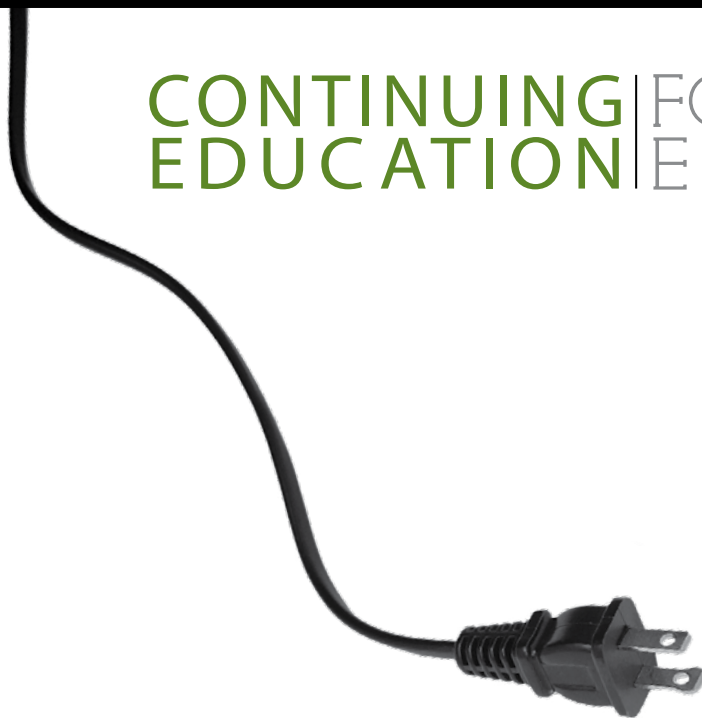


# **WCI** Wisconsin Contractors Institute

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EDUCATION** | FOR WISCONSIN  
ELECTRICIANS

**2014 NEC Change**  
Part 2 • 8 Hours



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DISCLAIMER NOTE: This course is APPROVED by the Wisconsin Department of safety and professional services for continuing education to renew your electrical license and is not intended to replace or supersede any state or local adopted codes.

## 2014 Code Changes • Part 2

The following course will summarize many of the important changes to the NEC code.

### This course is based on the changes to the 2014 code.

**(REVISED): 356.30 Securing and Supporting.** (4) Securing or supporting of LFNC-B shall not be required where installed in lengths not exceeding 1.8 m (6 ft) from the last point where the raceway is securely fastened for connections within an accessible ceiling to a luminaire(s) or other equipment. For the purpose of 356.30, listed liquidtight flexible nonmetallic conduit fittings shall be permitted as a means of support.

**(NEW): 356.60 Grounding.** Where equipment grounding is required using LFNC, a separate equipment grounding conductor shall be installed in the conduit.

**(NEW): Exception No. 1:** As permitted in 250.134(B), Exception No. 2, for dc circuits and 250.134(B), Exception No. 1, for separately run equipment grounding conductors.

**(NEW): Exception No. 2:** Where the grounded conductor is used to ground equipment as permitted in 250.142.

**(REVISED): 368.10 Uses Permitted. (E) Working Platform.** Lighting busway and trolley busway shall not be installed less than 2.5 m (8 ft) above the floor or working platform unless provided with an identified cover.

**(REVISED): 370.2 Definition. Cablebus.** An assembly of units or sections with insulated conductors having associated fittings forming a structural system used to securely fasten or support conductors and conductor terminations in a completely enclosed, ventilated, protective metal housing. This assembly is designed to carry fault current and to withstand the magnetic forces of such current.

**(REVISED): 370.10 Uses Permitted.** Approved cablebus shall be permitted:

- (1) At any voltage or current for which spaced conductors are rated and where installed only for exposed work, except as permitted in 370.18
- (2) For branch circuits, feeders, and services
- (3) To be installed outdoors or in corrosive, wet, or damp locations where identified for the use

**(NEW): 370.12 Uses Not Permitted.** Cablebus shall not be permitted to be installed:

- (1) In hoistways
- (2) In hazardous (classified) locations, unless specifically approved for the use

**(REVISED): 370.20 Conductor Size and Termination. (A) Conductors.** The current-carrying conductors in cablebus shall:

- (1) Have an insulation rating of 75°C (167°F) or higher and be of an approved type suitable for the application.
- (2) Be sized in accordance with the design of the cablebus but in no case be smaller than 1/0.



## Part 2 Exam Questions:

1. LFNC-B is not required to be supported where installed in lengths not exceeding \_\_\_\_\_ from the last point where the raceway is securely fastened.
  - A. 7 ft.
  - B. 5 ft.
  - C. 6 ft.
  - D. 4 ft.
  
2. Listed liquidtight flexible nonmetallic conduit fittings \_\_\_\_\_ be permitted as a means of support.
  - A. May
  - B. Shall not
  - C. Shall
  - D. Will
  
3. If you are required to use an equipment grounding conductor when using LFNC, a \_\_\_\_\_ equipment grounding conductor is to be installed in the conduit.
  - A. Common
  - B. Separate
  - C. Integral
  - D. New
  
4. What is the minimum height above a floor that lighting busway can be installed?
  - A. 4 ft.
  - B. 6 ft.
  - C. 8 ft.
  - D. 7 ft.
  
5. What article in the 2014 code would you locate information regarding cablebus?
  - A. 368
  - B. 370
  - C. 374
  - D. 392
  
6. A completely enclosed assembly of conductors and conductor terminations in a protective metal housing would be defined as \_\_\_\_\_.
  - A. Cablebus
  - B. Switchgear
  - C. Panelboard
  - D. Transformer
  
7. Cablebus can be used for \_\_\_\_\_.
  - A. All listed answers
  - B. Services
  - C. Branch circuits
  - D. Services
  
8. True or False, cablebus cannot be installed in wet locations.
  - A. True
  - B. False
  
9. Would it be considered acceptable or a violation of this code to install cablebus in a hoistway.
  - A. Violation
  - B. Acceptable
  
10. What is the minimum insulation rating required for cablebus conductors?
  - A. 60°C
  - B. 167°C
  - C. 75°F
  - D. 75°C
  
11. What is the minimum size a cablebus conductor can be?
  - A. 2/0
  - B. 1/0
  - C. # 1
  - D. # 2

**(REVISED): 370.30 Securing and Supporting. (A) Cablebus Supports.** Cablebus shall be securely supported at intervals not exceeding 3.7 m (12 ft). Where spans longer than 3.7 m (12 ft) are required, the structure shall be specifically designed for the required span length.

**(B) Conductor Supports.** The insulated conductors shall be supported on blocks or other identified mounting means. The individual conductors in a cablebus shall be supported at intervals not greater than 900 mm (3 ft) for horizontal runs and 450 mm (1 1/2 ft) for vertical runs. Vertical and horizontal spacing between supported conductors shall be not less than one conductor diameter at the points of support.

**(REVISED): 370.80 Ampacity of Conductors.** The ampacity of conductors in cablebus shall be in accordance with Table 310.15(B)(17) and Table 310.15(B)(19) for installations up to and including 2000 volts, or with Table 310.60(C)(69) and Table 310.60(C)(70) for installations 2001 to 35,000 volts.

**(NEW): 386.120 Marking.** Each length of surface metal raceway shall be clearly and durably identified as required in the first sentence of 110.21(A).

**(REVISED): 388.120 Marking.** Surface nonmetallic raceways that have limited smoke-producing characteristics shall be permitted to be so identified. Each length of surface nonmetallic raceway shall be clearly and durably identified as required in the first sentence of 110.21(A).

**(REVISED): 392.18 Cable Tray Installation. (H) Marking.** Cable trays containing conductors rated over 600 volts shall have a permanent, legible warning notice carrying the wording "DANGER — HIGH VOLTAGE — KEEP AWAY" placed in a readily visible position on all cable trays, with the spacing of warning notices not to exceed 3 m (10 ft). The danger marking(s) or labels shall comply with 110.21(B).



**(REVISED): 392.20 Cable and Conductor Installation.**

(A) Multiconductor Cables Operating at 600 Volts or Less. Multiconductor cables operating at 600 volts or less shall be permitted to be installed in the same tray.

(B) Cables Operating at Over 600 Volts. Cables operating at over 600 volts and those operating at 600 volts or less installed in the same cable tray shall comply with either of the following:

- (1) The cables operating at over 600 volts are Type MC.
- (2) The cables operating at over 600 volts are separated from the cables operating at 600 volts or less by a solid fixed barrier of a material compatible with the cable tray.

## Part 2 Exam Questions:

12. What is the maximum interval cablebus can be supported without modifying the structure?
  - A. 9 ft.
  - B. 10 ft.
  - C. 8 ft.
  - D. 12 ft.
13. When supporting cablebus conductors, the conductors are required to be supported every \_\_\_\_\_ for horizontal runs.
  - A. 5 ft.
  - B. 3 ft.
  - C. 4 ft.
  - D. 8 ft.
14. When supporting cablebus conductors, the conductors are required to be supported every \_\_\_\_\_ for vertical runs.
  - A. 3 ft.
  - B. 1 ½ ft.
  - C. 8 ft.
  - D. 11 ft.
15. The spacing between supported cablebus conductors cannot be less than \_\_\_\_\_ diameter at the points of support.
  - A. 15/16"
  - B. 1"
  - C. One conductor
  - D. No requirement

16. The maximum voltage listed in Table 310.60(C)(69) and Table 310.60(C)(70) for cablebus is?
- 1000
  - 35,000
  - 600
  - 300
17. Surface metal raceways are required to be identified in accordance with \_\_\_\_\_.
- 110.22(B)
  - 110.22(A)
  - 110.21(B)
  - 110.21(A)
18. Surface nonmetallic raceways are required to be identified in accordance with \_\_\_\_\_.
- 110.21(A)
  - 110.22(A)
  - 110.21(B)
  - 110.22(B)
19. If you were to install a cable tray system, article \_\_\_\_\_ should be referenced.
- 394
  - 388
  - 386
  - 392
20. Cable trays that contain conductors rated over \_\_\_\_\_ volts are required to have a permanent, legible warning notice carrying the wording "DANGER — HIGH VOLTAGE — KEEP AWAY".
- 480
  - 600
  - 300
  - 240
21. Cable trays that are required to have danger signs posted need to be placed every \_\_\_\_\_.
- 15 ft
  - 20 ft.
  - 10 ft.
  - 8 ft.
22. How many provisions does the 2014 code list when installing cables in cable tray with conductors over and under 600 volts?
- 1
  - 3
  - 4
  - 2
23. Conductors over 600 volts can share the same cable tray system with cables less than 600 volts if they are type \_\_\_\_\_.
- UF
  - NM
  - MC
  - SCR
24. Conductors over 600 volts can share the same cable tray system with cables less than 600 volts if they have a \_\_\_\_\_.
- Nonmetallic sheath
  - Barrier
  - Tray cable marking
  - SE marking

**(NEW): 400.4 Types.** Flexible cords and flexible cables shall conform to the description in Table 400.4. The use of flexible cords and flexible cables other than those in Table 400.4 shall require permission by the authority having jurisdiction.

**(REVISED): 400.5 Ampacities for Flexible Cords and Cables. (A) Ampacity Tables.** Table 400.5(A)(1) provides the allowable ampacities, and Table 400.5(A)(2) provides the ampacities for flexible cords and cables with not more than three current-carrying conductors. These tables shall be used in conjunction with applicable end-use product standards to ensure selection of the proper size and type. Where cords and cables are used in ambient temperatures other than 30°C (86°F), the temperature correction factors from Table 310.15(B)(2)

(a) that correspond to the temperature rating of the cord or cable shall be applied to the ampacity in Table 400.5(A)(1) and Table 400.5(A)(2). Cords and cables rated 105°C shall use correction factors in the 90°C column of Table 310.15(B)(2)(a) for temperature correction. Where the number of current-carrying conductors exceeds three, the allowable ampacity or the ampacity of each conductor shall be reduced from the three-conductor rating as shown in Table 400.5(A)(3).

