

International Association of Electrical Inspectors

Western Section

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The answers to these questions are the opinion of the person that answered the question. They are not the position of the IAEI, IAEI Western Section, NFPA or a code making panel.

1. I understand that I may use an arc-fault type of receptacle with not more than 75' of 12awg nm cable to the AFCI receptacle to provide the protection required by section 210.12. It appears that a special breaker is required for this application. What is this breaker? Also may I pass through switches etc on the way to the receptacle as long as I am under 75' on the cable run?

Answer: Limiting the conductor length is only applicable to 210.12(A)(3) and (4). (A)(3) limits 12 AWG to 70 ft. as well as requiring the use of a listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit type AFCI that is installed at the first outlet box. Then requiring that the branch-circuit wiring shall be continuous from the branch- circuit overcurrent device to the outlet branch circuit AFCI.

210.12(A)(4) also limits the conductor length for 12 AWG to 70 ft. as well as requiring that a listed outlet branch-circuit type AFCI is installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device. Then additionally requiring that the branch-circuit wiring shall be continuous from the listed branch-circuit overcurrent device to the listed outlet branch circuit AFCI. This application is only permitted if the combination of the branch-circuit overcurrent device and outlet branch-

circuit AFCI is identified and listed as meeting the requirements for a system combination type AFCI.

To the best of my knowledge, the equipment needed to comply with either 210.12(A)(3) or (A)(4) is not commercially available.

2. At the public boat dock on the river, wiring for lighting and two gfci protected receptacles is installed in sched.80 pvc with 12awg wg UF cable pulled through the PVC for added protection. Is this legal?

Reference: NEC 340.10(3), 352.22 2nd paragraph

Answer: YES

3. Recently I have noticed that the load centers I have been using are coming with plastic pieces that fit over the service terminals apparently to prevent accidental contact. I have been told that this is a 2017 NEC requirement. As we have not adopted the 2017 is this requirement still applicable per 110.3(B) listing of the product?

Answer: No. This isn't a listing issue by not installing the barriers. In most cases, the barrier will be included as part of the load center packaging. However, I would strongly suggest that the barrier be installed for safety reasons even though your state or municipality has not adopted the 2017 NEC.

4. On a recent parking deck job the inspector rejected the job for not using expansion fittings on exposed "rigid metal conduit" runs of about 120' in length. He additionally cited installing bonding jumpers around the expansion fittings to be installed as these fittings he says will impair the raceway's ability to function as a reliable equipment ground. I have never heard of this. Is he correct?

Answer: Yes

NEC 300.4(H) is applicable where conduit systems cross structural joints that allow buildings or portions thereof to expand, contract and deflect. Large buildings, bridges, parking garages, tunnels and many other structures incorporate expansion, contraction and deflection joints. Presumably the parking deck in question contains one or more expansion joints; they are very common, especially where the parking deck adjoins an office building. Where conduit systems cross these construction joints, the NEC requires listed expansion or deflection fittings or other approved means. NEC 250.98 also requires that expansion fittings or

telescoping sections of metallic raceways be made electrically continuous with listed equipment bonding jumpers or other approved means.

5. In a dwelling unit attached garage I have a 20 ampere gfcı protected branch circuit supplying only outlets located in the garage. This circuit consists of four receptacle outlets, (one for each car space) one for each door opener, and two luminaires. I also have a receptacle under each of the front windows in the garage supplied by a fifteen-ampere switched circuit for Edison's birthday lights on with the house's general lighting circuits. These "extra" receptacles in the garage are protected by a gfcı receptacle. The inspector say all 125 volt outlets in the garage must be on the garage circuit and my Edison's birthday receptacles must be on the garage circuit. Is this correct?

**Reference: 2017 NEC 210.11(C)(4)
See also 210.52(G)(1)**

Answer: No, although it appears the electrical inspector is making an interpretation of the rule as permitted in 90.4.

The electrician installed the one 20-ampere branch circuit the section referenced requires and it supplies receptacles in the garage. This section does not limit the branch circuits in the garage to one and it does not prevent the installation of another branch circuit.

In addition, the section does not require all receptacle outlets to be supplied by the one 20-ampere branch circuit that this section requires.

Keep in mind that Edison was a fan of direct current and thought alternating current unsafe!

6. Does the NEC require that all or some electrical systems be selectively coordinated? If so is this study required to be done by an Engineer?

Reference: NEC

Answer: Some, not all.

NEC 620.62 Elevators

NEC 646.27 Modular Data Centers

NEC 695.3(C)(3) Fire Pumps

NEC 700.10(B)(5)(b)(ii) and 700.32 Emergency Systems

NEC 701.27 Legally Required Standby

NEC 708.54 Critical Operations Power Systems

7. The output conductors from a residential pv utility interactive inverter connect to a 30-ampere breaker at the dwellings service panelboard. I noticed the

requirement for installing a fastener for this back-fed breaker has been removed from section 690.10(E) for utility interactive inverters and have been told this is no longer required. Why would this fastener not be required? As 408.36(D) still requires this fastener feature as a general rule, wouldn't this fastener still be required in the absence of a specific permission otherwise in Article 690?

Reference: 90.3, 705.12(B)(5)

Hold down kits required by 408 prevent users from accidentally touching the live parts (mounting teeth) when removed from a panelboard.

Interactive inverters are required to stop inverting (no output) upon loss of utility power.

The mounting teeth will not be "live" when a breaker is removed from a connection to utility power

8. Does a receptacle in a multi-family dwelling unit require gfc protection if within 6' of a sink but in another room, such as around a corner or through a doorway?

Answer: **Code Reference:** 210.8, 210.8(A)(7)

Answer: No. See new text added at 210.8 for the 2017 *NEC*.

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (E). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

9. We often run into situations where a 125v 20 ampere receptacle is located adjacent to a piece of hvac equipment for a condensation pump in the suspended ceiling of a commercial occupancy. This seems to run afoul of section 400.8 prohibiting flexible cords in suspended ceilings. If this is not permitted how do we power the pump? Are there any “hard wired” versions?

Reference: NEC 400.12 Exception 5 & 300.22 (c) (3)

Answer: We see this type of installation quite often, however it is a growing trend to install the pump inside the equipment.

10. We are experiencing a lot of florescent luminaires being converted to l.e.d. type luminaires via retro fit kits. Does this conversion affect the original listing of the luminaire?

Answer: In general, yes it will, the original listing of the luminaire is the manufacturers declaration that the luminaire complied with all applicable safety standards when it left the factory. Once modified, it is unknow if the product still complies with all applicable safety standards unless the field modifications are field evaluated.

Now with that said, the 2014 NEC Section 410.6 required retrofits to be listed. Prior to that, the 2008 NEC required luminaires to be listed. Therefore, if a listed luminaire is retrofitted with a listed retrofit kit installed in accordance with the installation instructions [110.3(B)] no field evacuation is required as it will comply with 410.6.

For additional information on certified (listed) retrofit kits, use UL Product Spec by going to UL.com/ProductSpec and searching the following product categories;

- Luminaire Conversions, Retrofit, IEUQ
- Light-emitting-diode Luminaire Retrofit Kits, IFAR
- Light-emitting-diode Retrofit Luminaire Conversion Kits for Commercial Refrigerators and Freezers, IFAS
- Retrofit Low-voltage-luminaire Conversion Kits, IFES

The common theme is that certified (listed) retrofit kits can only be installed within previously certified (listed) luminaires. If the existing luminaire was not originally certified (listed) or the certified (listed) retrofit kit is not installed in accordance with the installation instructions [110.3(B)], complete replacement or a field evaluation may be the only options to verify compliance with 410.6.

11. Questions frequently arise concerning the permissible distance from a service disconnecting means or meter base from a gas meter. Does the NEC address this? If not is there a distance stipulated somewhere else?

5.8.5.1 Line Pressure Regulators.

Line pressure regulators shall comply with all of the following:

1) An independent vent to the exterior of the building, sized in accordance with the regulator manufacturer's instructions, shall be provided where the location of a regulator is such that a ruptured diaphragm will cause a hazard.

