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1. During an inspection, I wrote a violation for an unlisted piece of equipment because all it has was a CE mark. The owner says is accepted every place else. What's the difference between that and a regular listing mark?
Response: The CE mark is usually a self-declaration of conformance to European directives by the manufacturer of the product to facilitate free trade among member countries of the European Union. The CE Mark is **NOT** a certification or Listing mark and has nothing to do with the North American safety system.

A product that only bears a CE mark should be field evaluated for compliance with the appropriate U.S. safety standard and for installation in accordance with the NEC. Code references to support a Field Evaluation of an un-certified product are NEC 90.7, 90.4, 110.2, 110.3(A),(B) and (C). If there is no certification (Listing) or field evaluation, it is up to the AHJ to use NEC 110.3(A) to evaluate the equipment.

A CE Marking is a European marking of conformity that indicates that a product complies with the essential requirements of the applicable European laws or Directives with respect to safety, health, environment and consumer protection. Generally, this conformity to the applicable directives is done through self-declaration. The CE Marking is required on products in the countries of the European Economic Area (EEA) to facilitate trade between the member countries. The manufacturer or his authorized representative established in the EEA is responsible for affixing the CE Marking to his product. The CE Marking provides a means for a manufacturer to demonstrate that his product complies with a common set of laws required by all of the countries in the EEA to allow free movement of trade within the EEA countries.

Unlike the UL Mark, the CE Marking:
Is not a safety certification mark,
Is generally based on self-declaration rather than third-party certification, and
Does not demonstrate compliance to North American safety standards or installation codes.

A product that bears a CE Marking may also bear a certification mark, such as UL's Listing Mark; however, the CE Marking and the UL Mark have no association. The UL Mark indicates compliance with the applicable safety requirements in effect in North America and is evidence of UL certification, which is accepted by model North American installation codes, such as the National Electrical Code® and the Canadian Electrical Code®.

The CE Marking on products is not a certification mark. AHJs should continue to look for the UL Mark on products in order to determine if a product complies with applicable safety requirements for North America.

For more information on UL Field Evaluations or to obtain a quote, please contact UL's Customer Service at 877-854-3577, #2 or www.ul.com/field.

2. 2. Does the NEC require a listed fitting when the GEC penetrates a separately derived transformer enclosure through a drilled opening or knockout?
Response: Like most Code questions, I'll give this one a definite "maybe"….
References: 250.64B, 250.64E, 352.46, 300.4(G), 300.5(D), 300.5(H)

Looking at 250.64 Grounding Electrode Conductor Installation it states

Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in (A) through (F)

Paren (B) has some relevant information so let's take a look at it…

250.64(B) Securing and Protection Against Physical Damage.
Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. 250.64(B)(1) Not Exposed to Physical Damage.
A 6 AWG or larger copper or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection.
250.64(B)(2) Exposed to Physical Damage.
A 6 AWG or larger copper or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), Schedule 80 rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor.
250.64(B)(3) Smaller Than 6 AWG.
Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, Schedule 80 PVC, RTRC-XW, EMT, or cable armor.

There's no mention in the question concerning the size of the GEC or if it's exposed to physical damage. Based on the (B)(1) requirements we just looked at, if the GEC is a #6 or larger conductor and not exposed to physical damage then it can run along the surface of the building construction without metal covering or protection. Well if it can installed like that then I don't see a reason for why a listed fitting would be required for where it enters the transformer.
But there are requirements for fittings that may apply in the beginning of Article 300 because 250.64(B)(2) and (B)(3) deal with when the GEC is exposed to physical damage and requires by some type of raceway or cable armor protection, and raceways and cables require fittings. But before we leave Article 250 let's look at 250.64(E)(4)

250.64 pertains to Raceways and Enclosures for Grounding Electrode
Conductors and paren (4) Wiring Methods states that:
If a raceway is used as protection for a GEC, the installation shall comply with the requirements of the appropriate raceway article.

Looking in Article 352 PVC as an example, 352.46 Bushings, says that where a conduit enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection.

I then flipped to Article 300…

300.4(G) Fittings.
Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected in accordance with any of the following:

I don't think this really applies, even though a GEC may be insulated, it's not a circuit conductor in my opinion.