**(REVISED): 400.23 Equipment Grounding Conductor Identification.** A conductor intended to be used as an equipment grounding conductor shall have a continuous identifying marker readily distinguishing it from the other conductor or conductors. Conductors having a continuous green color or a continuous green color with one or more yellow stripes shall not be used for other than equipment grounding conductors. Cords or cables consisting of integral insulation and a jacket without a nonintegral grounding conductor shall be permitted to be green. The identifying marker shall consist of one of the methods in 400.23(A) or (B).

**(REVISED): 400.31 Construction. (B) Equipment Grounding Conductor(s).** The 2014 code requires portable cables over 600 volts to have an equipment grounding conductor when three or more conductors are present. The total area shall not be less than that of the size of the equipment grounding conductor required in 250.122.

**(NEW): 404.2 Switch Connections. (C) Switches Controlling Lighting Loads.** The grounded circuit conductor for the controlled lighting circuit shall be provided at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit for other than the following:



- (1) Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor
- (2) Where the box enclosing the switch is accessible for the installation of an additional or replacement cable without removing finish materials
- (3) Where snap switches with integral enclosures comply with 300.15(E)
- (4) Where a switch does not serve a habitable room or bathroom
- (5) Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations
- (6) Where lighting in the area is controlled by automatic means
- (7) Where a switch controls a receptacle load

## Part 2 Exam Questions:

25. The \_\_\_\_\_ can allow flexible cables other than those in Table 400.4

- A. Qualified individual
- B. Customer
- C. GC
- D. AHJ

26. Table \_\_\_\_\_ provides the allowable ampacities for flexible cords and cables.

- A. 400.5(A)(1)
- B. 400.5(A)(2)
- C. 400.4
- D. 400.4(A)(1)

27. Table \_\_\_\_\_ provides the ampacities for flexible cords and cables with not more than three current-carrying conductors.
- 400.4(A)(1)
  - 400.4
  - 400.5(A)(2)
  - 400.5(A)(1)
28. Cords and cables rated 105°C are required to use the correction factors in the \_\_\_\_\_ column of Table 310.15(B)(2)(a) for temperature correction.
- 75°C
  - 90°C
  - 60°C
  - 105°C
29. If the number of current-carrying conductors exceeds three for flexible cords and cables, the allowable ampacity of each conductor can be reduced from the three-conductor rating as shown in \_\_\_\_\_.
- Table 400.5(A)(1)
  - Table 400.5(A)(2)
  - Table 400.5(A)(3)
  - No such requirement
30. When using flexible cords, a conductor intended to be used as a \_\_\_\_\_ is required to have a continuous identifying marker to make it different from the other conductors.
- Grounding electrode conductor
  - Equipment grounding conductor
  - High leg conductor
  - Single phase conductor
31. Flexible cords or cables consisting of integral insulation and a jacket without a nonintegral grounding conductor shall be permitted to be \_\_\_\_\_.
- Yellow
  - Green
  - White
  - Gray
32. Flexible conductors that have a continuous green color cannot be used for other than \_\_\_\_\_.
- Equipment grounding conductors
  - Grounding electrode conductor
  - Grounding Conductor
  - Grounded conductor
33. An equipment grounding conductor is required when three or more conductors are present in a portable cable operating at over \_\_\_\_\_ volts.
- 300
  - 575
  - 480
  - 600
34. Equipment grounding conductors are sized using \_\_\_\_\_.
- 250.105
  - 250.66
  - 250.122
  - 250.105(D)
35. True or False, as a general rule, the grounded conductor for a lighting circuit is required to be at all switch locations.
- True
  - False
36. How many conditions does the 2014 code list where the grounded conductor is not required to be at the switch location of the circuit?
- 4
  - 5
  - 2
  - 7
37. Would it be considered acceptable or a violation of this code to not install the grounded conductor at the switch location of a non-habitable room?
- Violation
  - Acceptable

**(REVISED): 404.10 Mounting of Snap Switches. (B) Box Mounted.** Flush-type snap switches mounted in boxes that are set back of the finished surface as permitted in 314.20 shall be installed so that the extension plaster ears are seated against the surface. Flush-type snap switches mounted in boxes that are flush with the finished surface or project from it shall be installed so that the mounting yoke or strap of the switch is seated against the box. Screws used for the purpose of attaching a snap switch to a box shall be of the type provided with a listed snap switch, or shall be machine screws having 32 threads per inch or part of listed assemblies or systems, in accordance with the manufacturer's instructions.

**(NEW): 406.3 Receptacle Rating and Type. (E) Controlled Receptacle Marking.** All non-locking type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device, or that incorporate control features that remove power from the outlet for the purpose of energy management or building automation, shall be marked with the symbol ( | ) as shown in Figure 406.3(E) and located on the controlled receptacle outlet where visible after installation.

**(REVISED); 406.4 General Installation Requirements. (D) Replacements.** Replacement of receptacles shall comply with 406.4(D)(1) through (D)(6), as applicable. Arc fault circuit-interrupter type and ground-fault circuit interrupter type receptacles shall be installed in a readily accessible location.

**406.5 Receptacle Mounting.** Receptacles shall be mounted in identified boxes or assemblies. The boxes or assemblies shall be securely fastened in place unless otherwise permitted elsewhere in this Code. Screws used for the purpose of attaching receptacles to a box shall be of the type provided with a listed receptacle, or shall be machine screws having 32 threads per inch or part of listed assemblies or systems, in accordance with the manufacturer's instructions.



**(REVISED): 406.5 Receptacle Mounting. (E) Receptacles in Countertops and Similar Work Surfaces.** Receptacles, unless listed as receptacle assemblies for countertop applications, shall not be installed in a face-up position in countertops or similar work surfaces. Where receptacle assemblies for countertop applications are required to provide ground-fault circuit-interrupter protection for personnel in accordance with 210.8, such assemblies shall be permitted to be listed as GFCI receptacle assemblies for countertop applications.

**(NEW): 406.5 Receptacle Mounting. (F) Receptacles in Seating Areas and Other Similar Surfaces.** In seating areas or similar surfaces, receptacles shall not be installed in a face-up position unless the receptacle is any of the following:

- (1) Part of an assembly listed as a furniture power distribution unit, if cord-and plug-connected
- (2) Part of an assembly listed either as household furnishings or as commercial furnishings
- (3) Listed either as a receptacle assembly for countertop applications or as a GFCI receptacle assembly for countertop applications
- (4) Installed in a listed floor box

**(REVISED): 406.9 Receptacles in Damp or Wet Locations. (B)(1) Receptacles of 15 and 20 Amperes in a Wet Location.** Receptacles of 15 and 20 amperes installed in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted. An outlet box hood installed for this purpose shall be listed and shall be identified as "extra duty." All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles shall be listed weather-resistant type.

## Part 2 Exam Questions:

- |  |  |
|--|--|
| <p>38. Flush-type snap switches that are mounted in boxes are required to be installed so that the mounting _____ or strap of the switch is seated against the box.</p> <ol style="list-style-type: none"> <li>A. Tab</li> <li>B. Screw</li> <li>C. Yoke</li> <li>D. Bolt</li> </ol> | <p>39. Machine screws used to mount flush-type snap switches are required to have _____ threads.</p> <ol style="list-style-type: none"> <li>A. 10-24</li> <li>B. 24</li> <li>C. 48</li> <li>D. 32</li> </ol> |
|--|--|



40. All non-locking type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device are required to be \_\_\_\_\_.
- A. Listed
  - B. Identified
  - C. Marked
  - D. No requirement
41. The symbol used to identify an automatic control device receptacle used for energy management systems can be found in \_\_\_\_\_.
- A. 403.6(E)
  - B. 406.3(E)
  - C. 404.3(E)
  - D. 339.4
42. When replacing receptacles, the 2014 code lists \_\_\_\_\_ requirements to follow.
- A. 2
  - B. 4
  - C. 5
  - D. 6
43. Ground-fault circuit interrupter and arc fault type receptacles are required to be installed in a \_\_\_\_\_ location.
- A. Readily accessible
  - B. Accessible
  - C. Open
  - D. Obvious
44. Machine screws used to mount receptacles are required to have \_\_\_\_\_ threads.
- A. 10-24
  - B. 32
  - C. 24
  - D. 48
45. The box used to mount a receptacle must be \_\_\_\_\_.
- A. All listed answers
  - B. Listed
  - C. Rated
  - D. Identified
46. Standard receptacles \_\_\_\_\_ be installed face up on a kitchen countertop.
- A. Shall
  - B. Shall not
  - C. May
  - D. Can
47. A receptacle installed in a kitchen countertop face up is required to be \_\_\_\_\_ for the application.
- A. Listed
  - B. Rated
  - C. Identified
  - D. Approved
48. True or False, receptacles are not allowed to be installed face up in seating areas.
- A. False
  - B. True
49. How many conditions does the 2014 code list as acceptable for mounting receptacles face up in seating areas.
- A. 5
  - B. 3
  - C. 4
  - D. 2
50. A receptacle installed in a wet location is required to be installed in a \_\_\_\_\_ enclosure.
- A. Waterproof
  - B. Weatherproof
  - C. Weather resistant
  - D. Watertight
51. An outlet box hood installed in a wet location is required to be listed and also identified as "\_\_\_\_\_."
- A. Weatherproof
  - B. Watertight
  - C. Extra duty
  - D. Durable
52. A non-locking-type receptacle used in a wet location is required to be listed as a \_\_\_\_\_ type.
- A. No requirement
  - B. Water-resistant
  - C. Watertight
  - D. Weather-resistant

**(REVISED): 406.12 Tamper-Resistant Receptacles.** Tamper-resistant receptacles shall be installed as specified in 406.12(A) through (C).

(A) Dwelling Units. In all areas specified in 210.52, all nonlocking-type 125-volt, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

(B) Guest Rooms and Guest Suites of Hotels and Motels. All nonlocking-type 125-volt, 15- and 20-ampere receptacles located in guest rooms and guest suites of hotels and motels shall be listed tamper-resistant receptacles.

(C) Child Care Facilities. In all child care facilities, all nonlocking-type 125-volt, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

**(NEW): 406.15 Dimmer-Controlled Receptacles.** A receptacle supplying lighting loads shall not be connected to a dimmer unless the plug/receptacle combination is a nonstandard configuration type that is specifically listed and identified for each such unique combination.

**(NEW): 408.3 Support and Arrangement of Busbars and Conductors. (E)(2) DC Bus Arrangement.** Direct-current ungrounded buses shall be permitted to be in any order. Arrangement of dc buses shall be field marked as to polarity, grounding system, and nominal voltage.



**(NEW): 408.3 Support and Arrangement of Busbars and Conductors (F)(3) High-Impedance Grounded Neutral AC System.** A switchboard, switchgear, or panelboard containing a high impedance grounded neutral ac system in accordance with 250.36 shall be legibly and permanently field marked as follows:

CAUTION: HIGH-IMPEDANCE GROUNDED NEUTRAL  
AC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN  
CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS

**(NEW): 408.3 Support and Arrangement of Busbars and Conductors (F)(4) Ungrounded DC Systems.** A switchboard, switchgear, or panelboard containing an ungrounded dc electrical system in accordance with 250.169 shall be legibly and permanently field marked as follows:

CAUTION: UNGROUNDED DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS

**(NEW): 408.3 Support and Arrangement of Busbars and Conductors (F)(5) Resistively Grounded DC Systems.** A switchboard, switchgear, or panelboard containing a resistive connection between current-carrying conductors and the grounding system to stabilize voltage to ground shall be legibly and permanently field marked as follows:

CAUTION: DC SYSTEM OPERATING — \_\_\_\_\_  
VOLTS BETWEEN CONDUCTORS AND  
MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR  
INDEFINITE PERIODS UNDER FAULT CONDITIONS

**(REVISED): 408.16 Switchboards and Switchgear in Damp or Wet Locations.** Switchboards and switchgear in damp or wet locations shall be installed in accordance with 312.2.