(a) Where more than one regulator is at a location, each regulator shall have a separate vent to the outdoors or, if approved by the authority having jurisdiction, the vent lines shall be permitted to be manifolded in accordance with accepted engineering practices to minimize back pressure in the event of diaphragm failure.

(b) Materials for vent piping shall be in accordance with Section [5.6](#).

Exception: A regulator and vent limiting means combination listed as complying with ANSI Z21.80/CSA 6.22, Line Pressure Regulators, shall be permitted to be used without a vent to the outdoors.

(2) The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.

(3) The regulator vent shall terminate at least 3 ft (0.9 m) from a source of ignition.

(4) At locations where regulators might be submerged during floods, a special antiflood-type breather vent fitting shall be installed, or the vent line shall be extended above the height of the expected flood waters.

(5) A regulator shall not be vented to the appliance flue or exhaust system.

12. The NEC allows us to round up the overcurrent device of a conductor to the next standard size ocpd up to 800 amperes. However, on the secondary of a transformer we are specifically forbidden from rounding up. Other than the code says so why is it ok to use a 400 ampere ocpd for a 380 ampere 500 KcMil feeder conductor but not a 500 KcMil tap conductor?

Reference: NEC 240.4(B)(1) – (3)

Answer: As long as it is not a Branch circuit rounding up to the next standard OCD and it does not exceed 800 Amperes this is permitted. The ampacity in 310.15(B)(16) is an insulation value the committee has determined rounding up is safe however, rounding up on a transformer feeder may cause an overload to the transformer which may not be safe

13. I have been seeing a lot more pv installations in my area in recent years. When grounding the module frames by direct connection of an equipment grounding conductor I see a 10awg installed in an emt raceway from the inverter to the rooftop junction box and an exposed 6awg to the module frame. Couldn't we just use the emt as the equipment ground from the inverter to the junction box? Why are we upsizing the 6awg egc where exposed on the roof top?

1st question: Couldn't we just use the EMT as the equipment ground from the inverter to the junction box?

Reference: NEC 250.118(4) and 690.43(C)

Answer: Yes, 250.118 states what can constitute an equipment grounding conductor and 250.118(4) states that Electrical Metallic Tubing (EMT) can be used as an Equipment Grounding Conductor.

Also 690.43(C) requires that the EGC(s) for the PV array(s) and support structure(s) “where installed” shall be contained within the same raceway, cable, or otherwise run with the PV array circuit conductors when those circuit conductors leave the vicinity of the PV array(s).

When it is a wire type EGC; 690.45 states that it must be sized in accordance with 250.122 of the NEC.

2nd question: Why are we upsizing the 6 AWG EGC where exposed on the roof top?

Reference: NEC 690.46 and 250.120(C)

Answer: NEC 690.46 states that Equipment Grounding Conductors smaller than a #6 AWG must comply with 250.120(C). Section 250.120(C) states that if we do not route EGC(s) with the circuit conductors, the equipment grounding conductors smaller than 6 AWG must be protected from “*physical damage*” by an identified raceway or cable armor. Sizing the EGC to a number 6 AWG provides a little extra protection from physical damage and is often less expensive and more efficient to install than a smaller conductor(s) that would require a raceway or cable armor.

- 14.** There have been rumors circulating about damage to building footings due to lightning when using concrete encased electrodes. Is there any truth to these rumors? Builders are asking if there any options other than using the rebar as an electrode?

Reference: 2017 NEC 250.50 and 250.52(A)(3)

Answer: I am not sure about the rumors. This has not been a subject at recent CMP-5 meetings. No Public Input (formerly Proposal) has been received to disallow the use of concrete grounding electrodes.

250.50 requires that the grounding electrodes in 250.52(A) be used as part of the grounding electrode system at the building if present. Other grounding electrodes can be used to supplement those that are required.

- 15.** I understand that the 2017 NEC is going to allow type TC cable for interior wiring. Virginia is currently on the 2011 NEC and we may not see adoption of the 2017 code in this life time. We have seen people try to use this cable as they would nm cable for mini splits and thing like that. Will this be a straight up substitution for nm in the 2017 code?

Reference: NEC 336.10(9)

Answer: Yes, for one and two family dwellings.

(9) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Exception: Where used to connect a generator and associated equipment having terminals rated 75°C (140°F) or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.

Informational Note No. 1: TC-ER cable that is suitable for pulling through structural members is marked "JP."

16. I have heard that on certain roof top installations EMT runs will be required to contain an insulated equipment grounding conductor in coming code editions. Is this true? Is the EMT no longer and equipment ground?

Reference: NEC 250.118 list item (4), 358.60, and 440.9

Answer: EMT was and still IS a viable EGC. However, CMP 11 (covering Art 440) has determined that **ALL metallic raceways** (EMT, IMC, RMC) supplying multi-motor and combination-load equipment installed on rooftops when using NON-threaded fittings must use a wire type EGC (which can be insulated, covered, or bare)

17. As I understand it stainless steel raceways may only be used with stainless steel fittings, boxes enclosures etc. Does this mean that stainless steel NEMA 4 enclosures may also only be used with stainless steel raceways?

Code Reference: 344.14, 342.14, and 358.14

Answer: Yes.

Dissimilar metals and alloys have different electrode potentials. When two or more dissimilar metals come into contact in an electrolyte, one metal acts as anode (*an electrode through which conventional current flows into a polarized electrical device*) and the other as a cathode (*the electrode from which a conventional current leaves a polarized electrical device*). The electropotential difference between the dissimilar metals is the driving force for an accelerated attack on the anode member of the galvanic couple. The anode metal dissolves into the electrolyte, and deposit collects on the cathodic metal. A galvanic action or corrosion is an electrochemical process in which one metal corrodes preferentially to another when both metals are in electrical contact, in the presence of an electrolyte. This same galvanic reaction is exploited in primary batteries to generate an electrical voltage.

To address dissimilar metals with rigid metal conduit (RMC), 344.14 was revised for the 2017 NEC to clarify the acceptable fittings that can be used with different types of RMC, based on

galvanic compatibility. With this revision, stainless steel RMC can only be used with stainless steel fittings, approved accessories, stainless steel outlet boxes, and stainless steel enclosures.

Stainless steel RMC is actually more self-sacrificing (or cathodic) than aluminum RMC and is also considerably more susceptible to the galvanic effect than steel and zinc (galvanized steel) RMC. Stainless steel RMC is subject to a more aggressive galvanic attack in the presence of an electrolyte. Stainless steel RMC used with aluminum or galvanized fittings, accessories, outlet boxes and enclosures could result in a galvanic action, leading to corrosion.

It should be noted that these same revisions occurred at 342.14 for intermediate metal conduit (IMC) and 358.14 for electrical metallic tubing (EMT).

344.14 Dissimilar Metals. Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences. Stainless steel RMC shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.

358.14 Dissimilar Metals. Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel EMT, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum EMT where not subject to severe corrosive influences. Stainless steel EMT shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.

18. Under the slab floor of a commercial motor vehicle repair garage is now identified as an unclassified location. At motor fuel dispensing facilities, the space below the class I areas with PVC type raceways must have 2' of cover and transition to rigid or intermediate where they turn up outside of the classified area. Does this apply to commercial garages? How about if the garage is also part of motor fuel dispensing facility?

Reference: NEC 511.3(C) & (B)

Answer: Looking at table 511.3(c) and 511.3 (B) I would look at this as Specific areas adjacent to a classified Location. I would still consider it as an unclassified area, please give me your input.

19. The gutter space for cabinets and cutout boxes may contain listed power monitoring equipment per Article 312. Is all equipment installed in this gutter space required to be listed? Are there any restrictions on the type of

equipment installed in the space? We had an electrical contractor ask if he could put a receptacle in the gutter space. Would that be legal?

Answer: 312.8 limits the wiring space within enclosures for switches and overcurrent devices to specific equipment as provided in (A) and (B).