300.5(D) Protection from Damage for Underground Installations. Direct-buried conductors and cables shall be protected from damage in accordance with (D)(1) through (D)(4)

300.5(D)(4) Enclosure or Raceway Damage.
Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

300.5(H) Bushing.
A bushing, or terminal fitting, with an integral bushed opening shall be used at the end of a conduit or other raceway that terminates underground where the conductors or cables emerge as a direct burial wiring method. A

seal incorporating the physical protection characteristics of a bushing shall be permitted to be used in lieu of a bushing.

I don't think these apply as a GEC is not a direct buried wiring method

After having said all that….

My recommendation is to use a listed fitting listed when the GEC penetrates a separately derived transformer enclosure through a drilled opening or knockout, if the GEC is installed in a raceway.

If it's not installed in a raceway my recommendation is to still use a listed fitting, although there seems to be a relaxation of the requirement based on 250.64(B)(1). Check with your local AHJ if you decide not to install the ½" male adapter that costs 50 cents.

3. A contractor wants to install a "soft start" fire pump controller to reduce the size of the over-current protection to something less than the indefinite locked rotor current of the fire pump and its associated equipment. Is that permitted?
Response: is NO.
Art 695 requires that overload protection be provided for a fire pump motor to
(2) Overcurrent Device Selection. Overcurrent devices shall **comply with 695.4(B)(2)(a) or (b).**
(a) *Individual Sources.* Overcurrent protection for individual
sources shall comply with 695.4(B)(2)(a)(1) or (2).
(1) Overcurrent protective device(s) shall be rated to carry indefinitely the sum of the locked-rotor current of the largest fire pump motor and the pressure maintenance pump motor(s) and the full-load current of all of the other pump motors and associated fire pump accessory equipment when connected to this power supply. Where the locked-rotor current value does not correspond to a standard overcurrent device size, the next standard overcurrent device size shall be used in accordance with 240.6. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s). The requirement to carry the locked rotor currents indefinitely shall not apply to feeder overcurrent protective devices installed in accordance with 695.3(C). [**20:**9.2.3.4]
(2) Overcurrent protection shall be provided by an assembly listed for fire pump service and complying with the following:
a. The overcurrent protective device shall not open within 2 minutes at 600 percent of the full load current of the fire pump motor(s).
b. The overcurrent protective device shall not open with a re-start transient of 24 times the full-load current of the fire pump motor(s).
c. The overcurrent protective device shall not open within 10 minutes at 300 percent of the full-load current of the fire pump motor(s).
d. The trip point for circuit breakers shall not be field adjustable. [**20:**9.2.3.4.1]

First. Let's define "soft-start" controller and "part-winding" motor.
According to Article 430.2:
Part-Winding Motors. A part-winding start induction or synchronous motor is one that is arranged for starting by first energizing part of its primary (armature) winding and, subsequently, energizing the remainder of this winding in one or more steps. A standard part-winding start induction motor is arranged so that one-half of its primary winding can be energized initially, and, subsequently, the remaining half can be energized, both halves then carrying equal current. A hermetic refrigerant compressor motor shall not be considered a standard part-winding start induction motor.

A **Soft Starter** is a device that **starts** motors with reduced power supplied at **start**-up. Reducing the power reduces potentially damaging electrical and mechanical shocks on the system. ... **Soft Starters** are a combination of a **controller** and overload protection. **CONTROLLERS** - turns electric current to the motor on and off.

Soft starter, Single Source **Inrush Current:** 400%
Motor Starting Operation:

Upon receiving a start signal, our model MCS controller begins ramping up the voltage from 40% to 100%. After 10 seconds, the bypass contactor closes to provide full voltage to the motor. When a stop signal is received, the bypass contactor opens and the soft starter begins ramping down until 40% voltage is reached. The motor will then shut down. If a start demand is received during a ramp down, the soft starter will immediately ramp back up.