**(REVISED): 408.18 Clearances. (A) From Ceiling.** For other than a totally enclosed switchboard or switchgear, a space not less than 900 mm (3 ft) shall be provided between the top of the switchboard or switchgear and any combustible ceiling, unless a noncombustible shield is provided between the switchboard or switchgear and the ceiling.

**(REVISED): 408.18 Clearances. (B) Around Switchboards and Switchgear.** Clearances around switchboards and switchgear shall comply with the provisions of 110.26.

## Part 2 Exam Questions:

53. How many provisions does the 2014 code list for installing tamper resistant receptacles?
- 5
  - 2
  - 4
  - 3
54. True or False, Child care facilities do not require tamper resistant receptacles to be installed.
- False
  - True
55. Would it be considered acceptable or a violation of this code to install a standard receptacle on a dimmer switch.
- Acceptable
  - Violation
56. A switchgear section that has a DC bus system is required to have the bus installed in \_\_\_\_\_ order.
- Neg to Pos
  - Pos to Neg
  - No
  - No listed answers
57. A dc bus system is required to be marked by \_\_\_\_\_.
- Grounding system
  - Polarity
  - Voltage
  - All listed answers
58. A switchgear section that contains a high impedance grounded neutral ac system is required to have a caution label that reads: \_\_\_\_\_.
- CAUTION: HIGH-IMPEDANCE GROUNDED NEUTRAL SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS.
  - CAUTION: HIGH-IMPEDANCE NEUTRAL AC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
  - CAUTION: HIGH-IMPEDANCE GROUNDED NEUTRAL AC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
  - CAUTION: HIGH-IMPEDANCE NEUTRAL GROUNDED AC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
59. A switchgear section that contains an ungrounded dc electrical system is required to have a caution label that reads: \_\_\_\_\_.
- CAUTION: DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS
  - CAUTION: UNGROUNDED DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS
  - CAUTION: DC UNGROUNDED SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS
  - CAUTION: UNGROUNDED \_\_\_\_\_ DC SYSTEM
60. A switchgear section that contains a resistive connection system is required to have a caution label that reads: \_\_\_\_\_.
- CAUTION: DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
  - CAUTION: AC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
  - CAUTION: DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR PERIODS UNDER FAULT CONDITIONS
  - CAUTION: DC SYSTEM OPERATING — \_\_\_\_\_ VOLTS BETWEEN CONDUCTORS AND MAY OPERATE — \_\_\_\_\_ VOLTS TO GROUND FOR INDEFINITE PERIODS UNDER FAULT CONDITIONS
61. What article does the 2014 code reference when installing switchgear in damp or wet locations?
- 250.34(C)(1)
  - 312
  - 312.2
  - 314.2
62. What is the minimum distance switchgear can be placed from a combustible ceiling?
- 4 ft.
  - 5 ft.
  - 3 ft.
  - No requirement
63. What article does the 2014 code reference with regards to the clearances required around switchgear?
- 110.24
  - 110.26
  - 110.26(B)
  - 110.30

**(REVISED): 408.22 Grounding of Instruments, Relays, Meters, and Instrument Transformers on Switchboards and Switchgear.** Instruments, relays, meters, and instrument transformers located on switchboards and switchgear shall be grounded as specified in 250.170 through 250.178.

**(REVISED): 408.52 Protection of Instrument Circuits.** Instruments, pilot lights, voltage (potential) transformers, and other switchboard or switchgear devices with potential coils shall be supplied by a circuit that is protected by standard overcurrent devices rated 15 amperes or less.

**(REVISED): 408.55 Wire-Bending Space Within an Enclosure Containing a Panelboard. (A) Top and Bottom Wire-Bending Space.** The enclosure for a panelboard shall have the top and bottom wire bending space sized in accordance with Table 312.6(B) for the largest conductor entering or leaving the enclosure.

**(NEW): 408.55 Wire-Bending Space Within an Enclosure Containing a Panelboard. (B) Side Wire-Bending Space.** Side wire-bending space shall be in accordance with Table 312.6(A) for the largest conductor to be terminated in that space.

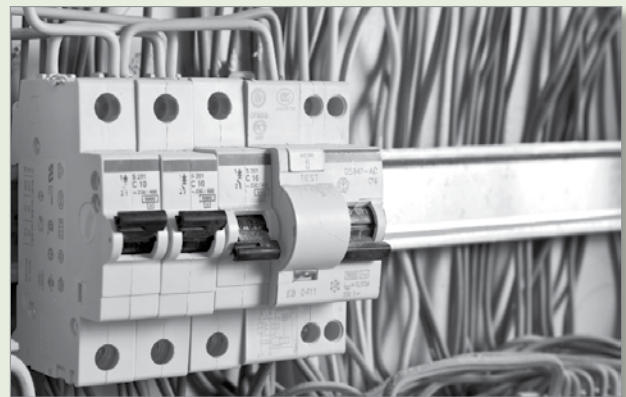
**(NEW): 408.55 Wire-Bending Space Within an Enclosure Containing a Panelboard. (C) Back Wire-Bending Space.** Where a raceway or cable entry is in the wall of the enclosure opposite a removable cover, the distance from that wall to the cover shall be permitted to comply with the distance required for one wire per terminal in Table 312.6(A). The distance between the center of the rear entry and the nearest termination for the entering conductors shall not be less than the distance given in Table 312.6(B).

**(REVISED): 409.20 Conductor — Minimum Size and Ampacity.** The size of the industrial control panel supply conductor shall have an ampacity not less than 125 percent of the full-load current rating of all heating loads plus 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all other connected motors and apparatus based on their duty cycle that may be in operation at the same time.

**(REVISED): 409.106 Spacings.** Spacings in feeder circuits between uninsulated live parts of adjacent components, between uninsulated live parts of components and grounded or accessible non-current-carrying metal parts, between uninsulated live parts of components and the enclosure, and at field wiring terminals shall be as shown in Table 430.97(D).

**(REVISED): Exception:** Spacings shall be permitted to be less than those specified in Table 430.97(D) at circuit breakers and switches and in listed components installed in industrial control panels.

**(NEW): 410.10 Luminaires in Specific Locations. (F) Luminaires Installed in or Under Roof Decking.** Luminaires installed in exposed or concealed locations under metal-corrugated sheet roof decking shall be installed and supported so there is not less than 38 mm (1 1/2 in.) measured from the lowest surface of the roof decking to the top of the luminaire.



**(REVISED): 410.23 Covering of Combustible Material at Outlet Boxes.** Any combustible wall or ceiling finish exposed between the edge of a luminaire canopy or pan and an outlet box having a surface area of 1160 mm<sup>2</sup> (180 in.<sup>2</sup>) or more shall be covered with noncombustible material.

**(REVISED): 410.141 Control. (B) Within Sight or Locked Type.** The switch or circuit breaker of a luminaire shall be located within sight from the luminaires or lamps, or it shall be permitted to be located elsewhere if it is lockable in accordance with 110.25.

## Part 2 Exam Questions:

64. Where would you start looking in the 2014 code for the grounding requirements of a meter installed on a section of switchgear?
- 250.170
  - 250.178
  - 250.168
  - 250.66(A)
65. Pilot lights with potential coils are required to be supplied by a circuit that is protected by standard overcurrent devices rated \_\_\_\_\_ amperes or less.
- 30
  - 20
  - 25
  - 15
66. What is the top and bottom wire bending space based on for a panelboard?
- Square inches
  - Largest conductor
  - Length of the space
  - All listed answers
67. What table is used to determine the minimum side wire-bending space for a panelboard?
- 312.6(A)
  - 316.2(A)
  - 361.6(A)
  - 360.61(A)
68. If a cable entry is in the wall of a panelboard opposite a removable cover, the distance from that wall to the cover is allowed to comply with the distance required in Table 312.6(A) for \_\_\_\_\_ wire per terminal.
- Copper
  - Two
  - One
  - Aluminum
69. What table does the 2014 code require using when determining the distance for entering conductors between the center of the rear entry and the nearest termination in a panelboard?
- 311.6(B)
  - 316.2(B)
  - 362.1(B)
  - 312.6(B)
70. Supply conductors for an industrial control panel are required to have an ampacity of \_\_\_\_\_ the full-load current rating of all heating loads.
- 75%
  - 100%
  - 25%
  - 125%
71. Supply conductors for an industrial control panel are required to have an ampacity of \_\_\_\_\_ the full-load current rating of the highest rated motor.
- 100%
  - 125%
  - 25%
  - 75%
72. What table is required to be used when determining the spacing in feeder circuits between the uninsulated live parts of adjacent components and the grounded or accessible non-current-carrying metal parts with regards to industrial control panels?
- 430.79(D)
  - 409.20
  - 430.97(D)
  - No such requirement
73. What is the minimum distance a luminaire can installed under metal-corrugated sheet roof decking to the top of the luminaire.
- 1"
  - 1 1/2"
  - 2"
  - 3/4"
74. The combustible material of a ceiling finish that is exposed between the edge of a luminaire canopy and an outlet box having a minimum surface area of \_\_\_\_\_ is required to be covered with noncombustible material.
- 160 in.
  - 180 in.
  - 160 in.2
  - 180 in.2

75. The switch of a luminaire is required to be installed within \_\_\_\_\_ of the luminaire.

- A. 15 ft.
- B. 25 ft.
- C. Sight
- D. 50 ft.

76. The switch of a luminaire can be lockable if installed as per \_\_\_\_\_.

- A. 101.25
- B. 110.25
- C. 115.25
- D. 410.23

**(REVISED): 410.146 Marking.** Each luminaire or each secondary circuit of tubing having an open-circuit voltage of over 1000 volts shall have a clearly legible marking in letters not less than 6 mm (1/4 in.) high reading "Caution \_\_\_\_\_ volts." The voltage indicated shall be the rated open-circuit voltage. The caution sign(s) or label(s) shall comply with 110.21(B).

**(REVISED): 410.151 Installation. (B) Connected Load.** The connected load on lighting track shall not exceed the rating of the track. Lighting track shall be supplied by a branch circuit having a rating not more than that of the track. The load calculation in 220.43(B) shall not be required to limit the length of track on a single branch circuit, and it shall not be required to limit the number of luminaires on a single track.

**(REVISED): 411.1 Scope.** This article covers lighting systems operating at 30 volts or less and their associated components. This article also covers lighting equipment connected to a Class 2 power source.

**(NEW): 411.3 Low-Voltage Lighting Systems. (A) General.** Lighting systems operating at 30 volts or less shall consist of an isolating power supply, low-voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes and 30 volts (42.4 volts peak) maximum under all load conditions.

**(NEW): 411.3 Low-Voltage Lighting Systems. (B) Class 2.** Listed Class 2 lighting equipment shall be rated in conformance with Chapter 9, Table 11(A) or Table 11(B).



**(REVISED): 411.7 Branch Circuit.** Lighting systems covered by this article shall be supplied from a maximum 20-ampere branch circuit.

**(NEW): 422.5 (Appliances) Ground-Fault Circuit-Interrupter (GFCI) Protection.** The device providing GFCI protection required in this article shall be readily accessible.