(A) Addresses conductors feeding through, spliced, or tapping;

- conductor fill does not exceed 40 percent of the cross sectional area of that space
- total area of all conductors, splices, and taps installed at any cross section of the wiring space does not exceed 75%

warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

B) Power Monitoring Equipment. The wiring space of enclosures

for switches or overcurrent devices shall be permitted to contain power monitoring equipment where all of the following conditions are met:

- The power monitoring equipment is **identified as a field installable accessory** as part of the **listed equipment**, or is a **listed kit evaluated for field installation** in switch or overcurrent device enclosures.
- The total area of all conductors, splices, taps, and equipment at any cross section of the wiring space **does not exceed 75%** of the cross-sectional area of that space.

20. The terminology associated with AFCI breakers and devices has been changing since almost the time they first appeared on the scene. Can you explain the difference between dual function and combination breakers? Also, if GFCI is required on a circuit might AFCI still be required?

Reference: NEC 210.12(A)(1), 210.8, definitions Article 100

Answer: Forget (1) I am told this is not going to be manufactured, the combination type was to detect series and parallel arcing type faults.

Dual function is available and satisfies both 210.12 and 210.8 requirements the two function type is necessary as one portion evaluates leakage current to ground the other detects arcing faults. AFCIs do not protect against leakage

21. I had a job recently failed by the inspector. The rejected item was a NEMA 3r enclosed disconnect mounted on strut that was attached to a 45 degree angled roof surface. The inspector says that NEMA 3r enclosures must be installed straight up and down and that if I wanted to install a disconnect in this manner it would need to be a much more expensive NEMA 4 enclosure. I cannot find this anywhere in the code. Is he correct?

Answer: See the manufacturer installation instructions for enclosure mounting.

22. At a free-standing PV array I understand the code requires a grounding electrode. This array is about 100 feet away from the building being supplied. Am I required to run a bonding jumper from the rod at the array to the buildings electrode system?

Reference: NEC 690.47, 690.43(C) and 690.45

Answer: No. The building and array will have a separate GEC(s) according to 690.47(A). An EGC required by 690.43(C) and sized to 690.47 would act as the bonding conductor between the building grounding electrode system to the array grounding electrode.

23. In general 24 volt outdoor lighting is not allowed within 10' of an outdoor swimming pool. In some cases 125 volt luminaires can be as close as 5 feet. This seems backwards to me. Is this intended?

Reference: 2017 NEC 411.5(B), 680.22(B)(6), 680.2

Answer: **411.5(B)** Pools, Spas, Fountains, and Similar Locations. Lighting systems shall be installed not less than 3 m (10 ft) horizontally from the nearest edge of the water, unless permitted by Article 680.

680.22(B)(6) Low-Voltage Luminaires. Listed low-voltage luminaires not requiring grounding, not exceeding the low-voltage contact limit, and supplied by listed transformers or power supplies that comply with 680.23(A)(2) shall be permitted to be located less than 1.5 m (5 ft) from the inside walls of the pool.

680.2 gives low-voltage contact levels

24. At a minor repair garage in my area the feeder supplied panelboards are located in a room designated as (storage 2). As I understand it overcurrent devices are not allowed in the vicinity of easily ignitable materials. This usually means closets, storage rooms and the like. However when I do the final inspection there will be nothing in the room as they have not yet obtained a c/o. This is a conundrum as I am nearly certain there will be combustibile items in the room after they move in. Does the code give me an angle to address this issue?

Reference: NEC 240.24(D)(E)&(F)

Answer: Section 240.24 specifically prohibit overcurrent devices in bathrooms, over stairs, and in the vicinity of easily ignitable materials such as clothes closets. There is no specific mention of storage rooms: this would be a judgement call by the AHJ.

NEC 110.26 has specific rules for clear working space in front of many types of electrical equipment. Many jurisdictions require this space to be marked with paint or other means.

Generally, the fire marshal's office inspects for this on a regular basis after the building is occupied.

25. Type AC cable comes with a smaller bare conductor that serves as an equipment ground along with the sheath of the cable. How does this bare conductor terminate? Is it permissible to connect this conductor directly to a snap switch equipment grounding screw instead of using a copper pigtail jumper from the switch to the box?

References: NEMA Engineering Bulletin 91,

AC shall have an uninsulated bonding strip located between the conductor assembly and the armor throughout its entire length. The bonding strip, which enhances the grounding ability of the interlocking armor, shall be of aluminum and shall not be smaller than 16 AWG.”

The bonding strip is not terminated in the same manner as EGC. The bonding strip is **not** an EGC according to either UL or the NEC and it is not necessary for it to be terminated.

Best Practices:

- (a) wrapping the bonding strip around the exterior of the cable armor, or
- (b) laying the bonding strip straight against the exterior of the armor.

26. Tamper resistant receptacles seem to be required in childcare facilities as defined by NEC section 406.2. The definition seems to be pretty broad especially when it comes to the term educational. Does this definition include

public schools, public libraries, the children's museum etc.? In the 2017 cmp 18 lists childcare facilities and elementary education facilities separately. Are they drawing a distinction between the two?

Code Reference: 406.2, 406.12

Answer: (1) No (2) Yes

Along with the tamper-resistant receptacle requirements of the 2014 *NEC*, tamper-resistant receptacle requirements were expanded to mobile and manufactured homes, preschools and elementary education facilities, dormitories, business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities, assembly occupancies including places of waiting, transportation, gymnasiums, skating rinks, and auditoriums. These are all areas where small children would be present and have ready access to energized receptacle outlets.

The voltage rating at which tamper-resistant receptacle requirements would be applicable to was expanded to 250 volts as well as the current voltage rating of 125 volts.

406.2 Definitions. Child Care Facility. A building or structure, or portion thereof, for educational, supervisory, or personal care services for more than four children 7 years old or less.

406.12 Tamper-Resistant Receptacles. All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in the areas specified in 406.12(1) through (7) shall be listed tamper-resistant receptacles.

(1) Dwelling units in all areas specified in 210.52 and 550.13

(2) Guest rooms and guest suites of hotels and motels

(3) Child care facilities

(4) Preschools and elementary education facilities

(5) Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities

(6) Subset of assembly occupancies described in 518.2 to include places of waiting transportation, gymnasiums, skating rinks, and auditoriums

(7) Dormitories

27. The NEC for last several cycles has required a receptacle on balconies, decks and porches accessible from the interior of the dwelling. I understand the NEC now does not require this receptacle for unattached porches and decks. In my area most decks and porches are not attached as they leave a small air gap to help prevent rot and deterioration. Does this small gap mean that no receptacle is required?

28. On a recent inspection of a service for entry way lighting and irrigation at a subdivision entrance I ran into a bit of a dilemma. The meter supplied a main lug panel with (7) 20 ampere circuit breakers protecting the seven 125v branch circuits. Each of the breakers served as a main. I cited the violation for having over 6 mains. When I came back for the re-inspection two of the 20 ampere breakers were joined with a handle tie. Would this arrangement be considered six mains even though I have 7 separate circuits?

Answer: Section 230.71(B) states that two or three single-pole switches or breakers, capable of individual operation, shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with identified handle ties or a master handle to disconnect all conductors of the service with no more than six operations of the hand.

Additional information may be located using UL.com/ProductSpec and category DIVQ;

- Single-pole or multi-pole independent trip circuit breakers with handle ties rated 120/240 V ac, are suitable for use on multi-wire circuits with line-to-line or line-to-neutral connected loads.
- 2-pole independent trip breakers and single-pole breakers with handle ties, rated 120/240 V ac, are suitable for use in line-to-line single-phase circuits or line-to-line lighting and appliance branch circuits connected to 3-phase, 4-wire systems, provided the systems have a grounded neutral and the voltage to ground does not exceed 120 V.

Converts any two adjacent 120/240 Vac 1-pole Homeline circuit breakers to independent trip 2-pole	HOM1HTCP
Converts any two adjacent 120/240 Vac 1-pole QO circuit breakers to independent trip 2-pole	QO1HTCP
Converts any two adjacent 120/240 Vac 1-pole side-by-side Homeline tandem breakers to independent trip 2-pole	HOMTHTCP
Converts any two adjacent 120/240 Vac 1-pole side-by-side QOT circuit breakers to independent trip 2-pole	QOTHTCP

29. A wye generator supplying the essential electrical system back up power at a hospital has a breaker on the generator rated 1600 amperes at 480v. The plan reviewer says the main breaker and the first set of feeder breakers must be equipped with GFPE per Article 517. The design engineer says that an emergency generator may have fault indicators instead of GFPE and his

design will be done that way only. I need my permit issued!!! Who is right so I can proceed?