4. 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?
Response: Electric Shock Drowning is in fact becoming a major issue because it is just now being recognized and understood. Essentially, it occurs due to stray currents in the water, usually at freshwater marinas, when a swimmer is subjected to voltage gradients in the water. Historically, the cause of death in many instances was listed as drowning, but the cause of drowning was actually muscle contractions in the victim.
The NEC has been addressing this problem over that past few editions through the expanded requirements of Type 1 GFCI's around marinas and boatyards, expanding the requirements to private docks and 240 volt circuits. Service and feeder circuits have required GFCI protection at levels from 30 mA to 100 mA. Bonding of metal parts in contact with the water is required similar to swimming pools, using an 8 AWG copper conductor.
The source of the voltage gradients and stray currents might be from the shore power wiring or from the boat itself if connected to shore power, or if the boat has a running generator or a battery bank serving an inverter.
The most effective way to mitigate ESD is to not have people in the water in or around marinas or near vessels with operational AC systems. To this end, the NEC also requires signage warning of the possibility of electric currents in the water. See 210.8 and Article 555.

5. 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?
Response: ***No, if used in an area that allows 200.6(E)exception no 1, that only qualified individuals service and maintain. Otherwise Yes, 200.6(E) requires multiconductor cables to have grounded conductors identified the entire length.***

6. I have installed a 1000 amp, 480/277 service with GFPE. Can you help me understand the testing requirements referenced in the code?
Response: **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 1000 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.

230.95(C) Performance Testing. The ground-fault protection system shall be performance tested when first installed on site. This testing shall be conducted by a qualified person(s) using a test process of primary current injection, in accordance with instructions that shall be provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.

Ground-fault protection of equipment (GFPE) at service equipment is an example of an NEC requirement that mandates performance testing to ensure safety technologies are functioning correctly when installed. GFCI's protect people from shock and GFPE protects the equipment from damage during a ground fault.

The requirement for testing the GFPE when first installed in accordance with the installation instructions and a written report made available to the authority having jurisdiction, Is this new? It first went into the code in 1978.

How many people believe the push-to-test feature on the device is the proper way to comply with the test requirements in 230.95(C).
Those requirements really haven't changed until the 2017 code which requires the testing to be conducted by qualified persons using a test process of primary current injection.

Unfortunately, the push-to-test feature does not properly test all aspects of the GFPE device which is required in the initial commissioning of the switchgear. For example, pressing a "push-to-test" button only initiates a test-current flow on a portion of the components, rather than all of the components that comprise the ground-fault

system. It does not sufficiently test the wiring, the polarity, the current sensor primary windings, and several other critical aspects of the ground-fault protection system.
A primary current injection test must be done to test all other features of the GFPE that the push-to-test feature does not address.

7. I am seeing a lot of florescent luminaires being converted to LED type luminaires via retro fit kits. Does this conversion affect the original listing of the luminaire?
Answer: Yes, when a UL Certified (Listed) luminaire is modified after it leaves the factory UL no longer know if the product complies with UL's requirements unless the appropriate UL Certified (Classified) LED Retrofit is used or the retrofitted luminaire is field evaluated.
The UL guide information and certifications (Listings) for LED retrofit kits can be found under the product category Light-emitting-diode Luminaire Retrofit Kits (IFAR) on UL Product iQ at productiq.ul.com and enter IFAR at the keyword search.

8. Since the exhaust is taking air from a classified location, is the fan located on the roof and in line with the air stream required to be listed for Class 1, Div 2?
Response: Yes and no, because there are other allowances for it to be a fan type other than one listed for a Class I, Division 2 per Section 501.125(B)

References: 501.125(B), 500.5(B)(2)

501.125(B) Motors and Generators in a Class I, Division 2 Location

They shall comply with (1), (2), or (3). They shall also comply with (4) and (5), if applicable.
(1) Be identified for Class I, Division 2 locations, or
(2) Be identified for Class I, Division 1 locations where sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent, overloading, and over- temperature devices), or integral resistance devices, either while starting or while running, are employed, or
(3) Be open or non-explosionproof enclosed motors, such as squirrel- cage induction motors without brushes, switching mechanisms, or similar arc-producing devices that are not identified for use in a Class I, Division 2 location.
(4) The exposed surface of space heaters used to prevent condensation of moisture during shutdown periods shall not exceed 80 percent of the autoignition temperature in degrees Celsius of the gas or vapor involved when operated at rated voltage, and the maximum space heater surface temperature [based on a 40°C or higher marked ambient] shall be permanently marked on a visible nameplate mounted on the motor. Otherwise, space heaters shall be identified for Class I, Division 2 locations.
(5) A sliding contact shaft bonding device used for the purpose of maintaining the rotor at ground potential, shall be permitted where the potential discharge energy is determined to be non-incendive for the application. The shaft bonding device shall be permitted to be installed on the inside or the outside of the motor.