**(NEW/REVISED): 422.11 Branch-Circuit Rating. (3) Water Heaters and Steam Boilers.** Resistance-type immersion electric heating elements shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes as follows:

- (1) Where contained in ASME-rated and stamped vessels
- (2) Where included in listed instantaneous water heaters
- (3) Where installed in low-pressure water heater tanks or open-outlet water heater vessels

## Part 2 Exam Questions:

77. A luminaire having an open-circuit voltage of over \_\_\_\_\_ volts is required to have a caution sign.
- 1000
  - 600
  - 300
  - 575
78. The caution sign required by 410.146 is required to have the letters a minimum of \_\_\_\_\_ high.
- $\frac{3}{4}$ "
  - $\frac{1}{2}$ "
  - $\frac{1}{4}$ "
  - $\frac{3}{8}$ "
79. Would it be considered acceptable or a violation of this code for the connected load of a lighting track to exceed the rating of the track?
- Violation
  - Acceptable
80. The load calculation in \_\_\_\_\_ for lighting track is not required to limit the length of track on a single branch circuit.
- 410.150
  - 220.34(B)
  - 210.43(B)
  - 220.43(B)
81. What is the maximum voltage that article 411 covers with regards to lighting systems?
- 300
  - 30
  - 50
  - 600
82. Article 411 covers lighting equipment connected to class \_\_\_\_\_ power sources.
- 3
  - 1
  - 2
  - 4
83. The power supply used for low voltage lighting systems needs to be rated for \_\_\_\_\_ amps.
- 20
  - 10
  - 30
  - 25
84. What is the maximum voltage a low voltage lighting system power supply should produce under all load conditions?
- 30
  - 42.4
  - 40
  - No listed answer
85. The rating of class 2 lighting equipment is required to conform with Chapter \_\_\_\_\_.
- 9
  - 4
  - 6
  - 5
86. How many tables does the 2014 code list for low voltage lighting equipment compliance?
- 2
  - 1
  - 3
  - 4
87. What is the maximum size branch circuit allowed by the 2014 code to supply a low voltage lighting system?
- 30
  - 20
  - 15
  - 40
88. GFCI protection for appliances is required to be \_\_\_\_\_.
- In line
  - Accessible
  - Readily accessible
  - Integral
89. How many amps does the 2014 code allow resistance-type immersion electric heating elements to be subdivided into?
- 130
  - 125
  - 120
  - 150

90. What is the maximum amperage that resistance-type immersion electric heating elements can be protected?

- A. 130
- B. 120
- C. 150
- D. 125

91. How many requirements does the 2014 code list for the protection of resistance-type immersion electric heating elements?

- A. No requirements
- B. 4
- C. 2
- D. 3

**(NEW): 422.19 Space for Conductors.** Canopies of ceiling suspended (paddle) fans and outlet boxes taken together shall provide sufficient space so that conductors and their connecting devices are capable of being installed in accordance with 314.16.

**(NEW): 422.20 Outlet Boxes to Be Covered.** In a completed installation, each outlet box shall be provided with a cover unless covered by means of a ceiling-suspended (paddle) fan canopy.

**(NEW): 422.21 Covering of Combustible Material at Outlet Boxes.** Any combustible ceiling finish exposed between the edge of a ceiling-suspended (paddle) fan canopy or pan and an outlet box shall be covered with noncombustible material.

**(NEW): 422.23 Tire Inflation and Automotive Vacuum Machines.** Tire inflation machines and automotive vacuum machines provided for public use shall be protected by a ground-fault circuit interrupter.

**(REVISED): 422.31 Disconnection of Permanently Connected Appliances. (B) Appliances Rated over 300 Volt-Amperes.** For permanently connected appliances rated over 300 volt-amperes, the branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance or is lockable in accordance with 110.25.

**(NEW): 422.31 Disconnection of Permanently Connected Appliances. (C) Motor-Operated Appliances Rated over 1/8 Horsepower.**

The disconnecting means shall comply with 430.109 and 430.110. For permanently connected motor operated appliances with motors rated over 1/8 hp, the disconnecting means shall meet 422.31(C)(1) or (2).

(1) The branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance.

(2) The disconnecting means shall be installed within sight of the appliance.

**(NEW/REVISED): 422.49 High-Pressure Spray Washers.** Cord-and plug connected high-pressure spray washing machines as specified in 422.49(1) or (2) shall be provided with factory installed ground-fault circuit-interrupter protection for personnel that is an integral part of the attachment plug or that is located in the supply cord within 300 mm (12 in.) of the attachment plug.

(1) All single-phase equipment rated 250 volts or less

(2) All 3-phase equipment rated 208Y/120 volts and 60 amperes or less



**(REVISED): 422.51 Vending Machines. (A) Cord-and Plug-Connected.** Cord-and plug-connected vending machines manufactured or remanufactured on or after January 1, 2005, shall include a ground-fault circuit interrupter identified for portable use as an integral part of the attachment plug or be located within 300 mm (12 in.) of the attachment plug. Older vending machines manufactured or remanufactured prior to January 1, 2005, shall be connected to a GFCI-protected outlet.



## Part 2 Exam Questions:

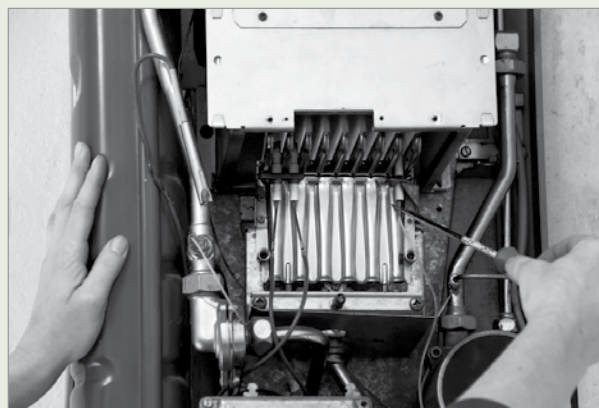
92. The canopies of ceiling suspended paddle fans are required to have enough space for conductors as required in \_\_\_\_\_.
- 300.68
  - 422.20
  - 312.45
  - 314.16
93. The outlet box used for a paddle fan is required to have a \_\_\_\_\_ unless covered by the paddle fan.
- Accessible door
  - Receptacle
  - Cover
  - Readily accessible door
94. If a paddle fan box is in contact with any combustible material, the box is required to be covered with \_\_\_\_\_.
- Fire caulk
  - Noncombustible material
  - Cambric
  - Rubber tape
95. The tire air machine at your local convenience store is required to be \_\_\_\_\_.
- All listed answers
  - Accessible
  - Isolated
  - GFCI protected
96. A lockable breaker is acceptable to disconnect an appliance rated over \_\_\_\_\_ if it is within sight.
- 300 A
  - 300 VA
  - 150 VA
  - 200 A
97. What section of the 2014 code is referenced with regards to lockable disconnects?
- 240.34
  - 110.23
  - 240.8
  - 110.25
98. The disconnect placement of a motor rated over 1/8 horsepower has \_\_\_\_\_ listed requirements in the 2014 code.
- 1
  - 2
  - 3
  - 4
99. A high pressure spray washer is required to have a \_\_\_\_\_ integral to the cord.
- Waterproofing
  - Green color
  - SOOW insulation
  - GFCI
100. How far from the end of a high pressure spray washer attachment plug does its protection need to be installed?
- 14 inches
  - 24 inches
  - 6 inches
  - 12 inches
101. 3-phase equipment cords rated 208Y/120 volts and \_\_\_\_\_ amperes or less is required to meet the provisions of 422.49.
- 40
  - 60
  - 20
  - 30
102. A vending machine cord made after \_\_\_\_\_ is required to be GFCI protected.
- 2005
  - 2007
  - 2006
  - 2013
103. What is the maximum distance from a cord end that an integral GFCI need to be installed for a vending machine?
- 10 inches
  - 18 inches
  - 12 inches
  - No requirement

**(NEW): 422.51 Vending Machines. (B) Other Than Cord-and Plug-Connected.** Vending machines not utilizing a cord and plug connection shall be connected to a ground-fault circuit-interrupter protected circuit.

**(REVISED): 424.19 Disconnecting Means.** Means shall be provided to simultaneously disconnect the heater, motor controller(s), and supplementary overcurrent protective device(s) of all fixed electric space-heating equipment from all ungrounded conductors. Where heating equipment is supplied by more than one source, feeder, or branch circuit, the disconnecting means shall be grouped and marked. The disconnecting means specified in 424.19(A) and (B) shall have an ampere rating not less than 125 percent of the total load of the motors and the heaters and shall be lockable in accordance with 110.25.

**(REVISED): 424.59 Airflow.** Means shall be provided to ensure uniform airflow over the face of the heater in accordance with the manufacturer's instructions with regards to duct heaters.

**(REVISED): 424.66 Installation. (A) General.** Duct heaters shall be installed in accordance with the manufacturer's instructions in such a manner that operation does not create a hazard to persons or property. Furthermore, duct heaters shall be located with respect to building construction and other equipment so as to permit access to the heater. Sufficient clearance shall be maintained to permit replacement of controls and heating elements and for adjusting and cleaning of controls and other parts requiring such attention. See 110.26. Working space about electrical enclosures for resistance heating element-type duct heaters that are mounted on duct systems and contain equipment that requires examination, adjustment, servicing, or maintenance while energized shall comply with 424.66(B).



**(NEW): 424.66 Installation. (B) Limited Access.** Where the enclosure is located in a space above a ceiling, all of the following shall apply:

- (1) The enclosure shall be accessible through a lay-in type ceiling or an access panel(s).
- (2) The width of the working space shall be the width of the enclosure or a minimum of 762 mm (30 in.), whichever is greater.
- (3) All doors or hinged panels shall open to at least 90 degrees.
- (4) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1). A horizontal ceiling T-bar shall be permitted in this space.

**(REVISED): 424.86 Markings.** All electrode-type boilers shall be marked to show the following:

- (1) The manufacturer's name.
- (2) The normal rating in volts, amperes, and kilowatts.
- (3) The electrical supply required specifying frequency, number of phases, and number of wires.
- (4) The marking "Electrode-Type Boiler."
- (5) A warning marking, "All Power Supplies Shall Be Disconnected Before Servicing, Including Servicing the Pressure Vessel." A field-applied warning marking or label shall comply with 110.21(B).

## Part 2 Exam Questions:

- 104. A vending machine that is hard wired is required to be?**
- A. Dedicated
  - B. AFCI protected
  - C. GFCI Protected
  - D. Listed
- 105. Space heating equipment is required to have a \_\_\_\_\_.**
- A. Current transformer
  - B. Disconnect
  - C. Induction coil
  - D. Capacitive coil
- 106. When using a disconnect for space heating equipment, the disconnect is required have an ampere rating of no less than \_\_\_\_\_ percent of the motors and heaters.**
- A. 100
  - B. 75
  - C. 115
  - D. 125
- 107. A duct heater is required to provide \_\_\_\_\_ airflow over the face of the heater.**
- A. Uniform
  - B. No
  - C. Partial
  - D. 35 cfm
- 108. A duct heater is required to be installed by the \_\_\_\_\_ instructions.**
- A. Electricians
  - B. Architects
  - C. Engineers
  - D. Manufacturers
- 109. A duct heater is required to be \_\_\_\_\_.**
- A. 240v
  - B. Readily Accessible
  - C. Accessible
  - D. Installed by the manufacturer
- 110. What part of the 2014 code is referenced for working space about electrical enclosures with regards to duct heaters?**
- A. 424.66
  - B. 110.26
  - C. 110.24
  - D. No requirement
- 111. If a duct heater is installed above a ceiling, the 2014 code requires \_\_\_\_\_ provisions must be met.**
- A. 3
  - B. 5
  - C. 4
  - D. 2
- 112. What is the minimum width allowed with regards to working space for a duct heater installed above a ceiling?**
- A. 24 inches
  - B. 30 inches
  - C. 36 inches
  - D. 18 inches
- 113. An electrode boiler is required to be marked by \_\_\_\_\_ different pieces of information.**
- A. 3
  - B. 6
  - C. 4
  - D. 5
- 114. What part of the 2014 code is referenced when using a field-applied warning label for an electrode boiler?**
- A. 110.21(B)
  - B. 110.24
  - C. 110.21(A)
  - D. No requirement

**(REVISED): 426.50 Disconnecting Means.(A) Disconnection.** All fixed outdoor deicing and snow melting equipment shall be provided with a means for simultaneous disconnection from all ungrounded conductors. Where readily accessible to the user of the equipment, the branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means. The disconnecting means shall be of the indicating type and be capable of being locked in the open (off) position.