Reference: NEC 517.17

Answer: No detectors do not cause the disconnecting means to open
This section states; protection shall consist of overcurrent devices and current transformers or other equivalent protective equipment that shall cause the feeder disconnecting means to open.

- 30.** A detached shed at a dwelling unit is supplied by a multi-wire 20 ampere branch circuit. The disconnecting means is a single 20 ampere double pole switch. The code allows me to have one branch circuit to the shed and does not require a ground rod. Is this one circuit, two circuits, one disconnect, two disconnects, and do I need a ground rod?

Answer: A multi-wire branch is by definition considered one circuit and the 20amp rated double pole switch would be considered one disconnect and no ground rod would be required in this installation.

- 31.** A local electrical contractor has a customer that wishes to eliminate pool junction boxes to the wet niche luminaires by running a type PVC raceway from the wet niche to the panelboard location in the dwelling unit. I see all the rules for installing a pool junction box in NEC Article 680, but no rule that states I must use a pool junction box. Is it permitted to run from the wet niche to the interior panelboard?

Reference: NEC 680.23(B)(2)

Answer: No -unless a junction box or enclosure meets the requirements of 680.24.

- 32.** When installing the system bonding jumper from the X/O tap of a transformer to the transformer enclosure, as well as any other bonding jumpers, where do we land the conductors? I often see these lug connections made through the ventilation openings. Is this legal? Do transformer manufacturers provide any direction on making these connections?

Reference: 2017 NEC 450.10(A)

Answer: (A) **Dry-Type Transformer Enclosures.** Where separate equipment grounding conductors and supply-side bonding jumpers are installed, a terminal bar for all grounding and bonding conductor connections shall be secured inside

the transformer enclosure. The terminal bar shall be bonded to the enclosure in accordance with 250.12 and shall not be installed on or over any vented portion of the enclosure.

33. A receptacle placed on an outside porch per 210.52(E)(3) is also able to be reached through the railing while standing at grade level. Is this permitted or would I need a receptacle for both the porch and the grade level access?

Reference: NEC 210.52(E)(1) and 210.52(E)(3)

Answer: The language in section 210.52(E)(1) of the 2014 NC Electrical Code was revised from the 2011 edition mandating the required front and back outdoor receptacles from being accessible while standing at “grade level” to being “readily accessible from grade.” The new language allows for a receptacle located for the deck as required in 210.52(E)(3) to meet the outdoor receptacle requirement in this section even if you cannot reach it through the railing so long as you can walk up the steps and access the receptacle without infringing on the “readily” accessibility.

34. At a single-family dwelling renovation, a non-grounding type receptacle was being used for the refrigerator. As no equipment grounding means was available in the device box a GFCI type receptacle was installed and marked “no equipment ground” as per section 406.4(D)(2)(b). The inspector says that I may not do this and that I have to physically ground the receptacle because it supplies a refrigerator. I see no reference to that in Article 406. Is the inspector correct?

Reference: NEC 250.114

Equipment connected by cord and plug

Under any of the conditions described in 250.114(1) through (4), exposed, normally non-current carrying metal parts of cord-and-plug connected equipment shall be connected to the EGC.

- 1) In hazardous (classified) locations
- 2) Where operated at over 150V to ground (two exceptions – guarded motors, special permission is granted for frames of electrically heated appliances)
- 3) In residential occupancies:
 - a. Refrigerators, freezers, and air conditioners
 - b. Clothes-washing, Dryers, DWs, ranges, DSPs, IT equipment. sump pumps, and electric aquarium equipment
 - c. Motor operated Tools (hand held, stationary, fixed, light industrial)
 - d. Portable hand lamps

4) In other than residential occupancies

35. I recently received a set of plans showing a 480volt 45kva transformer stepping down to 120/208 and supplying a 200 ampere MLO general lighting panelboard. The design engineer says that as the transformer primary is protected at not over 125% he does not need any protection on the secondary conductors or panelboard per table 450.3(B). Is this correct?

Code Reference: 450.3(B), Table 450.3(B)

Answer: Yes.

450.3 Overcurrent Protection. Overcurrent protection of transformers shall comply with 450.3(A), (B), or (C). As used in this section, the word transformer shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4, 240.21, 240.100, and 240.101 for overcurrent protection of conductors.

Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device.

(A) Transformers Over 1000 Volts, Nominal. Overcurrent protection shall be provided in accordance with Table 450.3(A).

(B) Transformers 1000 Volts, Nominal, or Less. Overcurrent protection shall be provided in accordance with Table 450.3(B).

Exception: *Where the transformer is installed as a motor control circuit transformer in accordance with 430.72(C)(1) through (C)(5).*

36. A strip shopping mall has three occupancies per building. Each building is supplied by a set of service laterals. Each occupancy is supplied by a set of entrance conductors. The water pipe for all three occupancies is bonded in occupancy 1. Does each occupant need access to this connection?

Reference: NEC 250.68, 240.24 (B0)

Answer: No

240.24 (B) only refers to overcurrent devices, and 250.68 (A) only says that it has to be accessible, but does not say by who.

37. An electric vehicle charging station is on a pad located about 100 feet from the building supplying the charging units. The feeds consist of three 20 ampere 125 volt circuits and one 208 volt three phase circuit. Is this considered one building or structure supplying another? Do the rules of Article 225 part II apply?

Reference: 225.30(A)(7) & 625.47

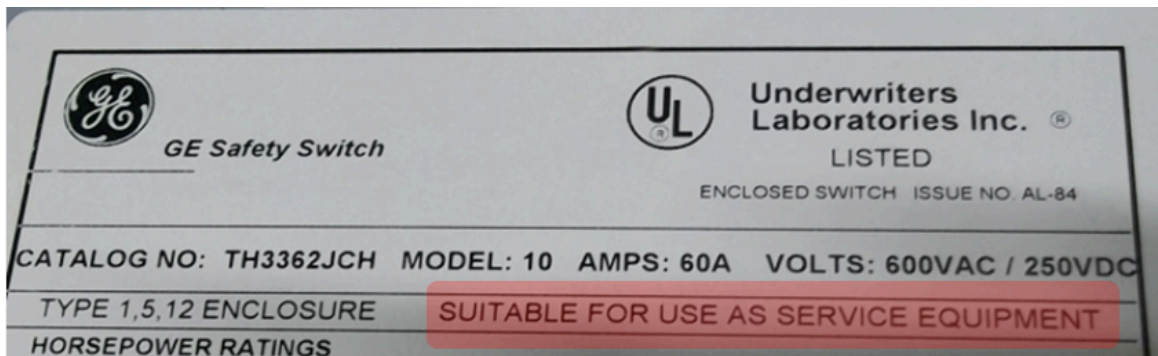
ANSWER: No. The EVCS is equipment and not a building or structure. So, there is no prohibition to installing more than one branch circuit or feeder to EVSE.

38. A residential PV system is supplying the utility powered panelboard by a tap ahead of the main. Does the breaker supplied by the inverter and the cutout box the breaker is installed in feeding this tap have to be service rated? Is a grounding electrode conductor required at this small panelboard?

Answer: NEC Section 705.12(A) permits a tap ahead of the main and 705.31 requires an OCPD for conductors connected to the supply side of the service disconnecting means in accordance with 705.12(A) shall be located within 10 feet of the tap. 690.13(C) requires that where connected to the supply side of the service disconnecting means, the PV system disconnecting means shall be listed as suitable for use as service equipment.

**SUITABLE ONLY FOR USE AS
SERVICE EQUIPMENT.**

For information on OCPD disconnects suitable for use as service equipment, go to UL.com/ProductSpec and search UL Product Categories DIVQ(Circuit Breakers, Molded Case and Circuit-breaker Enclosures), WIAX (Switches, Enclosed) or WJAZ (Switches, Molded Case)



39. At a single-family dwelling a set of flood lights on a detached garage are shining back at the rear door of the dwelling. There seems to be ample light however, the lighting outlet is located on another building instead of at the door of the dwelling. Is this permissible?

