellings, conductors, as listed in Table 310.15(B)(6), shall be permitted as 120/240-volt, 3-wire, single-phase service-entrance conductors, service lateral conductors, and feeder conductors that serve as the main power feeder to each dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder shall be the feeder between the main disconnect and the panelboard that supplies, either by branch circuits or by feeders, or both, all loads that are part or associated with the dwelling unit. The feeder conductors to a dwelling unit shall not be required to have an allowable ampacity rating greater than their service-entrance conductors

NEC Section 310.15(B)(6) & 310.15(B)(7) (2011 NEC)

123. Is it necessary to consider the available fault current when installing a fire pump controller?

Yes. References: 90.3, 110.9 & 110.10. 90.3. Sections 110.9 and 110.10 Are the general requirement for available fault current. Article 695 for fire Pumps does not amend or modify this general rule.

124. When does a fire pump connected ahead of a main service require a generator backup system?

695.3 Power Source(s) for Electric Motor-Driven Fire Pumps. Electric motor-driven fire pumps shall have a reliable source of power.

(A) Individual Sources. Where reliable, and where capable of carrying indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply, the power source for an electric motor driven fire pump shall be one or more of the following.

(1) Electric Utility Service Connection. A fire pump shall be permitted to be supplied by a separate service, or from a connection located ahead of and not within the same cabinet, enclosure, or vertical switchboard section as the service disconnecting means. The connection shall be located and arranged so as to minimize the possibility of damage by fire

from within the premises and from exposing hazards. A tap ahead of the service disconnecting means shall comply with 230.82(5). The service equipment shall comply with the labeling requirements in 230.2 and the location requirements in 230.72(B). [20:9.2.2(1)]

(2) On-Site Power Production Facility. A fire pump shall be permitted to be supplied by an on-site power production facility. The source facility shall be located and protected to minimize the possibility of damage by fire. [20:9.2.2(3)]

(3) Dedicated Feeder. A dedicated feeder shall be permitted where it is derived from a service connection as described in 695.3(A)(1). [20:9.2.2(3)]

(B) Multiple Sources. If reliable power cannot be obtained from a source described in 695.3(A), power shall be supplied by one of the following: [20:9.3.2]

(1) Individual Sources. An approved combination of two or more of the sources from 695.3(A).

(2) Individual Source and On-site Standby Generator. An approved combination of one or more of the sources in 695.3(A) and an on-site standby generator complying with 695.3(D). [20:9.3.4]

Exception to (B)(1) and (B)(2): An alternate source of power shall not be required where a back-up engine-driven or back-up steam turbine-driven fire pump is installed.[20:9.3.3]

125. Are there special wiring requirements for commercial woodworking shop fluorescent lighting?

Yes. Article 503 applies to commercial woodworking shops, and section 503.130 has the rules for luminaires (which includes fluorescent) in both Division I and Div II:
503.130 Luminaires — Class III, Divisions 1 and 2
(A) Fixed Lighting. Luminaires for fixed lighting shall provide enclosures for lamps and lampholders that are designed to minimize entrance of fibers/flyings and to prevent the escape of sparks, burning material, or hot metal. Each luminaire shall be clearly marked to show the maximum wattage of the lamps that shall be permitted without exceeding an exposed surface temperature of 165°C (329°F) under normal conditions of use.
(B) Physical Damage. A luminaire that may be exposed to physical damage shall be protected by a suitable guard.
If the fluorescent luminaires are portable, then (D) would also apply:
(D) Portable Lighting Equipment. Portable lighting equipment shall be equipped with handles and protected with substantial guards. Lampholders shall be of the unswitched type with no provision for receiving attachment plugs. There shall be no exposed current-carrying metal parts and all exposed non–current-carrying metal parts shall be grounded. In all other respects, portable lighting equipment shall comply with 503.130(A).

126. Why is # 4 AWG copper GEC the maximum size required for a concrete- encased electrode?

Because the NEC permits a 4 AWG copper conductor to be used as the concrete-encased grounding electrode. The grounding electrode conductor is not required to be larger than the grounding electrode. The 4 AWG conductor was used in some of the grounding electrodes used in the original study conducted by Herbert Ufer.