**(REVISED): 430.21 General.** Part II specifies ampacities of conductors that are capable of carrying the motor current without overheating under the conditions specified. The provisions of Part II shall not apply to motor circuits rated over 1000 volts, nominal.

**(REVISED): 430.32 Continuous-Duty Motors. (B)(4) Informational Note:** A Class 20 overload relay will provide a longer motor acceleration time than a Class 10 or Class 10A overload relay. A Class 30 overload relay will provide a longer motor acceleration time than a Class 20 overload relay. Use of a higher class overload relay may preclude the need for selection of a higher trip current.

#### 430.52 Rating or Setting for Individual Motor Circuit (C)(3).

*Informational Notes*

**(NEW): Informational Note No. 1:** Instantaneous trip circuit breakers are also known as motor-circuit protectors (MCPs).

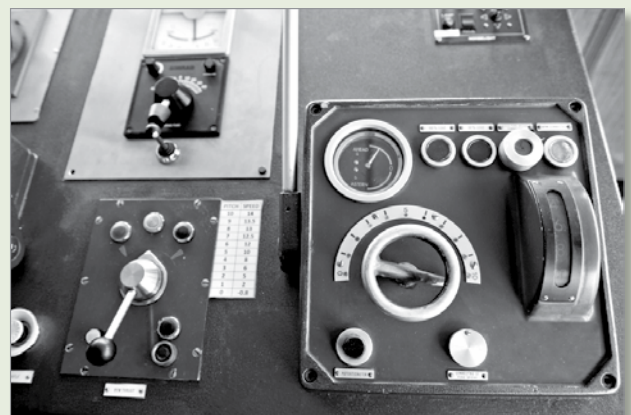
**(NEW): 430.130 Branch-Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment. (A) Circuits Containing Power Conversion Equipment.** Circuits containing power conversion equipment shall be protected by a branch-circuit short-circuit and ground-fault protective device in accordance with the following:

- (1) The rating and type of protection shall be determined by 430.52(C)(1), (C)(3), (C)(5), or (C)(6), using the full-load current rating of the motor load as determined by 430.6.
- (2) Where maximum branch-circuit short-circuit and ground-fault protective ratings are stipulated for specific device types in the manufacturer's instructions for the power conversion equipment or are otherwise marked on the equipment, they shall not be exceeded even if higher values are permitted by 430.130(A)(1).
- (3) A self-protected combination controller shall only be permitted where specifically identified in the manufacturer's instructions for the power conversion equipment or if otherwise marked on the equipment.

*Informational Notes*

**Informational Note:** The type of protective device, its rating, and its setting are often marked on or provided with the power conversion equipment.

**(NEW): 430.130 Branch-Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment. (B) Bypass Circuit/Device.** Branch-circuit short-circuit and ground-fault protection shall also be provided for a bypass circuit/device(s). Where a single branch-circuit short-circuit and ground-fault protective device is provided for circuits containing both power conversion equipment and a bypass circuit, the branch-circuit protective device type and its rating or setting shall be in accordance with those determined for the power conversion equipment and for the bypass circuit/device(s) equipment.



## Part 2 Exam Questions:

115. Outdoor snow melting equipment is required to have its disconnecting means capable of being locked in the \_\_\_\_\_ position.
- Reset
  - On
  - Tripped
  - Off
116. Part II of article 430 does not apply to motor circuits rated over \_\_\_\_\_ volts.
- 575
  - 600
  - 300
  - 1000
117. A Class 20 overload relay will provide a longer motor acceleration time than a Class \_\_\_\_\_.
- 10 B
  - 10
  - 30
  - 40
118. A Class 30 overload relay will provide a longer motor acceleration time than a Class \_\_\_\_\_ overload relay.
- 50 A
  - 35
  - 40
  - 20
119. Another name for an instantaneous trip circuit breaker is?
- Motor-surge protectors
  - Motor-circuit protectors
  - Motor-circuit overload
  - Motor-circuit fuse
120. What section of the 2014 code is used to determine the full-load current rating of a motor load.
- 430.130
  - 430.52
  - 430.6
  - 240.6
121. A self-protected combination controller is only permitted where specifically \_\_\_\_\_ in the manufacturer's instructions.
- Designed
  - Listed
  - Rated
  - Identified
122. True or False, power conversion equipment can exceed the manufacturers values if allowed by 430.130(A)(1).
- False
  - True
123. A bypass circuit is required to be \_\_\_\_\_ protected.
- Fuse
  - AFCI
  - GFCI
  - No requirement

**(NEW/REVISED): 445.11 Marking.** Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, the rated revolutions per minute, and the rated ambient temperature or rated temperature rise.

Nameplates for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the subtransient and transient impedances, the insulation system class, and the time rating.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to the generator frame. Where the bonding of a generator is modified in the field, additional marking shall be required to indicate whether the generator neutral is bonded to the generator frame.

**(NEW): 445.20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.** All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or

smaller portable generator either shall have ground-fault circuit-interrupter protection for personnel integral to the generator or receptacle or shall not be available for use when the 125/250-volt locking-type receptacle is in use. If the generator does not have a 125/250-volt locking-type receptacle, this requirement shall not apply.

**(NEW): 450.5 Exception:** An auto transformer with a wye configuration on its line side and a zigzag configuration on its load side that does not permit neutral or ground-fault current to return over the line connection shall be permitted on the load side of a system grounding connection. This exception shall not apply to a connection made from a high-resistance grounded system applied in accordance with 250.36.

**(REVISED): 450.5 Grounding Autotransformers. (A)(4) Rating.** The autotransformer shall have a continuous neutral-current rating that is not less than the maximum possible neutral unbalanced load current of the 4-wire system.



**(REVISED): 450.9 Ventilation.** The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.

**(NEW): 450.10 Grounding.(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.

**(NEW): Exception:** Where a dry-type transformer is equipped with wire-type connections (leads), the grounding and bonding connections shall be permitted to be connected together using any of the methods in 250.8 and shall be bonded to the enclosure if of metal.

**(REVISED): 450.11 Marking. (A) General.** Each transformer shall be provided with a nameplate giving the following information:

- (1) Name of manufacturer
- (2) Rated kilovolt-amperes
- (3) Frequency
- (4) Primary and secondary voltage
- (5) Impedance of transformers 25 kVA and larger
- (6) Required clearances for transformers with ventilating openings
- (7) Amount and kind of insulating liquid where used
- (8) For dry-type transformers, temperature class for the insulation system

## Part 2 Exam Questions:

124. A generator's nameplate is required to list the \_\_\_\_\_.

- A. All listed answers
- B. Manufacturer's name
- C. Number of phases
- D. Rated frequency

125. The nameplate of a stationary generator is required to list its power factor, the subtransient and transient impedances, the insulation system class, and the time rating if over \_\_\_\_\_.

- A. 15 kW
- B. 10 kW
- C. 8 kW
- D. 12 kW

126. A generator is required to be marked by the manufacturer to indicate whether or not the generators \_\_\_\_\_ is bonded to the generator frame.
- Ground
  - Neutral
  - Equipment grounding conductor
  - All listed answers
127. All 15 and 20 amp receptacles that are part of a \_\_\_\_\_ or smaller generator are required to be GFCI protected.
- 24 kW
  - 20 kW
  - 15 kW
  - 48 kW
128. If an auto transformer with a wye configuration on its line side and a \_\_\_\_\_ configuration on its load side that does not permit neutral or ground-fault current to return over the line connection is allowed on the load side of a system grounding connection.
- Capacitive
  - Impedance
  - Zigzag
  - Inductive
129. An autotransformer is required to have a continuous neutral current rating that is \_\_\_\_\_ than the maximum possible neutral unbalanced load current of the 4-wire system.
- No listed answer
  - More
  - Different
  - Not less
130. A transformer ventilation system is required to dispose its full-load \_\_\_\_\_ losses.
- Hysteresis
  - Power
  - Copper
  - Heat
131. A terminal bar for all grounding and bonding conductor connections is required to be installed \_\_\_\_\_ a transformer enclosure.
- Next to
  - Outside
  - Inside
  - Separate from
132. A terminal bar installed for a transformer is required to be bonded in accordance with \_\_\_\_\_.
- 250.66
  - 450.12
  - 250.12
  - 250.122
133. If a dry type transformer has wire grounding and bonding leads, the leads can be connected using the methods described in \_\_\_\_\_.
- 250.12
  - 250.8
  - 450.12
  - 250.66
134. A transformer nameplate is required to display \_\_\_\_\_ different pieces of information.
- 6
  - 9
  - 7
  - 8
135. A transformers nameplate is required to indicate its impedance if \_\_\_\_\_ and over.
- 20 KVA
  - 25 KVA
  - 15 KVA
  - 10 KVA

**(NEW): 450.11 Marking. (B) Source Marking.** A transformer shall be permitted to be supplied at the marked secondary voltage, provided that the installation is in accordance with the manufacturer's instructions.

**(REVISION): 450.42 Walls, Roofs, and Floors.** The walls and roofs of vaults shall be constructed of materials that have approved structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with the earth shall be of concrete that is not less than 100 mm (4 in.) thick, but, where the vault is constructed with a vacant space or other stories below it, the floor shall have approved structural strength for the load imposed thereon and a minimum fire resistance of 3 hours. For the purposes of this section, studs and wallboard construction shall not be permitted.

**(REVISED): 450.42. (B) Sills.** A door sill or curb that is of an approved height that will confine the oil from the largest transformer within the vault shall be provided, and in no case shall the height be less than 100 mm (4 in.).

### Article 480 Storage Batteries.

#### Definitions:

**(NEW): Cell.** The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy.

**(NEW): Container.** A vessel that holds the plates, electrolyte, and other elements of a single unit in a battery.

**(NEW): Electrolyte.** The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.

**(NEW): Intercell Connector.** An electrically conductive bar or cable used to connect adjacent cells.

**(NEW): Intertier Connector.** An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.

**(NEW): Nominal Voltage (Battery or Cell).** The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation. The operating voltage of the cell or battery may vary above or below this value.

**(NEW): Terminal.** That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post).

**(NEW): 480.3 Battery and Cell Terminations. (A) Dissimilar Metals.** Where mating dissimilar metals, antioxidant material suitable for the battery connection shall be used.