Reference: NEC 210.70(1) – (3) and exception

Answer: If the lumination is switch controlled from the house Yes, if not, it is a AHJ call as the exception permits *remote, central, or automatic control of lighting shall be permitted*. The question does not say how the flood lights are controlled and is the light energized when there is movement at the exterior door to the house.

40. A set of gasoline pumps is covered by a canopy. One of the canopy posts is hollow allowing an electrical raceway to rise vertically from underground to the luminaires on the ceiling surface. This post has a gasket and a bolt down cover over an access hole. Would this be considered a suitable barrier and accordingly the raceway inside the post would not be passing through the Class I Div. II area around the pumps as it separated from the classified area?

Answer: No. Ref. 514.9 (A) & (B).
514.9(B) directs you to 501.1(A)(4) & (B)(2) .

41. Are the conductors between a 30-amp breaker and a 30-amp fused disconnect feeding a single air condition unit defined as a feeder or a branch circuit? Would the answer change if the fuses in the 30-ampere disconnect are reduced to 25 amps to meet the name plate rating of the equipment?

Reference: Article 100- Definitions

Feeder. All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.

Answer: Looks like a feeder, smells like a feeder- it must be a feeder.

42. The DC conductors from a rooftop PV array at a single-family dwelling are run to a roof top junction box where they transition to thwn in size 10awg and are installed in emt to the inverter. The inspector says these conductors

must be red and black along the entire run from the roof-top j-box to the inverter as they are smaller than 6awg DC conductors. Is he correct?

Reference: 2017 NEC 690.31(B)(1)

Answer: Don't think so! It does not seem that 210.5 applies to the source circuits of PV systems. Article 210 applies to branch circuits. They are defined in Article 100. For PV systems, these are PV output circuit conductors. 690.31(B)(1) makes reference to only 200.6 for identification of solidly grounded conductors.

43. A 3000 ampere 480/277 service rated piece of switchgear that formerly contained the building's 3000 ampere service disconnecting means is being re-fed from a new 4000 - ampere service switchgear. The main breaker of the 3000- ampere switchgear is provided with GFPE. I must remove the main bonding jumper as this switchgear is now feeder supplied. Will the GFPE still work with the main bonding jumper removed? If not would it be a code violation to have a non- required gfpe device that does not work?

Reference: NEC 230.95

Informational Note No. 1: Ground-fault protection that functions to open the service disconnect affords no protection from faults on the line side of the protective element. It serves only to limit damage to conductors and equipment **on the load side** in the event of an arcing ground fault on the load side of the protective element.

Answer: Yes, the GFPE will operate properly. Removing the bonding jumper from the 3000 ampere switchgear will permit the new 4000 ampere switchgear GFPE to function properly. Although, the NEC does not directly address the installation of GFPE that will not function properly it should never be overlooked. There are three criteria used to determine acceptable GFPE performance: (1) No tripping due to unbalanced loading; (2) No tripping due to circulating ground currents from other systems; (3) Proper sensing and tripping for ground faults.

44. I recently came across a device that via a pin connection allows one to install a luminaire or paddle fan to a ceiling outlet box. I understand that article 314 now permits this device and the code calls it a receptacle. The one I saw was rated 125volt 15 ampere. If I install one of these in a dwelling unit bathroom would it require gfci protection? Could it legally be installed on the 20 ampere bathroom receptacle circuit even though it is supplying a luminaire?

45. Is a three phase 250-volt receptacle suitable for use on a three phase 208-volt circuit?

Code Reference: 210.21(B)(1), UL 498, clause 94.2.2

Answer: Yes.

Section 210.21(B)(1) permits this.

From UL 498 (*Standard for Safety Attachment Plugs and Receptacles*) clause 94.2.2 requires that if a device has a dual voltage rating and a dual current rating it is tested at the maximum rating in volts and with 150 percent of the rated current that corresponds to the maximum voltage rating. In general, devices are tested at 150 percent during the following tests;

- Current overload test
- Overload Test

210.21(B)(1) Single Receptacle on an Individual Branch Circuit. A single receptacle installed on an individual branch circuit shall have an ampere rating not less than that of the branch circuit.

46. We are increasingly running into jobs with automated building energy management systems. Many of these systems will turn off 50% of the receptacles through-out the building. The only requirement seems to be that these receptacles are marked, and now have the word “controlled” on the face of the receptacle. If a receptacle is required by other sections of the code is it permissible to be controlled in this manner?

Reference: NEC 406.3 (C)

Answer: Correct 406.3 (C) deals with marking, I could not find any other requirement, I would assume the installer would use common sense to avoid refrigerators, freezers, computers and other similar items.

47. I was field threading several sections of rigid metal conduit when the inspector turned up and asked “what are you using to coat the threaded ends of the conduit with”? These raceways are not being used for direct burial. Where does the code tell me to do this and with what?

Answer: Section 300.6(A) States that where corrosion protection is necessary and the conduit is threaded in the field, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

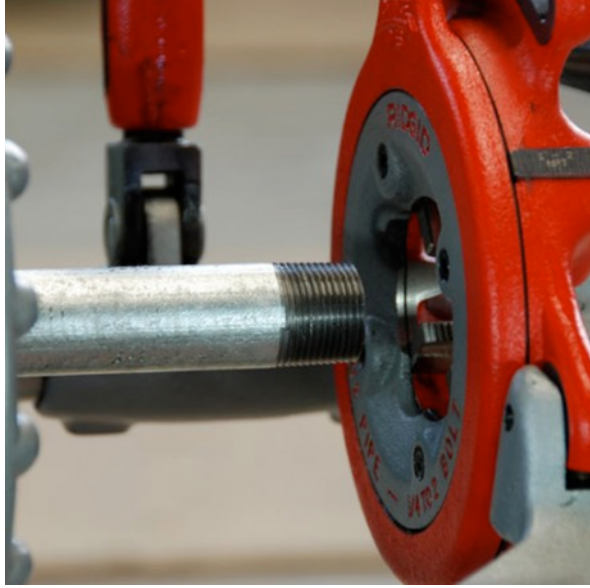




EXHIBIT 300.11 KOPR-Shield® (a registered trademark of Jet Lube) is a conductive anti-corrosion surface compound suitable for application on field-cut conduit threads where protection from corrosion is necessary. (Courtesy of Thomas and Betts, A Member of the ABB Group)

This is an image from the 2017 NEC Handbook. These products are covered by UL Product Category DVYW and currently there are 6 manufacturers of certified products. Additional information can be located using UL.com/ProductSpec and entering DVYW into the Product Category Code search field.

48. I recently wired a pool pavilion of a single-family dwelling in the fashionable part of town. The pavilion is covered using exposed lumber and brass rigid metal conduit in the ceiling supplying the paddle fans and luminaires. The inspector says that brass rigid is only permitted for underground wiring and pool wiring. I offered to re-pull the wiring in the ceiling with UF cable which would not even require a raceway and he said “no dice the brass rigid has to go”. Is he right?

Reference:) , 90.5(B), NEC NO 344.10(A) (1), (2), (3) & (4)

Answer: NO, 90.5 explains how the terms shall and shall be permitted are applied in the NEC. 344.10(A)(2) provides information that Red Brass rigid conduit is not affected by the corrosion conditions usually present around pools or underground

Section 344.10 includes all types of rigid conduit (1) through (4) give guidance to the application of different types of rigid conduit.

- 49.** I understand that the issue of electric shock drowning has become a major issue throughout the US. How is this caused and what steps is the NEC taking to prevent these occurrences?

Reference: NEC 553.4, 555.3, 680 GFCI protection and Equipotential Bonding
NFPA.org/water safety

Answer: The cause of drowning by electric shock is the water being energized by an electrical fault or other electrical means. In short, current passes through the body by radiant potential a lot like step potential and causes paralysis which results in drowning.

