IOWA IAEI CHAPTER
FALL 2010
CODE QUESTIONS

1. Customer wants a ceiling fan installed in their living room where there has not ever been a light or fan. The existing switch has adequate power and grounding. Is the new ceiling fan required to be AFCI protected.

Answer: Under the 2008 NEC, I would say no as they are extending an existing branch circuit not installing a new one. See 210.12(B). In the 2011 NEC however, 210.12(B) will require branch circuit extensions or modifications to be AFCI protected with either an AFCI breaker or an AFCI Outlet Branch circuit AFCI receptacle.

There is now one mfr with Listed Outlet Branch Circuit AFCIs (AWBZ) on page 66 in the White Book. That is Cooper Wiring Devices.

2. House has two wire receptacles throughout. The customer wants to have 3 prong receptacles. Traditionally, we would fish a #12 THHN green to the box, ground the box, and then ground the outlet. Is that still acceptable? Would the circuit be required to be AFCI protected?

Answer: The method described is an acceptable way to provide an equipment grounding conductor to the new receptacle. 210.12(B) requires any new circuit installed to be protected by an AFCI. Therefore the receptacles replaced on an existing circuit would not require AFCI protection.

3. Does bare copper grounding electrode conductor through ferrous raceway relieve the requirement to bond the raceway at both ends per NEC 250.64(E)?

Answer: The incidental contact between the bare copper grounding electrode conductor and the ferrous raceway cannot be considered bonding. The definition of bonding in Article 100 is, “Connected to establish electrical continuity and conductivity.” The commentary in the Handbook on 250.92(A)(3) states that, “Bonding the raceway to the conductor reduces the impedance and minimizes the potential difference between the electrical equipment and ground.”

4. A sub panel is fed from a single phase 240V panel. This sub panel has a neutral bar but the branch circuit loads for this panel are all 2-wire with no neutral loads. Does the feeder to this sub panel need to include a neutral even if there is no neutral load?

Answer: I would say nothing requires you to pull a grounded conductor (neutral) to a panel unless it is a service panel. 250.24(C) requires a grounded conductor brought to service equipment at all service disconnects.

5. If I change out my dwelling panel because of insurance or upgrade from 60 amps to 100 amps, do I need to change anything in the rest of the house besides the service entrance?

Answer: The NEC does not require the rest of the house to be upgraded at the time of a service upgrade. However, some jurisdictions that continue to do their local electrical inspections may have ordinances written that may be more restrictive than the NEC. Check the interactive inspector map on the State's website to see if you are in one of these jurisdictions and use the contact information given to find out their requirements.

If receptacle change-outs occur, the installation shall comply with 406.3(D) Grounding/Nongrounding type receptacles, 406.3(D)(2) (GFCI), 406.11 (Tamper Resistant receptacles), and 406.8(B)(1) (Weather Resistant receptacles)

6. Would like to see the calculations for the size of the electric stove back box and dryer back box for receptacles.

Per 314.16(B)(4). A device that is wider than a single (2 in.) device box shall have double volume allowances provided for each gang required for mounting.

Dyer Box (30 amp) circuit with # 10-3w/grd. AWG cable

Per Table 314.16(B) volume of a #10 AWG conductor is 2.5 cu. in./conductor

Four -- #10AWG……..4 conductors
One -- #10 (if clamp is needed)…… 1 conductor
Device—2 cond. X 2 (double volume)…… …….4 conductors
9 conductors

9 conductors X 2.5 cu. in. = 22.5 cu. in. two gang box minimum

Range Box – 40 amp circuit with #8-3w/grd. AWG cable

Per Table 314.16(B) volume of a #8 conductor is 3 cu. in./conductor

Four -- # 8 AWG……4 conductors
One -- # 8 AWG (if clamp is used)……1 conductor
Device—(2 cond. X 2 (double volume)……4 conductors
9 conductors

9 conductors X 3 cu. in. = 27 cu. in. two gang box minimum

Range Box – 50 amp circuit with #6-3w/grd. AWG cable

Per Table 314.16(B) volume of a #6 conductor is 5 cu. in./conductor

Four -- # 6 AWG……4 conductors
One -- # 6 AWG (if clamp is used)……1 conductor
Device—(2 cond. X 2 (double volume)……4 conductors
9 conductors

9 conductors X 3 cu. in. = 45 cu. in. - two gang box minimum

7. Would like to see calculations for a rooftop installation using the 310 chart for temperature adjustments?

Answer: From 2008 NEC Handbook. See 310.15B)(2)(c)

(c) Conduits Exposed to Sunlight on Rooftops. Where conductors or cables are installed in conduits exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(2)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.16 and Table 310.18.

FPN: One source for the average ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

Calculation Example

A feeder installed in intermediate metal conduit, Type IMC, supplies a panelboard inside a mechanical room on top of a commercial building in the St. Louis, MO, area. The calculated load on the feeder is 175 amperes. The lateral portion of the raceway is secured to elevated supports, crosses the rooftop, and is exposed to sunlight. The elevated supports are not less than 15 in. above the finished rooftop surface. Determine the minimum size circuit conductor using alumi-num 90°C XHHW-2 insulation, taking into consideration only the exposure of sunlight. In this example, none of the loads are continuous and the neutral is not considered a current-carrying conductor. For this example, the design temperature is based on the averaged June, July, and August 2 percent design temperature from the 2005 ASHRAE Handbook. The 2008 NEC references are 310.15(B)(2)(c), Table 310.16, and 110.14(C).