## Part 2 Exam Questions:

136. A transformer can be supplied at the marked secondary voltage if installed by the \_\_\_\_\_ instructions.
- Engineers
  - Manufacturers
  - Architects
  - Electricians
137. The roof and walls of a transformer vault are required to be constructed of an \_\_\_\_\_ material.
- Fireproof
  - Identified
  - Approved
  - Engineered
138. What is the minimum allowable fire resistance rating of a transformer vaults wall and roof?
- 2 hours
  - 3 hours
  - 4 hours
  - No requirement
139. The floor of a transformer vault is required to be constructed of \_\_\_\_\_ if in contact with the earth.
- Brick
  - Cinder Block
  - Concrete
  - Asphalt
140. What is the minimum thickness of a transformer vaults floor if in direct contact with the earth?
- 2 inches
  - 3 inches
  - 6 inches
  - 4 inches
141. What is the minimum height of a transformer vaults door sill?
- 3 inches
  - 4 inches
  - 5 inches
  - 2 inches



142. A vessel that holds the plates, electrolyte, and other elements of a single unit in a battery is known as a?
- Intertier Connector
  - Cell
  - Intercellular Connector
  - Container
143. The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation would be defined as a?
- Cellulose
  - Intercellular Connector
  - Nominal Voltage (Battery or Cell)
  - Container
144. The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy is known as a?
- Cell
  - Intercellular Connector
  - Intertier Connector
  - Container
145. An electrically conductive bar or cable used to connect adjacent cells would be defined as a?
- Intertier Connector
  - Intercellular Connector
  - Intercell Connector
  - Container
146. The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell is known as a?
- Intercellular Connector
  - Electrolyte
  - Cell
  - Container
147. An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack would be defined as a?
- Cell
  - Intercellular Connector
  - Intertier Connector
  - Container
148. That part of a cell, container, or battery to which an external connection is made is known as a?
- Nominal Voltage (Battery or Cell)
  - Terminal
  - Intercellular Connector
  - Cell
149. Battery connections can be made using dissimilar metals so long as you use an \_\_\_\_\_ material suitable for the battery connection.
- Thermal
  - Conductive
  - Insulating
  - Antioxidant

**(NEW): 480.3 Battery and Cell Terminations. (B) Intercell and Intertier Conductors and Connections.** The ampacity of field-assembled intercell and intertier connectors and conductors shall be of such cross sectional area that the temperature rise under maximum load conditions and at maximum ambient temperature shall not exceed the safe operating temperature of the conductor insulation or of the material of the conductor supports.

**(NEW): 480.3 Battery and Cell Terminations. (C) Battery Terminals.** Electrical connections to the battery, and the cable(s) between cells on separate levels or racks, shall not put mechanical strain on the battery terminals. Terminal plates shall be used where practicable.

**(REVISED): 480.5 Overcurrent Protection for Prime Movers.** Overcurrent protection shall not be required for conductors from a battery with a nominal voltage of 50 volts or less if the battery provides power for starting, ignition, or control of prime movers. Section 300.3 shall not apply to these conductors.



**(REVISED):480.6 DC Disconnect Methods. (A) Disconnecting Means.** A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a nominal voltage over 50 volts. A disconnecting means shall be readily accessible and located within sight of the battery system.

**(REVISED): 480.6 DC Disconnect Methods. (D) Notification.** The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

- (1) Nominal battery voltage
- (2) Maximum available short-circuit current derived from the stationary battery system
- (3) Date the calculation was performed

**(REVISED): 480.7 Insulation of Batteries Not Over 250 Volts. (B) Vented Alkaline-Type Batteries.** Cells with covers sealed to containers of nonconductive, heat-resistant material shall require no additional insulation support. Cells in containers of conductive material shall be installed in trays of nonconductive material with not more than 20 cells (24 volts, nominal) in the series circuit in any one tray.

**(REVISED): 480.7 Insulation of Batteries Not Over 250 Volts. (C) Rubber Containers.** Cells in rubber or composition containers shall require no additional insulating support where the total nominal voltage of all cells in series does not exceed 150 volts. Where the total voltage exceeds 150 volts, batteries shall be sectionalized into groups of 150 volts or less, and each group shall have the individual cells installed in trays or on racks.

**(NEW): 480.8 Racks and Trays. (C) Accessibility.** The terminals of all cells or multi-cell units shall be readily accessible for readings, inspection, and cleaning where required by the equipment design. One side of transparent battery containers shall be readily accessible for inspection of the internal components.

## Part 2 Exam Questions:

150. The insulation of field-assembled intercell and intertier conductors must be able to withstand the maximum current under maximum \_\_\_\_\_.
- A. Ambient temperature
  - B. Load
  - C. Force
  - D. No requirement
151. True or False, terminal plates cannot be used for battery terminations.
- A. True
  - B. False
152. What is the minimum voltage for conductors that provide power for prime movers that do not need over current protection?
- A. 75 volts
  - B. 50 volts
  - C. 100 volts
  - D. 150 volts
153. A disconnect is required for the ungrounded conductors of a stationary battery system over \_\_\_\_\_ DC.
- A. 150 volts
  - B. 75 volts
  - C. 100 volts
  - D. 50 volts
154. A disconnect is required to be \_\_\_\_\_ for stationary DC battery systems.
- A. Accessible
  - B. Readily accessible
  - C. Guarded
  - D. No requirement
155. How many pieces of information does the 2014 code require a stationary DC battery system disconnect to have listed?
- A. 5
  - B. 2
  - C. 4
  - D. 3

156. True or False, battery cells with covers sealed to containers of nonconductive, heat-resistant material are required to have additional insulation and support.

- A. False
- B. True

157. What are the maximum number of cells allowed in containers with conductive material installed in the series circuit in any one tray of nonconductive material?

- A. 24
- B. 20
- C. 15
- D. 30

158. If cells are in rubber containers, they do not require additional support if the voltage does not exceed \_\_\_\_\_.

- A. 600
- B. 175
- C. 300
- D. 150

159. The terminals of multi-cell units are required to be \_\_\_\_\_.

- A. Labeled
- B. Accessible
- C. Readily accessible
- D. Identified

160. Transparent battery containers are required to have one side \_\_\_\_\_ for inspection of the internal components.

- A. Identified
- B. Accessible
- C. Labeled
- D. Readily accessible

**(NEW/REVISED): 480.9 Battery Locations. (C) Spaces About Battery Systems.** Spaces about battery systems shall comply with 110.27. Working space shall be measured from the edge of the battery cabinet, racks, or trays. For battery racks, there shall be a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance. Battery stands shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90 percent of its length.

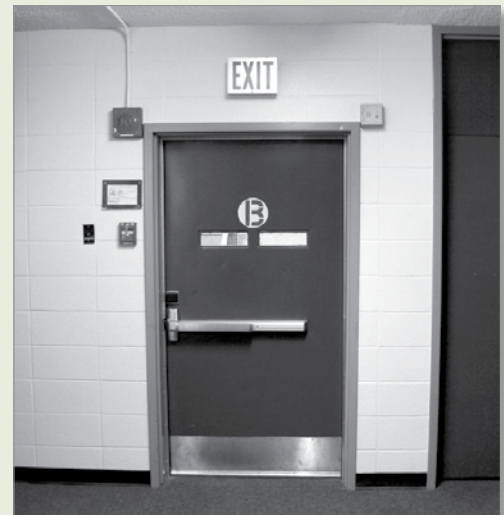
**(NEW): 480.9 Battery Locations. (D) Top Terminal Batteries.** Where top terminal batteries are installed on tiered racks, working space in accordance with the battery manufacturer's instructions shall be provided between the highest point on a cell and the row or ceiling above that point.

**(NEW): 480.9 Battery Locations. (E) Egress.** A personnel door(s) intended for entrance to, and egress from, rooms designated as battery rooms shall open in the direction of egress and shall be equipped with listed panic hardware.

**(NEW): 480.9 Battery Locations. (F) Piping in Battery Rooms.** Gas piping shall not be permitted in dedicated battery rooms.

**(NEW): 480.9 Battery Locations. (G) Illumination.** Illumination shall be provided for working spaces containing battery systems. The lighting outlets shall not be controlled by automatic means only. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source. The location of luminaires shall not:

- (1) Expose personnel to energized battery components while performing maintenance on the luminaires in the battery space; or
- (2) Create a hazard to the battery upon failure of the luminaire.



**(REVISED): 490.21 Circuit-Interrupting Devices. (B)(6) Fuseholders.** Fuseholders shall be designed or installed so that they are de-energized while a fuse is being replaced. A field-applied permanent and legible sign, in accordance with 110.21(B), shall be installed immediately adjacent to the fuseholders and shall be worded as follows:

DANGER — DISCONNECT CIRCUIT BEFORE REPLACING  
FUSES.

**(NEW/REVISED): 490.47 Switchgear Used as Service Equipment.** Switchgear installed as high-voltage service equipment shall include a ground bus for the connection of service cable shields and to facilitate the attachment of safety grounds for personnel protection. This bus shall be extended into the compartment where the service conductors are terminated. Where the compartment door or panel provides access to parts that can only be de-energized and visibly isolated by the serving utility, the warning sign required by 490.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.

## Part 2 Exam Questions:

161. What section of the 2014 code is referenced for the working space about battery systems?
- 480.24
  - 110.24
  - 110.27
  - 480.9
162. The working space about a battery system is required to be measured from the \_\_\_\_\_ of the battery cabinet.
- Edge
  - Center
  - Door
  - Battery storage area
163. What is the minimum clearance between a cell container and a wall on the side not requiring access for maintenance?
- No requirement
  - 2 inches
  - 6 inches
  - 1 inch
164. A battery stand can be in contact with an adjacent wall if the battery shelf has a free air space for not less than \_\_\_\_\_ percent of its length.
- 50
  - 90
  - 75
  - 100
165. The working space for \_\_\_\_\_ batteries is required to be measured from the highest point on a cell and the row or ceiling above that point.
- Top terminal
  - Side Terminal
  - Rechargeable
  - UPS system
166. A battery room door is required to have \_\_\_\_\_ panic hardware.
- UL 2365
  - Simple pressure
  - Fireproof
  - Listed
167. True or False, A  $\frac{3}{4}$ " natural gas pipe is allowed to pass through a dedicated battery room provided it is bonded to the battery rack or enclosure.
- False
  - True
168. The light installed in a dedicated battery room cannot be controlled by \_\_\_\_\_ means only.
- Motion sensing
  - Manual
  - Automatic
  - All listed answers

169. The 2014 code lists \_\_\_\_\_ specific locations where luminaires cannot be installed in a dedicated battery room.
- 3
  - 2
  - 4
  - 5
170. A fuse holder for systems over 1000 volts are designed to be \_\_\_\_\_ while the fuse is being replaced.
- Closed
  - De-energized
  - Open
  - Energized
171. What section of the 2014 code does a field applied warning sign need to comply with for fuses on systems operating over 1000 volts?
- 240.36
  - 110.21(A)
  - 490.7
  - 110.21(B)
172. High voltage service equipment is required to have a \_\_\_\_\_ that extends into the compartment where the service conductors are terminated.
- Ground bus
  - Current transformer
  - Grounded conductor
  - Grounding Conductor
173. Where is the warning sign required 490.35(A) to be posted?
- Switchyard Gate
  - Service disconnect
  - Compartment door
  - Substation Control room

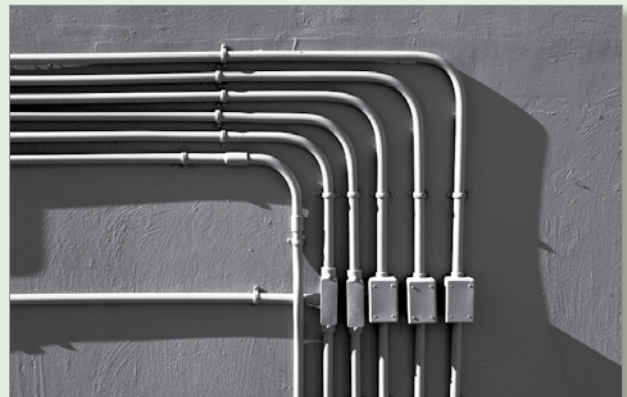
### Article 500.2. Definitions:

**(NEW): Combustible Dust.** Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-09, Standard Specification for Wire Cloth and Sieves for Testing Purposes) and present a fire or explosion hazard when dispersed and ignited in air.

**(REVISED): 501.15 Sealing and Drainage. (A)(4) Class I, Division 1 Boundary.** A conduit seal shall be required in each conduit run leaving a Division 1 location. The sealing fitting shall be permitted to be installed on either side of the boundary within 3.05 m (10 ft) of the boundary, and it shall be designed and installed to minimize the amount of gas or vapor within the portion of the conduit installed in the Division 1 location that can be communicated beyond the seal. The conduit run between the conduit seal and the point at which the conduit leaves the Division 1 location shall contain no union, coupling, box, or other fitting except for a listed explosion proof reducer installed at the conduit seal.