- 50.** During the plan review process, I have had several designers attempt to avoid the requirements of Article 225 Part II by attempting to use the exceptions for documented safe switching procedures. I can find no definitive guide as to what the procedures should include. Additionally, 225.32 exc. 1 stipulates these procedures to be monitored by qualified individuals. After we figure out what the heck documented safe switching procedure are does this mean someone (likely an electrician) is onsite 24/7?

Reference: 225.32 Exc. No. 1

Answer: There is apparently no clear definition of the term that I can find. It has been much cussed and discussed in various magazine articles and code forums for years but never defined. The best way to resolve it may be to approach CMP 4 and possibly CMP 1 and ask them for assistance. A Public Input to have them clarify the matter could help. Meanwhile, check with your AHJ about it. I would not allow this exception to be used outside of an industrial environment with a fully-qualified electrical staff.

- 51.** A single-family dwelling with an indoor swimming pool has totally enclosed luminaires at about 9' above the maximum water level. The luminaires are protected by a gfcı receptacle that also provides the required receptacle between 6 and 20 feet. The inspector says I have to use a breaker in the panel for the lighting protection. Why won't a receptacle provide the same level of protection?

Reference; Nec 680.

Answer:

680.5 allows GFCI receptacle type protection.

680.22(A)(1) does require a gfcI receptacle within 20' of the pool & not higher than 6'6" from a general branch circuit.

680.22(b)(2) gfcI protected enclosed lights are compliant at 9' above water level.

This ? may lack specifics that could support the inspectors judgement

- 52.** I have heard that occupancy sensors that are installed after a certain date will require a grounded conductor to operate. I have been told that the standard for these devices allows connection to an equipment ground when no grounded conductor is available. Is this true and will we be able to replace occupancy sensors when they go bad?

Reference: 2017 NEC 404.22 & Exception, 404.2(C)

Answer: True- the equipment grounding conductor (EGC) is allowed to be utilized presently to complete the path for the electronic circuit to operate. There is a delayed date of 1-1-2020 for these devices not to introduce current on the EGC.

- 53.** Dwelling unit dishwashers are now required to be gfcI protected. Can a receptacle supplying the dishwasher be on the kitchen small appliance branch circuit that is also gfcI protected? Does the listing also require connection to a gfcI protected circuit or outlet making the requirement enforceable before 2014 NEC adoption?

Answer: No, only kitchen countertop can be on the small appliance circuit.

No mention of GFCI in UL TSXU or under UL standard 749

Replacements: No requirement for branch circuit, but could be for the receptacle itself.

Reference: *NEC 210.52(B) 1 & 2 for new
NEC 406.4(D) for replacements
UL TSXU and Standard 749*

- 54.** The issue of interchangeable breakers has been around for a while. With the AFCI requirements that mandate AFCI protection upgrade where circuits are extended or outlets added the issue is becoming more prevalent. Are most

AFCI breakers that are designed such that they fit snugly on other panelboards ok to use? Is there a compatibility chart that is available?

First of all, let it be known that I am not advocating for or against any particular manufacturer, that being said:

NEC 90.4 Enforcement – Authority having Jurisdiction. Special Permission. Use caution when approving equipment that is ‘Classified’, especially when the instructions with a specific panel has a list of breakers that have been tested with that specific panel. Where does the liability lie, with the classified breaker manufacturer? With the panelboard manufacturer? With the contractor? With the inspecting authority? The proper method would be to use a breaker or fuse assembly that is listed as tested with the existing panel and set a subpanel to use listed AFCI breakers that are a tested combination of breaker and panel. Or, if the panel is outdated and there are no breakers available, it is time to change out the entire service.

<https://www.platt.com/CutSheets/Eaton%20Distribution/Breakers-ClassifiedType.pdf> (this is the answer to the last part of the question)

Square D Crouse-Hinds General Electric Siemens Murray Thomas & Betts
These are the panelboards that Eaton lists the “classified” breakers to fit.

Reference NEC 110.3(B)

Classified Circuit Breaker Manufacturers would have you believe that installation contrary to the marking on the panelboard (load center) is consistent with the National Electrical Code (NEC). In fact, NEC 110.3(B) is clear in the requirement to follow the listing and label instructions. Labels added “in the field” as a part of the Classified Circuit Breaker Program can be contrary to the Listed panel markings and is in conflict with NEC 110.3(B). The only method to ensure compliance with the NEC is to maintain the integrity of the Listed panelboard markings and install only the circuit breakers listed on the panelboard product markings as it left the factory. (Quoted from the website)

UL Classified

Siemens Type QD circuit breakers are UL Classified for use in specific Square D Load centers in place of Square D Type QO(r) circuit breakers. The interrupting rating on these circuit breakers is 10,000A IR maximum and they are not series rated with Square D circuit breakers or equipment. This UL Classification allows a Siemens Type QD circuit breaker to be used in place of a Square D Type QO circuit breaker in specific load centers.

SUBJECT: Classified Circuit Breakers (Quoted from their website)

Square D Company recognizes the important electrical safety role played by electrical inspectors. because of this role, we want you to

be aware of the possible reduction in the level of public safety from the use of Classified circuit breakers and other types of interchangeable circuit breakers.

55. The 2011 NEC outlawed isolated ground receptacles at health care facilities and changed the rule back in the 2014 to “not within the patient vicinity.” Is there still equipment out there that needs isolated equipment grounding? By keeping the receptacles out of the patient vicinity is this rule defeated by simply using longer cords? I hear more changes are coming in the 2017. Where is CMP15 headed with this?

Reference: NEC 517.16

Answer: 1) By keeping the receptacles out of the patient vicinity is this rule defeated by simply using longer cords? Changing to a longer cord would void any listing of the product and use of extension cords would violate 400.10(B) and NFPA 99:4.3.2.2.7.1

Answer: 2) Where is CMP15 headed with this? *CMP 15 like any panel is only headed in the direction Pl's or PC's send them.*

History:

The revisions to 517.16 in the 2011 NEC did in fact prohibit the use of isolated ground receptacles in patient care vicinity's so as not to conflict with the redundant grounding requirements of 517.13.

Revisions to the 2014 prohibited isolated grounding type receptacles within a patient care vicinity only (*rather than the entire health care facility*).

Changes to the 2017 added a title to 517.16(A) “Inside of a Patient care Vicinity” and in(B) “Outside of a Patient Care Vicinity” revised the installation and identification requirements of the two EGC's.

56. A transformer rated 75 kva is installed on a mezzanine. The only way to access the transformer is by a “ship's ladder” that is welded to the metal frame of the mezzanine. The transformer is not visible until you are on the mezzanine. Is this code compliant with regard to location?

Reference: NEC 450.13, 450.13(A), and 450.21

Answer: Per 450.13, all transformer and transformer vaults shall be readily accessible to qualified personnel for inspection and maintenance.

Per 450.13(A), dry-type transformers 1000V, nominal, or less, located in the open on walls, columns, or structures, shall not be required to be readily accessible.

Per 450.21, dry-type transformers installed indoors and rated 112 ½ kVA or less shall have a separation of at least 12 in. from combustible material unless separated from the combustible material by a fire-resistant, heat-insulated barrier.

57. A number of micro-breweries are springing up in the area. I have some concern over the grain handling process which can be rather dusty and combustible. Would any of these areas likely be considered a class II location?

Reference: NEC 500.4 (A) 500.5 (C) NFPA 499

Answer: The persons that design the micro-breweries must be providing documentation that no combustible dust in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures or, where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignition mixtures to be produced.

58. A 2000 ampere piece of service switchgear was installed that requires rear access in order to access the grounded and grounding connections located at the back of the enclosure. The switchgear is tight against the rear wall. The manufacturer rep wants to reconfigure the bussing such that the grounded and grounding terminals are now at the front. Will this require a field evaluation by a NTRL?

Reference: 110.2

Answer: Yes. The type of modifications, even if performed by the manufacturer's personnel, represents a significant departure from the original design of the listed equipment and the condition it was in when labeled at the factory. Thus, the original listing would be nullified by the changes and must be field evaluated and re-labeled.