Informational Note No. 1: It is important to consider the temperature of internal and external surfaces that may be exposed to the flammable atmosphere.

Informational Note No. 2: It is important to consider the risk of ignition due to currents arcing across discontinuities and over- heating of parts in multi-section enclosures of large motors and generators. Such motors and generators may need equipotential bonding jumpers across joints in the enclosure and from enclosure to ground. Where the presence of ignitible gases or vapors is suspected, clean-air purging may be needed immediately prior to and during start-up periods.

Informational Note No. 3: For further information on the application of electric motors in Class I, Division 2 hazardous (classified) locations, see IEEE 1349- 2011, IEEE Guide for the Application of Electric Motors in Class I, Division 2 and Class I, Zone 2 Hazardous (Classified) Locations.

Informational Note No. 4: Reciprocating engine–driven generators, compressors, and other equipment installed in Class I, Division 2 locations may present a risk of ignition of flammable materials associated with fuel, starting, compression, and so forth, due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I, Division 2 hazardous

(classified) locations, see ANSI/UL 122001-2014, General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations.
Additional information concerning a Class I, Division 2 location can be found in 500.5(B)(2)

Section 500.5(B)(2) tells us a Class I, Division 2 location is a location:

(1) In which volatile flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment, or
(2) In which ignitible concentrations of flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors are normally prevented by positive mechanical ventilation and which might become hazardous through failure or abnormal operation of the ventilating equipment, or
(3) That is adjacent to a Class I, Division 1 location, and to which ignitible concentrations of flammable gases, flammable liquid–produced vapors, or combustible liquid–produced vapors above their flash points might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

9. At a multi-family dwelling renovation, a non-grounding type receptacle was being used for the refrigerator. I replaced this receptacle with a GFCI type receptacle as there was no ground in the box. The inspector says that I may not do this and that I must physically ground the receptacle because it supplies a refrigerator. Is the inspector correct?
Response: I believe the inspector is wrong about GFCI protection required based on the *type of equipment involved.* GFCI protection might be required depending on the location of the receptacle
First, we look in 210.8
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. 2: See 422.5(A) for GFCI requirements for appliances.
422.5 Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.
(A) General. Appliances identified in 422.5(A)(1) through (5) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective devices shall be permitted but shall not be required.
(1) Automotive vacuum machines provided for public use
(2) Drinking water coolers
(3) High-pressure spray washing machines — cord-and plug-connected
(4) Tire inflation machines provided for public use
(5) Vending machines

Refrigerators are not included in this list. So, the inspector is wrong in claiming that that GFCI protection must be provided because of the type of equipment.

What about the equipment's location?
210.8
(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere 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

So, the receptacle would ONLY be required to be GFCI protected if it is located within 6 ft of the outside edge of the sink in any direction, or if the manufacturer's product safety instructions include that requirement.

10. I am installing a free-standing PV array 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?

Response: There is nothing I can find in Article 690, 705, or 250 that would require grounding electrodes for one structure to be bonded to electrodes at another structure. Those electrodes will likely be connected together through equipment grounding conductors or grounded conductors in the normal course of installing the electrical system.

11. 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).
Response: No, 300.5 and Table 300.5 minimum cover requirements require that direct burial cables be in a raceway if under a building and be a minimum 18" below grade under a 4" concrete slab for exterior.

12. Can you explain the difference between dual function and combination breakers? The terminology for AFCI breakers and devices is confusing to me.
Response: I totally understand the confusion of the terminology of the AFCI Breakers and Devices. When they first went into the code it just referenced Arc-Fault Circuit-Interrupters. The 2005 code introduced the Branch/Feeder Type and the Combination AFCI. The Branch/Feeder AFIC protected against Parallel arcing and the Combination Type protects for both series and paralleling arcing. The term Dual Function is not in Section 210.12 in the 2017 or 2020 versions of the code. I do not think it is addressed in the UL Product IQ. To my knowledge Dual Function means that the breaker or receptacle will provide both GFCI and AFCI Protection.
UL Product IQ Breakers DIYG. CB/GFCI/Combination AFCI Circuit Devices. KCXX.