**(REVISED): 501.15 Sealing and Drainage. (A)(2) Pressurized Enclosures.** Conduit seals shall be installed within 450 mm (18 in.) of the enclosure in each conduit entry into a pressurized enclosure where the conduit is not pressurized as part of the protection system.

**(REVISED): 501.15 Sealing and Drainage. (C)(1) Fittings.** Enclosures that contain connections or equipment shall be provided with an integral sealing means, or sealing fittings listed for the location shall be used. Sealing fittings shall be listed for use with one or more specific compounds and shall be accessible.



**(REVISED): 501.15 Sealing and Drainage. (C)(2) Compound.** The compound shall provide a seal to minimize the passage of gas and/or vapors through the sealing fitting and shall not be affected by the surrounding atmosphere or liquids. The melting point of the compound shall not be less than 93°C (200°F).

**(REVISED): 501.15 Sealing and Drainage. (C)(3) Thickness of Compounds.** The thickness of the sealing compound installed in completed seals, other than listed cable sealing fittings, shall not be less than the metric designator (trade size) of the sealing fitting expressed in the units of measurement employed; however, in no case shall the thickness of the compound be less than 16 mm (5/8 in.).

**(REVISED): 501.15 Sealing and Drainage. (C)(6) Conductor or Optical Fiber Fill.** The cross-sectional area of the conductors or optical fiber tubes (metallic or nonmetallic) permitted in a seal shall not exceed 25 percent of the cross-sectional area of a rigid metal conduit of the same trade size unless the seal is specifically identified for a higher percentage of fill.

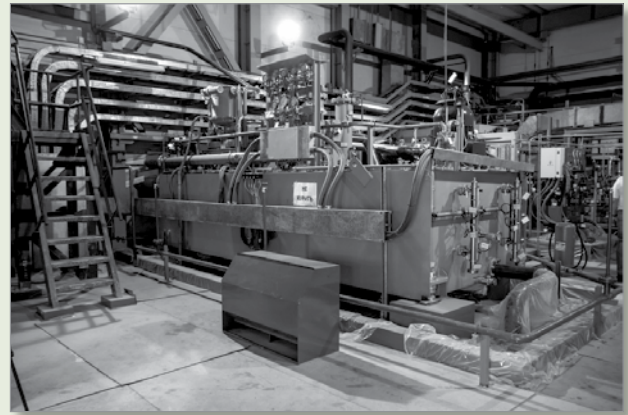
**(NEW): 504.30 Separation of Intrinsically Safe Conductors. (C) From Grounded Metal.** The clearance between the un-insulated parts of field wiring conductors connected to terminals and grounded metal or other conducting parts shall be at least 3 mm (0.125 in.).

**(REVISED): 505.2 Definitions. Informational Note No. 2:** Encapsulation is designated type of protection "ma" for use in Zone 0 locations. Encapsulation is designated type of protection "m" or "mb" for use in Zone 1 locations. Encapsulation is designated type of protection "mc" for use in Zone 2 locations.

**(NEW): 505.7 Special Precaution. (F) Available Short-Circuit Current for Type of Protection "e".** The available short-circuit current for electrical equipment using type of protection "e" for the field wiring connections in Zone 1 locations shall be limited to 10,000 rms symmetrical amperes to reduce the likelihood of ignition of a flammable atmosphere by an arc during a short-circuit event.

**(NEW): 505.17 Flexible Cords and Connections. (B) Instrumentation Connections for Zone 2.** To facilitate replacements, process control instruments shall be permitted to be connected through flexible cords, attachment plugs, and receptacles, provided that all of the following conditions apply:

- (1) A switch listed for Zone 2 is provided so that the attachment plug is not depended on to interrupt current, unless the circuit is type "ia," "ib," or "ic" protection, in which case the switch is not required.
- (2) The current does not exceed 3 amperes at 120 volts, nominal.
- (3) The power-supply cord does not exceed 900 mm (3 ft), is of a type listed for extra-hard usage or for hard usage if protected by location, and is supplied through an attachment plug and receptacle of the locking and grounding type.
- (4) Only necessary receptacles are provided.
- (5) The receptacle carries a label warning against unplugging under load.



## Part 2 Exam Questions:

- 174. What size particle is defined as combustible according to the 2014 code?**
- 500 microns
  - 500 millicrons
  - 300 microns
  - 400 millicrons
- 175. A conduit seal is required on any conduit leaving a \_\_\_\_\_ location.**
- Classified
  - Petrochemical
  - Division 1
  - All listed answers
- 176. If a conduit seal is required to be placed in any run, it is required to be placed within \_\_\_\_\_ feet of the boundary.**
- 15
  - 10
  - 20
  - 25
- 177. If a conduit is run from a pressurized panel in a division 1 location, What is the maximum distance a conduit seal can be placed from this panel?**
- 36 inches
  - 12 inches
  - 24 inches
  - 18 inches
- 178. A sealing fitting that contains sealing compound is required to be \_\_\_\_\_.**
- Zone rated
  - Readily accessible
  - Accessible
  - Watertight
- 179. What is the minimum melting point of sealing compound as required by the 2014 code?**
- 500°F
  - 300°F
  - 100°F
  - 200°F
- 180. What is the minimum thickness of sealing compound allowed by the 2014 code when sealing a conduit seal?**
- 7/8 inch
  - 3/8 inch
  - 1 inch
  - 5/8 inch
- 181. What is the maximum conductor fill allowed for a conduit seal?**
- 50%
  - 25%
  - 70%
  - 30%
- 182. What is the minimum distance intrinsically safe conductor terminations can be from grounded metal parts?**
- No requirement
  - 0.25 inches
  - 0.130 inches
  - 0.125 inches
- 183. What zone location can type "mc" encapsulation designator be used in?**
- 2
  - 1
  - 3
  - 4
- 184. The available short circuit current using type "e" protection is required to be limited to \_\_\_\_\_.**
- 10,000 rms
  - 20,000 rms
  - 5,000 rms
  - 12,000 rms
- 185. Process control instruments can be connected by attachment plugs provided they meet \_\_\_\_\_ listed provisions in the 2014 code.**
- 4
  - 6
  - 5
  - 3

**186. What is the maximum distance a power-supply cord can be when used to power a process control instrument?**

- A. No requirement
- B. 2 ft.
- C. 4 ft.
- D. 3 ft.

**187. A flexible cord can be used to power a process control instrument if the current does not exceed \_\_\_\_\_ amperes at 120 volts.**

- A. 6
- B. 4
- C. 5
- D. 3

### Article 516. Definitions:

**(NEW): Flash-Off Area.** An open or enclosed area after a spray application process where vapors are released due to exposure to ambient air or a heated atmosphere.

**(NEW): Limited Finishing Workstation.** An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3 of NFPA 33.

**(NEW): Resin Application Area.** Any area in which polyester resins or gel-coats are spray applied.

**(NEW): Spray Booth.** A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system.

**(NEW): Spray Room.** A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials.

**(NEW): Unenclosed Spray Area.** Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined.



### Article 517. Definitions:

**(REVISED): Life Safety Branch.** A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source.

**(REVISED): Patient Care Space.** Space within a health care facility wherein patients are intended to be examined or treated.

**(NEW): Basic Care Space.** Space in which failure of equipment or a system is not likely to cause injury to the patients or caregivers but may cause patient discomfort.

**(NEW): General Care Space.** Space in which failure of equipment or a system is likely to cause minor injury to patients or caregivers.

**(NEW): Critical Care Space.** Space in which failure of equipment or a system is likely to cause major injury or death to patients or caregivers.

**(NEW): Support Space.** Space in which failure of equipment or a system is not likely to have a physical impact on patients or caregivers.

**(REVISED): Patient Care Vicinity.** A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the patient bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor.



## Part 2 Exam Questions:

- 188. A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials would be defined as a?**
- Unenclosed Spray Area
  - Spray Room
  - Spray Booth
  - Limited Finishing Workstation
- 189. A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system is defined as a?**
- Enclosed Spray Area
  - Spray Room
  - Unenclosed Spray Area
  - Spray Booth
- 190. Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined would be a?**
- Spray Room
  - Unenclosed Spray Area
  - Enclosed Spray Area
  - Limited Finishing Workstation
- 191. An open or enclosed area after a spray application process where vapors are released due to exposure to ambient air or a heated atmosphere is defined as a?**
- Flash-Off Area
  - Spray Room
  - Enclosed Spray Area
  - Limited Finishing Workstation
- 192. Any area in which polyester resins or gel-coats are spray applied is known as a?**
- Spray Booth
  - Unenclosed Spray Area
  - Resin Application Area
  - Limited Finishing Workstation
- 193. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3 of NFPA 33 is defined as a?**
- Unenclosed Spray Area
  - Spray Room
  - Limited Finishing Workstation
  - Enclosed Spray Area
- 194. Space in which failure of equipment or a system is not likely to have a physical impact on patients or caregivers is defined as a?**
- Patient Care Space
  - Patient Care Vicinity
  - Critical Care Space
  - Support Space
- 195. Space in which failure of equipment or a system is likely to cause major injury or death to patients or caregivers would be defined as a?**
- Basic Care Space
  - Critical Care Space
  - Patient Care Space
  - Support Space
- 196. Space in which failure of equipment or a system is likely to cause minor injury to patients or caregivers is known as a?**
- Patient Care Space
  - Patient Care Vicinity
  - Critical Care Space
  - General Care Space
- 197. Space within a health care facility wherein patients are intended to be examined or treated.**
- Patient Care Vicinity
  - Support Space
  - Patient Care Space
  - Critical Care Space
- 198. A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source is defined as a?**
- Life Safety Critical Branch
  - Critical Safety Branch
  - Life Safety Branch
  - Dedicated Safety Branch

199. Space in which failure of equipment or a system is not likely to cause injury to the patients or caregivers but may cause patient discomfort is known as a?

- A. Support Space
- B. Basic Care Space
- C. Patient Care Vicinity
- D. Critical Care Space

200. A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the patient bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor would be defined as a?

- A. Patient Care Vicinity
- B. Support Space
- C. Basic Care Space
- D. Critical Care Space

**(REVISED): 517.18 General Care Areas. (B) Patient Bed Location Receptacles.** Each patient bed location shall be provided with a minimum of eight receptacles. They shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

**(REVISED): 517.19 Critical Care Areas. (B) Patient Bed Location Receptacles. (1) Minimum Number and Supply.** Each patient bed location shall be provided with a minimum of 14 receptacles, at least one of which shall be connected to either of the following:

- (1) The normal system branch circuit required in 517.19(A)
- (2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location

**(NEW): 517.19 Critical Care Areas. (C) Operating Room Receptacles. (1) Minimum Number and Supply.** Each operating room shall be provided with a minimum of 36 receptacles, at least 12 of which shall be connected to either of the following:

- (1) The normal system branch circuit required in 517.19(A)
- (2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

**(REVISED): 517.26 Application of Other Articles.** The life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

#### **Article 520.2. Definitions:**

**(NEW): Stage Equipment.** Equipment at any location on the premises integral to the stage production including, but not limited to, equipment for lighting, audio, special effects, rigging, motion control, projection, or video.

**(NEW): Stage Lighting Hoist.** A motorized lifting device that contains a mounting position for one or more luminaires, with wiring devices for connection of luminaires to branch circuits, circuits, and integral flexible cables to allow the luminaires to travel over the lifting range of the hoist while energized.



**(NEW): Stage Switchboard.** A switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used primarily to feed stage equipment.

**(NEW): 551.4 General Requirements. (C) Labels.** Labels required by Article 551 shall be made of etched, metal-stamped, or embossed brass; stainless steel; plastic laminates not less than 0.13 mm (0.005 in.) thick; or anodized or al clad aluminum not less than 0.5 mm (0.020 in.) thick or the equivalent.