59. When adding a lug to the inside wall of a NEMA 3r enclosure do I have to scrape paint away from the area that the lug is contacting? If yes doesn't facilitate corrosion around the lug impairing the connection? Is the wall of the enclosure thick enough to get the required two full threads? Are self-tapping screws ok for this operation?

Reference;

Answer;

UI 50 3R enclosures under "accessories" typically offer

1. Ground lug kit;
2. Touch up paint.
3. Additional studs or and holes for adding lugs.

4. As an AHJ I would not take issue with a drilled hole (doubling as a weep hole) in the bottom of the enclosure with a minimal amount of paint removed to maintain or achieve compliance with NEC 250.4 providing an effective ground fault path.

60. Since the exhaust is taking air from the classified location, is the fan located on the roof and in line with the air stream required to be listed for Class 1, Div2?

511.3(C)(1)(a) states that with ventilation provided, the area is unclassified but I can't see the requirements for the actual ventilation system.

The same question would apply to the ceiling area as well. And, could this same vehicle exhaust system be used to ventilate the ceiling space if a opening was cut into the ducting if within the 18" of the ceiling?

Of course, the Owner will tell us that he will not work on natural gas vehicles.

61. The electrical utility company in a rural area installs a meter pedestal that contains a 200 ampere breaker at the property line. The inspector says that I must install an equipment grounding conductor with the service lateral conductor from the road to my house. I believe that the utility company pedestal does meet the definition of service equipment and, therefore, I should not be required to install the equipment grounding conductor. Who is correct?

Reference: NEC 230.70 *Service disc. and*

Grounded Service 250.24C

Grounding Feeder 250.32B

Answer: *I'm not sure as the info is not complete.*

62. Does the NEC require a listed fitting when the GEC penetrates a separately derived transformer enclosure through a drilled opening or knockout?

Reference 110.3(A) & (B). Examination, Identification, Installation Use, and Listing of Equipment. And 90.4 Enforcement (By special permission)

This is a two part question. 1) If the transformer has a factory designed punched (or drilled) hole that is designed for the entrance of the grounding electrode conductor, much like the punched hole found on electrical panels or meter sockets, it would not require an additional fitting. It would be up to the AHJ, using 90.4 to approve a field drilled similar hole, as he or she would have to take into consideration of the location of the hole as to not

be interfering with the interior components of the transformer. Safely drilled, I would approve the “similar drilled hole”..

2nd part) A knockout would require a listed fitting for the grounding electrode conductor.

63. We have many outdoor pre-fab skids that have mechanical controllers above 6’7”, actually they are 12’ above finished floor. Is it required to install a working platform for servicing?

Reference: NEC 409.30, Part IX of Article 430, 404.8(A) Exception No. 2

Answer: While I am not aware of any height requirements for the operation of any Control Panel there are disconnecting means requirements in Section 409.30 that require compliance with Part IX of Article 430. The general rule for the max. 6’7” height is actually covered in 404.8(A) for switches and circuit breakers used as switches. Exception No. 2 states: Switches and circuit breakers installed adjacent to motors, appliances, or other equipment that they supply shall be permitted to be located higher than 2.0 m (6 ft 7 in.) and to be accessible by portable means.

64. A standby generator containing a 200 amp breaker and a transfer switch is located 50 feet from the building it serves. Does the panelboard in the building require a main breaker or can it be a main lug only panelboard?

Reference: NEC 225.3, 445.18, 701, 702.12

Answer: Article 100 defines within sight as within 50 ft distance. Per 702.12 an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building structure as long as the main disconnect at the generator is within sight. Main lug only panels may ONLY be used if less than 50 ft.

65. A 3-wire, 20A multi-wire branch circuit is installed between a single-family dwelling and its detached garage. One circuit for lights and the other for receptacles. NEC 225.39 Rating of Disconnect (B) Two-Circuit Installations require a 30a disconnecting means. Is it required to install #10 wire for the 30a disconnecting means or can we install #12 wire from the house to the garage since its being fed from a 20a 2 pole circuit? Could we also use a 2 gang box with 2-20a switches and combine the ratings to achieve the 30a requirement?

Reference: NEC 240.4, 225.39 (B)

Answer: According to 225.39 (B) you must install a two pole 30 amp breaker at the house and #10 feeders to the garage then install a small load center with 20 amp overcurrent devices for the lighting and outlet circuits.

66. On a typical 100 amp, residential service, the contractor installed a RMC nipple between the meter enclosure and the main service disconnect. He then ran the 4 AWG concrete encased grounding electrode conductor thru the lug on the bonding

bushing and on to the bonded neutral bus. Does this installation meet the Exception to 250.121 Use of Equipment Grounding Conductors?

Reference: NEC 250.121 Exc.

Answer: Yes. The question does not state if the 4 AWG conductor is solid or stranded. In this condition I would likely accept it, but would like to remind everyone of the requirements of 310.106(C) that conductors 8 AWG and larger, when installed in a raceway, must be stranded.

67. NEC 110.21; 2000a main breaker, is it required to have to separate labels with 2 different clearing times? 1 for the utility fault current available and 1 for the values when arc flash reduction (maintenance mode) is engaged

Reference NEC 110.16(B)

Answer;

NEC 110.16(b) requires labeling in other than dwellings be applied to service equipment rated 1,200a or more. Installing for the 2017 NEC, Only one label would needed to meet the minimum requirements. This label would likely apply the fault current values and clearing time from the utility without applying any type of reduction. Consideration of a 2nd label applying arc flash duration would only benefit those who work on downstream equipment. I personally know that making the 2nd label a requirement.

68. Is it a violation of NEC 200.7 to re-identify the white wire of a 12-3 MC cable, to a gray with phase tape for the 277v branch circuit neutral? There is 120/208v & 277/480v in the building?

Reference: 2017 NEC 200.6(A), (D) & (E), NEC 200.7(A)(1)-(3), NEC 200.7(C)(1)

Answer: Reidentifying the white conductor to gray with phase tape would be acceptable.

- NEC 200.6(A) allows white or gray color for grounded conductors
- NEC 200.6(D) For different systems installed in same raceways, enclosures, etc. shall be identified differently in accordance with NEC 200.6(A) or (B)
- NEC 200.6(E) Multiconductor cables allowed to have grounded conductor identified by white or gray, or by 3 continuous white or gray stripes along entire length of conductor

Reidentifying the white conductor to gray with phase tape is acceptable.

- NEC 200.6(E) Multiconductor cables allowed to have grounded conductor identified by white or gray, or by 3 continuous white or gray stripes along entire length of conductor.
- NEC 200.7(A)(3) Allows white or gray marking at the termination.

- NEC 200.7(C)(1) Permits grounded conductor to be reidentified as an ungrounded conductor.
- Nothing prohibits white wire from being reidentified as gray

69. Many generators have a keyed on/off device that would shut down the generator. Can this keyed device be used as the required disconnect?

Reference: *NEC 445.18(A) Disconnect, NEC 445.18(B) 1 & 2 Shutdown*

Answer: *Maybe.... Disconnect must open both ungrounded conductors and be lockable in open position, and be able to disable start control and/or initiate shutdown that requires mechanical reset*

70. Is UF cable rated and permitted to be installed in direct contact with concrete? ie.. UF cable laid directly on the dirt & covered with a concrete slab. (Not embedded in concrete)

Reference: NEC 340 Underground Feeder and Branch-Circuit Cable Type UF 340.12 Uses Not Permitted. (8) Embedded in poured concrete. (laid on the dirt would mean that the top and two sides would be “embedded in the concrete.”) Cover it with some dirt, then pour the concrete. Then follow Table 300.5 for depth requirements.

71. Type TC tray cable approved for direct-burial and sunlight resistant is installed in a trench from a shop to a barn. At the barn, Schedule 80 PVC conduit is used to sleeve the TC cable up to a height of 10 feet on the exterior of the barn. Then the cable is strapped to the siding and runs several feet before entering the structure. Would this portion of the installation be code compliant?

Reference: NEC 336.10

Answer: Yes

All portions of this installation comply with NEC Section 336.10 uses permitted.