13. 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?

    Answer: This is not addressed in the NEC except perhaps for working space and dedicated equipment space in NEC 110.26. I'm not sure if there is anything in the MRC or perhaps the utility has specific requirements. .

14. 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?
Response: I could only find three sections in the NEC that require hospital grade receptacles and they were all in Article 517 Health Care Facilities, which makes sense:
    - 517.18(B) Patient bed location receptacles in Category 2 spaces
    - 517.19(B)(2) Patient bed location receptacles in Category 1 spaces
    - 517.61(C)(2) Receptacles and attachment plugs in unclassified areas of inhalation anesthetizing locations

    Now the question is…..is the patient room in the dentist office a Category 1 space, category 2 space, or unclassified area of the inhalation anesthetizing location….

    I don't think we have to worry about the unclassified area of the inhalation anesthetizing location because it's very unlikely that we'll run into a classified area to start with. Here's commentary from the NEC Handbook that follows section 517.60 concerning these locations:

    Some countries still use flammable anesthetics and rely on these safety measures. there are no known medical schools in the United States still teaching the use of flammable anesthetics or health care facilities in the United States using flammable anesthetics. Use of these precautions would be necessary should flammable anesthetics be re-instituted.

    Section 517.60 designates anesthetizing locations either as hazardous locations, where flammable or nonflammable anesthetics may be interchangeably employed [517.60(A)], or as other-than-hazardous locations, where only nonflammable anesthetics are used [517.60(B)].

    Category 1 (Critical Care) Space.
    Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [99:3.3.136.1]

Informational Note: Category 1 spaces, formerly known as critical care rooms, are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care– related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post- anesthesia care units, trauma rooms, and other similar rooms. [99:A.3.3.136.1]

Category 2 (General Care) Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [99:3.3.136.2]

Informational Note: Category 2 spaces were formerly known as general care rooms. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [99:A.3.3.136.2]

Category 3 (Basic Care) Space.

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [99:3.3.136.3]

Informational Note: Category 3 spaces, formerly known as basic care rooms, are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [99:A.3.3.136.3]

So it looks like hospital grade receptacles are not required since the question referenced a dental room

15. Can these count any of the outlets installed in the ceilings as any of the receptacles required in a meeting room?
Response: NO
210.71 Meeting Rooms.
(A) General. Each meeting room of not more than 93 m2 (1000 ft2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.71(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.
(1) Receptacle Outlets in Fixed Walls. Receptacle outlets shall be installed in accordance with 210.52(A)(1) through (A)(4).

210.52 Dwelling Unit Receptacle Outlets. 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:
(1) Part of a luminaire or appliance, or
(2) Controlled by a wall switch in accordance with 210.70(A)(1), Exception No. 1, or
(3) Located within cabinets or cupboards, or
(4) Located more than 1.7 m (5½ ft) above the floor

16. Separate structures require a grounding electrode. Since this conductor does not go to the grounded conductor is it legal to simply install a lug in the panel and use the panel as a conductor to the ground bar?
Response: There is nothing specific on this, but this does not appear to be compliant. 250.32(D)(2) and 250.64(D) requires the equipment grounding conductor to be connected to the grounding electrode conductor. Attaching it to the enclosure wouldn't seem to meet this requirement. 250.64(C) requires the GEC to be run unspliced and the lug introduces a splice between it and the egc. 250.28 requires that a system bonding jumper be a wire, bus, screw, or similar suitable conductor. Using the enclosure as part of the system bonding jumper would not comply.

17. Is a bow in a run of PVC raceway considered a bend? To get to the garage from the house, I had to get around a few trees in an arc. The inspector cited us for having a run of conduit that exceeded 360 degrees of bends.
Response: Bow and Bend are used interchangeably in daily use. The wording regarding bends is that they cannot exceed four quarter bends between pull points in the various raceway articles xxx.26. The limitation was put into place to limit the strain on the wires being pulled. So yes, if strain would be placed on the wires being pulled through the bow(bend). AHJ would have final say. 110.2

18. I have seen installers cut some of the grates at the bottom of the transformer and stub up PVC conduits in this area, is this legal?
Response: The ventilation openings in the bottom of transformers are for ventilation and should not be blocked or minimize air flow. There is a specific amount of ventilation required by the NEMA Standard for Transformers. The Manufacturers normally recommend the raceways to enter the side of the transformer, so the ventilation is not adversely affected.
Section 450.9 Ventilation in the second paragraph states: Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer.
Code sections 450.9 and 110.3(B) based on the installation instructions.