127. Where can I find information in the NEC detailing requirements for sealing conduit that passes from ambient temperature rooms into a refrigerated room? I know that condensation will form inside the raceway unless sealed.

NEC 300.7(A) requires that where portions of a raceway are subjected to different temperatures and condensation is known to be a problem the raceway must be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway. An explosion-proof seal is not required for this purpose. Duct seal has been generally been approved (90.4) for this purpose.

128. Do we still have to bond the deck of an outdoor swimming pool if the deck is constructed of paving blocks?

YES, NEC 680.26(B)(2) requires the bonding of the perimeter surfaces are required to be bonded, and the Code language indicates " shall include unpaved surfaces, as well as poured concrete surfaces and other types of paving" , therefore paving blocks would be included in the requirement. The bonding of the perimeter surfaces shall installed as required by

680.26(B)(2)(a) or (2)(b) and shall be attached to the pool reinforcing steel or copper conductor grid at a minimum of 4 points uniformly spaced around the perimeter of the pool. For nonconductive pool shells, bonding at the four points shall not be required. This requirement 1st came into the NEC in the 2005 edition, ROP 17-122 brought up concerns there were voltage differences being measured from the pool to adjacent surfaces, therefore CMP 17 during the comment stage of the 2005 NEC introduced new language to require the perimeter surfaces be included in the bonding requirements, even when there is no reinforcing steel rebar installed. After the 2005 NEC was published, there was a TIA issued, the Tentative Interim Amendment #05-2 was issued in August of 2005, the TIA was intended on helping the end users of the NEC better understand the new requirement, then in NEC 680.26(C). 680.26 was significantly revised during the 2005 and 2008 Code cycles to make the section easier to follow & understand.

Short Answer: YES, NEC 680.26(B)(2) requires the bonding of the perimeter surfaces are required to be bonded, and the Code language indicates " shall include unpaved surfaces, as well as poured concrete surfaces and other types of paving" , therefore paving blocks would be included in the requirement

129. We have the circuit for an A/C and also a GFCI circuit in the same raceway, but the GFCI needs to be mounted a few feet away. Can the A/C disconnect be used as a raceway for the circuit?

Yes, provided you comply with NEC 312.8 which requires Switch and Overcurrent Device

Enclosures with Splices, Taps, and Feed-Through Conductors

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, and taps installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label is applied to the enclosure that identifies the closest disconnecting means for any feedthrough conductors.

130. We installed a separately derived system (transformer) at the far end of a large warehouse. We proposed to use a primary equipment grounding conductor that would be sized based on the required grounding electrode for the derived system. This way one conductor acts as both the equipment grounding conductor and grounding electrode conductor. Is this installation prohibited?

Yes it is 250.30(A)(3) requires the grounding electrode to be as near as practicable to, and preferably in the same area as, the grounding electrode conductor connection to the system. Handbook: This is to minimize the impedance of the connection to ground, 250.30(A)(4) requires the grounding electrode for a separately derived system to be in close proximity to the point at which the grounding electrode conductor connects to the system either at the source or at the first system disconnecting means. If a structural metal grounding electrode or a metal water pipe grounding electrode is available, 250.30(A)(4) requires the one closest to where the grounding electrode is connected to the system to be used. Where an effectively grounded metal water pipe is used as the grounding electrode for a separately derived system, 250.68(C)(1) specifies that only the first 5 ft of water piping entering the building can be used as the point to make grounding electrode conductor connections or as a conductor to interconnect grounding electrodes. Additionally, 250.121 prohibits an equipment grounding conductor from being used as a grounding electrode conductor.

NEC Section 250.30(A)(3) & 250.121

131. A standby generator with a 400-amp main and transfer switch is located 35' from a building. Its underground feed terminates in a main lug panel located inside of the building. Does this main lug panel need to have a main breaker?

Yes Reference 225.33The installation would fall under Part II of Article 225 (Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)). The question does not state if the generator is a 700, 701 or 702 stand by system.

700.12(B)(5) for Emergency Systems, 701.12(B)(5) for Legally Required Systems and 701.12 for Optional Standby Systems all have the same requirement in that the panel would not be required to meet the provisions of Section 225.36 as meeting the requirement for Suitable for the use as Service Equipment.