STEP 1.
Determine the ambient temperature (compensated for proximity of conduit to the rooftop exposure to sunlight).

a. Ambient temperature (compensated for proximity of conduit to the rooftop exposure to sunlight) = design temperature + value from Table 310.15(B)(2)(c).

b. Design temperature for St. Louis area = 94° F.

c. Temperature adder from Table 310.15(B)(2)(c) for raceway elevated 15 in. above rooftop = 25°F.

d. Compensated ambient temperature = 94°F + 25° F = 119°F.

STEP 2.
Determine the temperature correction factor for this application.

From Table 310.16 for aluminum 90°C XHHW-2 insulated conductors, select the proper temperature correction factor. Using the aluminum 90°C column and the temperature correction factor row for 119°F, the temperature correction factor is 0.82.

STEP 3.
Using aluminum 90°C XHHW-2 insulated conductors, determine the proper conductor size to be used in the IMC to supply the 175-ampere load.

a. Because the load is calculated at 175 amperes non-continuous, and the neutral conductor is not considered to be a current-carrying conductor, the conductor ampacity is calculated as follows:

175 A divided by 0.82 = 213 amps

b. Now, moving back to the 90°C column of Table 310.16, select a conductor not less than 213 amperes, or a minimum size conductor of 250 kcmil aluminum XHHW-2:

250 kcmil aluminum XHHW-2

c. Verify that the conductor ampacity at 75°C is sufficient for the calculated load to comply with terminal temperature requirements of 110.14(C): The 75°C aluminum column of Table 310.16 ampacity equals 205 amperes, which is greater than the 175-ampere calculated load.

Using a very specific set of circumstances, this example demonstrates that roughly an 18 percent loss of usable conductor material occurred. This loss is due solely to high ambient heat present where a cable or raceway is subjected to sunlight and is installed within a specific proximity to the rooftop.

8. Per NEC '08 section 210.52, in a single family dwelling kitchen/dining room, is it permissible to install a receptacle outlet seven feet above the floor, supplied by a 15 amp general purpose circuit, for a wall-mounted television, or is this receptacle outlet required to be supplied by one of the two or more 20 amp small appliance circuits?

Answer: 210.52 states "The receptacles required in this section shall be in addition to any receptacle that is: ….. (4) Located more than 1.7m (5 1/2ft) above the floor. Therefore, the receptacle mounted 7ft above the floor would not be required to comply with the requirements of 210.52. However, if this receptacle were located in the dining room, it would require AFCI protection as required in 210.12(B).

9. Per NEC '08 section210.52, in a single family dwelling, if a kitchen island countertop has the required receptacle outlets provided above and within 20 inches of the countertop surface, are additional receptacle outlets permitted to be installed below a countertop that extends more than 6 inches beyond the supporting cabinets? More or less than 12 inches below top?

Answer: No. The Exception to (5) states that receptacles may not be located below the countertop if the countertop extends more than 6 in. beyond its support base.

10. NEC 210.52, are receptacle outlets described in the 210.52 general statement (numbers 1-4) required to be tamper-resistant?

1. Part of a luminaire or appliance
2. Controlled by a wall switch in accordance with 210.70(A)(1) Exception No. 1
3. Located within cabinets or cupboards
4. Located more than 5 ½ feet above the floor

Answer: The answer is no. 406.11 Tamper-Resistant Receptacles in Dwelling Units.

In all areas specified in 210.52, all 125-volt, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

210.52 states: 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:

11. What is the reason for not allowing service disconnects (230.70(A)(2)) or over-current devices (240.24(E) in bathrooms? Are bathrooms considered damp locations?

Answer: The restriction of over-current devices in a bathroom first appeared in the 1993 NEC. Discussion had started in earlier cycles and was finally accepted into the Code when someone pointed out that users of the bathroom in their house locked the door which then rendered the OCPD in the panelboard inaccessible as defined in Article 100. After some head scratching the CMP had to admit the proposal had an irrefutable point so it became 240.24(E).

12. Proper grounding and bonding for 2-200 amp panels with a 60 amp subpanel? Do both main panels require individual grounding?

Answer: 250.24(A) requires that a grounding electrode conductor be run to both main panels. This may be done in a number of ways.

The main and subpanel must be bonded by an equipment grounding conductor. According to 250.118 this conductor may be a wire or various types of conduit or raceway.

Of course the grounded neutral conductor may not be bonded to the equipment grounding conductor at the subpanel.

13. A fluorescent luminaire requires 2 switch legs, a neutral, and a ECG. Can it be direct wired into a junction box using a listed rubber cord? There is no ceiling. Would Art. 410.62 (C)(1) prohibit this?

Answer: It appears as if 410.62(C)(1) would prohibit it, however, 400.7(A) and 410.62(B) would permit it.

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