19. 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?
Response: Well, sort of. The language in the 2017 NEC isn't sufficiently descriptive regarding this subject. Stainless steel actually exists in two states: active and passive. In the active state, the surface of the SS is exposed to air/oxygen, and reacts with it to create a surface barrier to resist corrosion. In the passive state, the SS is not exposed to the air and can react quite readily with other metals. This can occur where straps, fittings, threads, etc. prevent contact with air. The other requirement for dissimilar metals to be problematic is that there must be an electrolyte to transfer molecules from one metal to another. The Steel Tube Institute manufacturers recommend making any transitions from stainless steel to painted or galvanized steel in a normally dry location where galvanic action is minimized.
The 2020 language will clarify the initial intent: (342.14, 344.14, 358.14)
Dissimilar Metals.
Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Stainless steel and aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC (IMC, EMT), and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences.
Stainless steel rigid conduit shall only be used with the following:
    1. Stainless steel fittings
    2. Stainless steel boxes and enclosures
    3. Steel (galvanized, painted, powder or PVC coated, and so forth)boxes and enclosures when not subject to severe corrosive influences
Stainless steel, nonmetallic, or approved accessories

20. Recently I have noticed that the load centers I have been using are coming with plastic pieces that fit over the service terminals as required by the 2017 NEC, apparently to prevent accidental contact. Does this apply to just services or all panel-boards? (IE feeders or fed from transformer secondaries)
Response: For the 2017 NEC this requirement for barriers was specific to service panelboards, switchboards, and switchgear only as noted in Section 408.3(A), paren (2), and it states:
Service Panelboards, Switchboards, and Switchgear. Barriers shall be placed in all service panelboards, switchboards, and switchgear such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

Exception: This requirement shall not apply to service panelboards with provisions for more than one service disconnect within a single enclosure as permitted in 408.36, Exceptions 1, 2, and 3.

For the 2020 NEC this requirement for barriers was expanded and relocated to 230.62(C) Barriers and states: Barriers shall be placed in all service equipment such that no uninsulated, ungrounded service busbar or service

terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

So any type of service equipment, including a SUSE rated transfer switch for example, is required to have this barrier protection.

Manufacturer's have this covered and either ship the equipment with the barriers or the barriers are available as accessories or kits if they're needed

21. A detached garage 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, one phase supplies the lights and the other phase supplies the receptacles. Am I required to install a grounding electrode system at the garage?
Response: A grounding electrode is NOT required in this situation if an equipment grounding conductor is installed in the branch circuit supplying the garage.
ART 225
Part II. Buildings or Other Structures
Supplied by a Feeder(s) or Branch Circuit(s)
225.30 Number of Supplies. A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 225.30(A) through (E). **Forthe purpose of this section, a multiwire branch circuit shall be considered a single circuit.**

250.32 Buildings or Structures Supplied by a Feeder(s)or Branch Circuit(s).
(A) Grounding Electrode. Building(s) or structure(s) supplied by feeder(s) or branch circuit(s) shall have a grounding electrode or grounding electrode system installed in accordance with Part III of Article 250. The grounding electrode conductor(s) shall be connected in accordance with 250.32(B) or (C). Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.
Exception: A grounding electrode shall not be required where only a single branch circuit, including a multiwire branch circuit, supplies the building or structure and the branch circuit includes an equipment grounding conductor for grounding the normally non–current-carrying metal parts of equipment