132. Does Section 230.71(A)1 require a service disconnect on the structure or could it be located away from the structure (pole)? If it can be located away, what is the maximum distance?

(A) Location. The service disconnecting means shall be installed in accordance with 230.70(A)(1), (A)(2), and (A)(3).

(1) Readily Accessible Location. The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.

(2) Bathrooms. Service disconnecting means shall not be installed in bathrooms.

(3) Remote Control. Where a remote control device(s) is used to actuate the service disconnecting means, the service disconnecting means shall be located in accordance with

230.70(A)(1).

225.32 Location. The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors.

133. If a building or structure has more than one water pipe that meets the requirements of a grounding electrode, do both water pipes need to be used or is one sufficient?

Both must be used per Section 250.50

> 250.50 Grounding Electrode System. All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system.

134. A service is calculated at 600-amp. The utility installs a 75kva transformer (208-amp secondary). As inspector/plan reviewer, do I require equipment fault current protection for the utility's possible future installation of a larger transformer?

There is basis in the NEC to provide for the possible future expansion of an electrical system. While this might be a good design practice, there is no rule to require such provision. See 90.8.

135. A #6 cu conductor is connected to the 20-amp breaker for parking lot lighting to allow for voltage drop. What size does the grounding conductor need to be?

NEC 250.122(B) requires that where ungrounded conductors are increased in size, equipment-grounding conductors, where installed, must be increased in size proportionately according to the circular mil area of the ungrounded conductors. A 12 AWG conductor, which would normally be used for this circuit, has a circular mil area of 6530 cm. The 6 AWG conductor, which is being used for voltage drop considerations has a cm area of 26240 cm. This is an increase in cm area of 400%. According to Table 250.122 a 12 AWG equipment- grounding conductor is required for a 20-ampere circuit. This conductor must be increased in cm size 400 percent or 6530 x 4 = 26120 cm. This requires a 6 AWG, which has a 26240 cm area.

136. As an inspector, should I refuse to accept 15 amp receptacles installed in a building where the engineer specified 20 amp receptacles?

My answer would be no, we enforce the minimum requirements of the NEC, enforcing the project specifications of the Engineer is not the electrical inspectors responsibility. As an electrical inspector we are employed to enforce the requirements of the National Electrical Code, State and/or Municipal Code requirements. If installing a 15 ampere receptacle on a 20 amp circuit is installed in accordance with 210.21(B)(1) and/or (B)(2)the installation should be acceptable to the Inspector. If the engineer specifies a certain product or has requirements above the minimum requirements of the National, State or local electrical Codes, that is great, but it is the responsibility of the engineer to

assure his or her minimum specifications are followed. Can tell story of City project if time warrants, GEC sizing @ parking ramp.

Short answer: The Inspector many times will only be enforcing the NEC and any State or local amendments, although some Jurisdictions throughout the Western Section do enforce specifications if electrical plan review is required by the State or Local Jurisdiction, then the approved plans are many times required to be followed, this would also include the specifications referenced in the approved plans. It is best to check with your local AHJ.

137. Can I run NMB cable directly from PV micro-inverters with A/C outputs, through attics and other areas of the house?

I would say no, NM cable does not comply with 690.31 as it is not intended or identified for use in PV systems and the fact that micro inverters would be mounted outside on the building in a wet location. Type NM Cable is not suitable for use in damp or wet locations see section 334.12(B).

138. Can a 50-amp receptacle be used on a 40-amp circuit?

Yes, Table 210.21(B)(3), which covers receptacle ratings for various circuits, permits a 50-amp receptacle on a 40-amp circuit.

NEC Section: Table 210.21(B)(3)

139. What is the proper way to deal with XO on an isolation transformer for a VFD drive? Primary is 480 delta. Secondary is 480 Y. Some of the VFD drive manufacturers leave the XO floating. How does the floating XO affect the overcurrent device not having a reference point?

The NEC does not require a conductor to be run from the XO terminal to the equipment being supplied, nor does the Code require the system to be grounded if the neutral or common conductor is not being used as a circuit conductor. (250.20(B)) However, if the secondary system is not grounded, the voltage to ground is considered to be the phase to phase voltage (Definition of voltage to ground in Art. 100) and that would make any CBs (or other equipment) used on the secondary with a "slash" voltage rating incompatible with the system voltage being derived from the ungrounded wye. (See 240.85). Equipment with a "straight" voltage marking would be necessary for the secondary system.