72. Is it necessary to install an additional electrode for grounding the array frame of a roof-mounted solar array?

Reference: NEC 250.166, 690.47(A)

Answer: A building or structure supporting a PV array shall have a grounding electrode system installed in accordance with Part III of Article 250 which gives sizing requirements based on the grounding electrode used.

Array is connected to building electrical grounding electrode system.

73. Is it compliant to install the required current limiting fuse or breaker on the load side of a 10k scrr meter to meet NEC 110.10?

Reference: NEC 110.10

Answer: Yes Listed equipment applied in accordance with their listing shall be considered to meet the requirements of this section.

74. Is individual surge protection required on a life safety sub panel when the emergency main distribution has surge protection?

Reference: NEC 700.8

Answer: Yes. Section 700.8 states “A listed SPD shall be installed in or on all emergency systems switchboards and panelboards.”

75. I’m inspecting a hospital that has an expansion joint with 4’ of flex being installed, it is hard piped on both sides of the metallic flex. Some conduits are 20a for patient care areas and 2 conduits are 100a circuits for the critical branch feeders. Is it required to install a bonding jumper over the 4’ metallic flex.

Reference; Nec 517.13 & 517.31

Answer:

- For the 20a circuits going to patient care areas; NEC 517.13 requires a raceway type redundant EGC and a wire type egc 250.118 would make a 4’ piece of FMC with listed fittings compliant.
- For the 100a;

517.31(3) requires mechanical protection with a non-flexible conduit. However, 517.31(3)(3)(e) allows a listed flexible raceway where flexibility is needed, also making a 4’ piece of FMC compliant

76. Is it NEC compliant to install a set of current limiting fuses ahead of an industrial controller or Roof top unit controller and use the RMS symmetrical let through values to reduce the fault current to get under the SCCR rating of the unit?

Reference: 2017 NEC 110.9

Answer: Typically installing current limiting fuses is not an acceptable method to correct the issue.

Options to resolve issue:

- Modify equipment and obtain recertification.
- Install more conductor to increase impedance.

- Install transformer in circuit to reduce fault current.

77. What are the placard requirements for a new PV system with Rapid Shut Down function being installed on the same structure with an older PV array w/o Rapid Shut Down capability?

Reference: *NEC 690.56(C) and 690.56(C)1a for shutdown of array and leaving conductors 690.56(C)1b for only the conductors leaving the array 690.56(C)2 for buildings with both kinds of systems 690.56(C)3 for label within 3' of Rapid Shutdown switch 690.59 directs to 705.10 if Interconnected Power Production*

Answer: *See the Labels with specific requirements and diagrams and sizing in the code reference*

78. I recently installed a 120 volt circuit utilizing RMC to power a fuel pump that is mounted on top of a 300 gallon, metal diesel tank. The inspector left a correction requiring that I install seal-off fittings at the boundaries of the hazardous area. I have been told that diesel fuel is not a classified liquid and, therefore, seal-offs are not required. Your take?

Reference NFPA 30A SECTION A.3.2.2 Authority Having Jurisdiction (AHJ) Remember that most Code Adopting Agencies give their AHJ authority to determine the requirements that will be enforced at that level. According to the Code for Motor Fuel Dispensing Facilities... Diesel Fuel does not have the Flash point to require the aforementioned seals.

However, it is up to the local authority to determine the classification of the areas.

Table B.1 Typical Flammable and Combustible Liquids Found at Motor Fuel Dispensing Facilities

Flash Point: (degrees F)
Diesel Fuel # 1 - 100 Degrees F
Diesel Fuel # 2 – 125 Degrees F
Diesel Fuel # 4 – 130 Degrees F

79. . is a fusible AC disconnect tapped to the service conductors of a residential main panelboard to the tie in PV 705.12(A) considered a service disconnect requiring grounding and bonding per 250.24 or is it something else?

Reference: NEC 250.24(A)

Answer: Yes

The fusible disconnect in this case is just that, a service disconnect. Therefore the grounding and bonding requirements of 250.24 applies.

- 80.** NEC 511 does not require anything over 20a to be GFCI protected. Does a commercial garage mandate 50a single phase and 100a receptacles to have GFCI protection as stated in NEC 210.8?

Reference: NEC 210.8(B)(8)

Answer: All single-phase receptacles rated 150V to ground or less, 50A or less and three-phase receptacles rated 150V to ground or less, 100A or less installed in the following location shall have ground-fault circuit-interrupter protection for personnel . . . (8) garages, service bays, and similar areas other than vehicle exhibition halls and showrooms.

NEC 511 deals with classified locations. Receptacles and plugs typically have special requirements to prevent arcing in classified areas.

- 81.** Do the Ambient Temperature Correction Factors in Table 310.15(B)(2)(a) apply to the maximum ambient temperature that the conductor will ever be in, such as during the summer months, or is it based on the ambient temperatures in various locations found in the ASHRAE Handbook - Fundamentals mentioned in the Informational Note to 310.15(B)(3)(c)?

Reference: NEC 310.15(B)(3)(c) I.N.

Answer: I believe it is based on the ambient temperatures in various locations in the ASHRAE Handbook, there may be other sources that are used. Check with the local AHJ that may use a different ambient temperature correction factor.

- 82.** Is it required to have a bonding bushing in a 208v disconnect when a reducing washer is used and all of the rings were not removed?

Reference: 110.3B, UL Category Code QCRV

Answer: Yes. In UL Product Spec, category code QCRV, reducing washers are considered suitable for grounding where concentric or eccentric knockouts are encountered only when all such rings are removed, unless such enclosures have been specifically certified for bonding purposes. In the question's scenario, the grounding bushing is the best way to ensure the low impedance path required by 250.4(A)(5).

83. Is it required to have any separation between the critical branch feeder breakers or wire and the optional standby breaker or wire in a distribution panel on the line side of the transfer switch being fed by the back-up generator?

Reference; NEC 517.

Answer; No, NEC 517.31(A) requires division or separation at the Transfer switches

84. Is a bow in a run of PVC raceway considered a bend? To get from the meter pole on a farmstead, we trenched in a large arc to get around a storage shed and then back to the residence. The inspector cited us for having a run of conduit that exceeded 360 degrees of bends. The conduit installation only had two 90 degree elbows in it. We oversized the PVC and had absolutely no trouble pulling the conductors in the conduit.

Reference: 2017 NEC 352.24 & 352.26

Answer: Maximum of 360° of bends between pull points. If there are gradual bends, but the total number of degree's equal 360°, then AHJ would be correct.

End of the day – judgment call by AHJ.

85. On final inspection, the inspector required that I install hospital grade receptacles in the patient rooms of a dental clinic. Is this required by the NEC?

Reference: *NEC 517.18[B] Patient bed, 517.19[B] Critical care, 517.19[C] Operating room and 110.3[B] listed/labeled use*

Answer: Maybe.. It would be needed if there was a Patient bed, Critical care, an Operating room or there was a label on a device to be used there stating it needed it

86. What is the minimum size of copper conductors that I must install from a 100 amp output generator to the first overcurrent device?

NEC 445.13 Ampacity of Conductors: The ampacity of the conductors from the generator output terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. Without consideration for ambient temperatures, the conductor from the 75 degree chart would be AWG 2 Copper rated at 115 amps.

87. In a 120/240V residential installation: Can a 3 wire feeder (w/o Neutral) be installed to a sub panel with only 240V loads? Please factor in that all circuit breaker spaces are unused and additional 1 pole breakers can be installed.

Reference: NEC 250.24(C)

Answer: Yes

Section 250.24(C) for services is the only requirement for the grounded conductor to be brought to a disconnecting means. The only reason for this requirement is for an effective ground fault return path back to the source to facilitate the opening of the overcurrent device under a ground fault condition.

88. Where does a residential smoke alarm need to be placed in a room with a vaulted ceiling?

Reference: NFPA 72 29.8.3.1 & 2

Answer: Smoke alarms or smoke detectors mounted on a peaked or sloped ceiling shall be located within 36 in. horizontally of the peak or high side of the ceiling, but not closer than 4 in. vertically to the transition.