22. I have heard that on certain roof top installations EMT runs will be required to contain an insulated equipment grounding conductor. Is this true? Is EMT not a suitable equipment ground?
Response: There is no requirement for an equipment grounding conductor to be insulated. However, for installations falling under Article 400. 9 for installations that use "non-threaded" fittings in 2017 and raceways that use "compression-type" fittings in 2020, a wire-type EGC must be installed. This comes from CMP-8. CMP-5, that has jurisdiction over grounding, recognizes EMT as an equipment grounding conductor without the installation of a wire-type EGC installed in all installations. The conduit and fittings are required to be listed and to comply with all UL standards for grounding. CMP-8 feels that if the proper wiring method is used and installed and maintained properly, it will serve adequately as the ground fault current path. It has been proven by test the EMT is a better ground fault current path than a wire sized per Table 250.122 (See GEMI program at steeltubeinstitute.org)

23. I recently received a violation for not having my C/O detectors in the proper locations. I cannot seem to find anything in the Michigan Residential Code that tells me where they belong.
Response: ***Correct R315 does not specify a location. Public Act 230 does. MCL 125.1504f Sec4(f)(1)***

24. 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. Is he right?
Response: Section 110.12 Mechanical Execution of Work. Electrical equipment shall be installed in a neat and workmanlike manner.
The 2017 NEC Informational Note ANSI/NECA 1 2015 Standard for Good Workmanship in Electrical Construction Section 10. Equipment Mounting. (f) Equipment shall be installed plumb, true as intended and secure. NEIS, National Electrical Installation Standards.
I feel the inspector is correct and Section 110.12 and 90.4 along with the ANSI/NECA -1 standard.

25. I recently came across a device to install a luminaire or paddle fan to a ceiling outlet box. I understand that article 314 permits this device and the code calls it a receptacle. If I install one of these in a dwelling unit bathroom would it require gfci protection?
Response: Yes, if they are rated 125-volt, single-phase, 15- and 20-ampere receptacles.

26. It is not uncommon to see a deck adjacent to a building and accessible from the inside of the dwelling, but not attached to the building. Am I still required to install an outlet at the deck?
Response: 210.52(E)(3) Outdoor outlets - Balconies, Decks, and Porches.
2017 NEC
Balconies, decks, and porches that are attached to the dwelling unit and are accessible from inside the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 6½ ft. above the balcony, deck, or porch walking surface
2020 NEC
Balconies, decks, and porches that are within 4 inches horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 6½ ft. above the balcony, deck, or porch walking surface

So as far as the 2017 NEC- a receptacle is only required if the deck is physically attached to the dwelling and the deck is accessible from inside the dwelling.

For the 2020 NEC- a receptacle is required as long as the deck is within 4 inches of the dwelling, whether or not it is physically attached, and whether or not it's accessible from inside the dwelling

27. Is it a NEC violation to have MC sheath touching copper tubing?
Response: NO. There is no Code violation here. This is not spoken to in either Art 300 or Art 330.12 The submitter might be considering the risk of having dissimilar metals touching, and speeding up corrosion…but the Code does not speak to this in situation other than at terminations and in requirements for support of cable wiring methods.

28. Can the receptacle on the front porch that has 3 steps of a single family dwelling also be the receptacle for the front of the house?
Response: Maybe. 210.52(E)(1) requires that a receptacle outlet be installed at both front and back of a dwelling and that it be accessible from grade. If the porch is at a height above grade that a railing is not required (30") and the receptacle can be reached from grade, then it would seem to comply with the relevant code section. If there is a railing and the receptacle could be reached through the rail while standing on grade, then the AHJ could allow it. If the receptacle were too far from grade to reach, or if the railing prevented access (glass railing), then no.

29. Is it required to identify the switch leg the same color as the hot when there are 2 voltages in a building?
Response: ***Yes 210.5(C)(1). Where the premisis has more than one nominal voltage all ungrounded conductors of branch circuits are to be identified by phase, line or system at all termination, connection and splice points.***

30. Are the DC conductors from a rooftop PV array to the inverter at a single-family dwelling required to be identified red and black along the entire length?
Response: The short answer is "NO". Color coding is a method permitted but not required.

The requirements for identification of PV source/output conductors are found in 690.31(B)(1). Color coding is permitted but not required by this section. Notice that I referenced "PV source/output conductors" and not "dc branch circuit conductors".

The NEC requirement of black & red color coding for dc conductors in 210.5(C)(2) is applicable to dc branch circuits of a dc distribution system…not the dc source/output conductors of a PV supply system.