140. Is the bonding grid requirement for an above ground portable hot tub the same as a built -in hot tub? If this tub is on a deck 36" above grade and made of wood, how would you bond it?

TIA to 680.42(B) Bonding. Bonding by metal-to-metal mounting on a common frame or base shall be permitted.
Exception No. 1: The metal bands or hoops used to secure wooden staves shall not be required to be bonded as required in 680.26.
Exception No. 2: A listed self-contained spa or hot tub that meets all of the following conditions shall not be required to have equipotential bonding of perimeter surfaces installed as required in 680.26(B)(2):
(1) Is installed in accordance with manufacturer's instructions on or above grade.
(2) The vertical measurement from all permanent perimeter surfaces within 30 horizontal inches (76 cm) of the spa to the top rim of the spa is greater than 28 inches (71 cm).
Informational Note: For further information regarding the grounding and bonding requirements for self-contained spas and hot tubs, see ANSI/UL 1563 – 2009, Standard for Electric Spas, Equipment Assemblies, and Associated Equipment

141. An accessory building (shed) needs an electrical disconnect switch. If the outside electric panel feeding the building is within sight (less than 50') does this rule still apply?

NEC Section 225.31 requires that a disconnecting means be installed at the second building:

> 225.31 Disconnecting Means. Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors.

But like all good code language, there are a multitude of exceptions, one of which might apply:

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained for disconnection, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises.

142. If a metallic conduit sleeve containing a grounding electrode conductor is run from a panel to the Grounding electrode, does the panel- end of the sleeve need to have a bonding fitting installed in addition to the conduit connector?

Yes, see 250.64(E). "Bonding methods in compliance with 250.92(B) for installations at service equipment locations and with 250.92(B)(2) through (B)(4) for other than service equipment locations shall apply at each end and to all intervening ferrous raceways, boxes, and enclosures between the cabinets or equipment and the grounding electrode."

143. What is the maximum unsupported length of type MC that may be used to supply a luminaire in an accessible ceiling?

NEC 330.30(D)(2) requires that Type MC cable be supported not more than 6 ft. in length from the last point of cable support to the point of connection to a luminaire within an accessible ceiling.

144. Why would someone put both arc fault and GFI protection on the same circuit? I've been taught the arc fault breakers are for all living areas, while GFI's are for garage and exterior receptacles and bath and kitchen counters. Have I missed something?

No you have not missed anything. I cannot answer why someone would install both AFCI and GFCI protection, besides maybe assuming the electrician is trying to go above the minimum requirements of the NEC and provide the customer with a safer installation. This installation would be acceptable and would in fact work, AFCI breaker and GFCI devices will work together, as the AFCI breaker is looking for "bad" arcing event, and GFCI devices are looking for unequal currents, currents which are leaving the GFCI device on the ungrounded conductor, but the same amount of currents are not returning on the grounded conductor at a 3ma or greater value of current, but instead the electricity is possibly being redirected to a person and/or redirected to the equipment grounding conductor due to a problem with the appliance or electrical equipment being supplied by the branch circuit.

210.8(A) has the required locations where GFCI protection is required in dwelling units, 210.12 has the requirements for where AFCI protection is required in dwelling units, so yes in a nutshell your analysis is generally correct, if GFCI protection in required, the AFCI protection is not required, and vice versa. Basically AFCI protection is required for all areas within a dwelling unit with the exception of the kitchen, bathroom, garage, unfinished basement. In some cases if the dining room receptacles are supplied from a small appliance circuit also supplying kitchen countertop receptacles, there will be both AFCI & GFCI protection, due to the routing of the circuit, again not required, but acceptable.

Short answer: There are some instances where both GFCI and AFCI protection will be required, such as at a wet bar sink in a basement family room, or where there are receptacles installed near a sink in another area of the home where AFCI protection is required for the branch circuit. In other areas of the dwelling, where both AFCI and GFCI are not required by the NEC, why someone would put both AFCI & GFCI protection on the same circuit is unclear, but this would be acceptable. NEC 210.8 has the requirements for the locations of GFCI's, and 210.12 has the locations where AFCI protection is required.

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