**(NEW/REVISED): 600.21 Ballasts, Transformers, Electronic Power Supplies, and Class 2 Power Sources. (D) Working Space.** A working space at least 900 mm (3 ft) high × 900 mm (3 ft) wide × 900 mm (3 ft) deep shall be provided at each ballast, transformer, electronic power supply, and Class 2 power source or at its enclosure where not installed in a sign.

**(REVISED): 605.9 Freestanding-Type Office Furnishings, Cord- and Plug-Connected. (C) Receptacle Outlets, Maximum.** An individual office furnishing or groups of interconnected individual office furnishings shall not contain more than 13 15 ampere, 125-volt receptacle outlets.

**(REVISED): 625.18 Interlock.** Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector whenever the electrical connector is uncoupled from the electric vehicle. An interlock shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes. An interlock shall not be required for dc supplies less than 50 volts dc.

## Part 2 Exam Questions:

201. What is the minimum amount of general care receptacles required at each patient bed location?
- 2
  - 6
  - 4
  - 8
202. The receptacles installed at each patient bed location are required to be \_\_\_\_\_.
- Commercial grade
  - Hospital grade
  - Isolated
  - Double duplex
203. What is the minimum amount of critical care receptacles required at each patient bed location?
- 14
  - 8
  - 10
  - 6
204. What is the minimum amount of receptacles required in an operating room?
- 30
  - 14
  - 26
  - 36
205. How many critical branch circuit receptacles are required to be supplied by a different transfer switch in an operating room from the total amount required?
- 14
  - 12
  - 16
  - 18
206. The essential electrical system life safety branch circuit is required to meet the provisions of article \_\_\_\_\_.
- 800
  - 600
  - 250
  - 700
207. A motorized lifting device that contains a mounting position for one or more luminaires, with wiring devices for connection of luminaires to branch circuits, circuits, and integral flexible cables to allow the luminaires to travel over the lifting range of the hoist while energized is defined as a?
- Stage Switchboard
  - Stage Lighting Hoist
  - Stage boom
  - Proscenium

208. A switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used primarily to feed stage equipment is defined as a?
- Proscenium
  - Stage Lighting Hoist
  - Stage Panel Equipment
  - Stage Switchboard
209. Equipment at any location on the premises integral to the stage production including, but not limited to, equipment for lighting, audio, special effects, rigging, motion control, projection, or video is defined as?
- Stage Switchboard
  - Stage Lighting Hoist
  - Stage Equipment
  - Proscenium
210. What is the minimum thickness required by the 2014 code for aluminum recreational vehicle labels?
- 0.050 inches
  - 0.005 inches
  - 0.002 inches
  - 0.020 inches
211. What is the minimum working space width required by the 2014 code for a class 2 power source not installed in a sign?
- 3 ft.
  - 2 ft.
  - 4 ft.
  - 18 inches
212. What is the maximum number of interconnected 15 amp receptacle outlets allowed for office furnishing groups?
- 10
  - 15
  - 13
  - 5
213. Electric vehicle supply equipment is required to have a \_\_\_\_\_ that de-energizes the electric vehicle connector whenever the electrical connector is uncoupled from the vehicle.
- Disconnect
  - Interlock
  - Rectifier
  - Wheatstone bridge
214. Interlocks for electric vehicles are not required for DC supplies less than \_\_\_\_\_ volts.
- 50
  - 100
  - 150
  - 300

**(REVISED) 625.50 Location.** The electric vehicle supply equipment shall be located for direct electrical coupling of the EV connector (conductive or inductive) to the electric vehicle. Unless specifically listed and marked for the location, the coupling means of the electric vehicle supply equipment shall be stored or located at a height of not less than 450 mm (18 in.) above the floor level for indoor locations and 600 mm (24 in.) above the grade level for outdoor locations.

**(NEW): 645.27 Selective Coordination.** Critical operations data system(s) overcurrent protective devices shall be selectively coordinated with all supply-side overcurrent protective devices.

**(REVISED): 680.22 Lighting, Receptacles, and Equipment. (A) Receptacles. (1) Required Receptacle, Location.** Where a permanently installed pool is installed, no fewer than one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit shall be located not less than 1.83 m (6 ft) from, and not more than 6.0 m (20 ft) from, the inside wall of the pool. This receptacle shall be located not more than 2.0 m (6 ft 6 in.) above the floor, platform, or grade level serving the pool.

**(NEW): 680.22 Lighting, Receptacles, and Equipment. (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.

**(NEW/REVISED): 680.26 Equipotential Bonding. (C) Pool Water.** Where none of the bonded parts is in direct connection with the pool water, the pool water shall be in direct contact with an approved corrosion-resistant conductive surface that exposes not less than 5800 mm<sup>2</sup> (9 in.<sup>2</sup>) of surface area to the pool water at all times. The conductive surface shall be located where it is not exposed to physical damage or dislodgement during usual pool activities, and it shall be bonded in accordance with 680.26(B).

**(REVISED): 680.34 Receptacle Locations.** Receptacles shall not be located less than 1.83 m (6 ft) from the inside walls of a storable pool, storable spa, or storable hot tub. In determining these dimensions, the distance to be measured shall be the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

**(NEW): 690.9 Overcurrent Protection. (B) Overcurrent Device Ratings.** Overcurrent device ratings shall be not less than 125 percent of the maximum currents calculated in 690.8(A).

**(NEW): 690.12 Rapid Shutdown of PV Systems on Buildings.** PV system circuits installed on or in buildings shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(1) through (5) as follows.

- (1) Requirements for controlled conductors shall apply only to PV system conductors of more than 1.5 m (5 ft) in length inside a building, or more than 3 m (10 ft) from a PV array.
- (2) Controlled conductors shall be limited to not more than 30 volts and 240 volt-amperes within 10 seconds of rapid shutdown initiation.
- (3) Voltage and power shall be measured between any two conductors and between any conductor and ground.
- (4) The rapid shutdown initiation methods shall be labeled in accordance with 690.56(B).
- (5) Equipment that performs the rapid shutdown shall be listed and identified.



## Part 2 Exam Questions:

215. Electric vehicle supply equipment is required to be located not less than \_\_\_\_\_ inches above the floor for indoor installations.
- A. 12
  - B. 24
  - C. 18
  - D. 30
216. What is the minimum distance above the floor that electric vehicle supply equipment can be installed for outdoor installations?
- A. 24 inches
  - B. 18 inches
  - C. 30 inches
  - D. 20 inches
217. The overcurrent protective devices for a critical operations data system is required to be coordinated with all \_\_\_\_\_ overcurrent protective devices.
- A. Supply-side
  - B. Load side
  - C. Data
  - D. All listed answers
218. What is the minimum distance a receptacle can be installed from the inside wall of a permanently installed pool?
- A. 3 ft.
  - B. 4 ft.
  - C. 6 ft.
  - D. 5 ft.

219. What is the maximum height allowed from grade for a receptacle that serves a permanently installed pool?
- 36 in.
  - 6 ft.
  - 48 in.
  - 6 ft. 6 in.
220. A listed low voltage light not requiring grounding is allowed to be located less than \_\_\_\_\_ from the inside walls of the pool.
- 4 ft.
  - 6 ft.
  - 5 ft.
  - 8 ft.
221. Water in a pool is required to be bonded by a plate that is \_\_\_\_\_.
- 8x8 in.
  - 9 in.2
  - 5x5 in.
  - No such requirement
222. What is the minimum distance from the inside wall of a storable hot tub that a receptacle can be installed?
- 3 ft.
  - 5 ft.
  - 4 ft.
  - 6 ft.
223. A PV system overcurrent device cannot be less than \_\_\_\_\_ of the maximum currents calculated in 690.8(A).
- 150%
  - 100%
  - 125%
  - 225%
224. The 2014 code requires PV system circuits that are installed on \_\_\_\_\_ to have a rapid shutdown function.
- No requirement
  - Floating platforms
  - Arrays
  - Buildings
225. The labeling for a rapid PV system shutdown initiation is required to be done as described in \_\_\_\_\_.
- 690.56(B)
  - 110.24
  - 110.56
  - 690.65(B)

**(NEW): 690.15 Disconnection of Photovoltaic Equipment. (C) Direct-Current Combiner Disconnects.** The dc output of dc combiners mounted on roofs of dwellings or other buildings shall have a load break disconnecting means located in the combiner or within 1.8 m (6 ft) of the combiner. The disconnecting means shall be permitted to be remotely controlled but shall be manually operable locally when control power is not available.

**(NEW): 690.31 Methods Permitted. (C)(2) Cable Tray.** PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4.5 ft).

**(NEW): 690.81 Listing.** Products listed for PV systems shall be permitted to be used and installed in accordance with their listing. PV wire that is listed for direct burial at voltages above 600 volts, but not exceeding 2000 volts, shall be installed in accordance with Table 300.50, column 1.

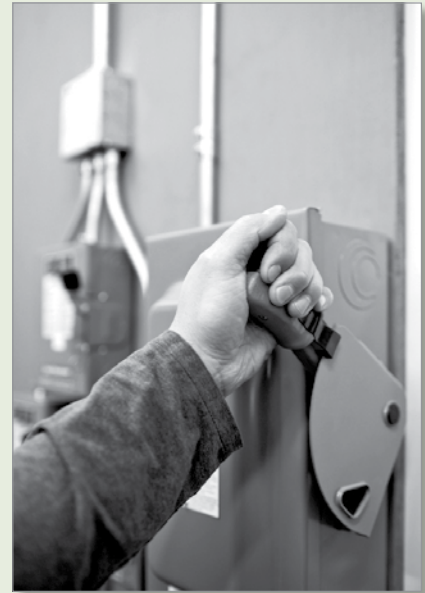
**(NEW): 700.8 Surge Protection.** A listed SPD shall be installed in or on all emergency systems switchboards and panelboards.

**(NEW): 700.19 Multiwire Branch Circuits.** The branch circuit serving emergency lighting and power circuits shall not be part of a multiwire branch circuit.

**(REVISED): 702.12 Outdoor Generator Sets. (B) Portable Generators 15 kW or Less.** Where a portable generator, rated 15 kW or less, is installed using a flanged inlet or other cord- and plug-type connection, a disconnecting means shall not be required where ungrounded conductors serve or pass through a building or structure.

**(NEW): 705.31 Location of Overcurrent Protection.** Overcurrent protection for electric power production source conductors, connected to the supply side of the service disconnecting means in accordance with 705.12(A), shall be located within 3m (10 ft) of the point where the electric power production source conductors are connected to the service.

**(NEW): 760.24 Mechanical Execution of Work. (B) Circuit Integrity (CI) Cable.** Circuit integrity (CI) cables shall be supported at a distance not exceeding 610 mm (24 in.). Where located within 2.1 m (7 ft) of the floor, as covered in 760.53(A)(1) and 760.130(1), as applicable, the cable shall be fastened in an approved manner at intervals of not more than 450 mm (18 in.). Cable supports and fasteners shall be steel.



**(NEW): 770.100 (A) Bonding Conductor or Grounding Electrode Conductor. (4) Length.** The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable not to exceed 6.0 m (20 ft) in length.

**(NEW): 770.110 Raceways and Cable Routing Assemblies for Optical Fiber Cables. (C)(1) Horizontal Support.** Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft), and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(NEW): 770.110 Raceways and Cable Routing Assemblies for Optical Fiber Cables. (C)(2) Horizontal Support. Vertical Support.** Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(REVISED): 800.44 Overhead (Aerial) Communications Wires and Cables. (A)(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to communications service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

**(NEW): 800.170 Equipment. (C) Plenum Grade Cable Ties.** Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

## Part 2 Exam Questions:

226. A DC combiners disconnect is required to be installed within \_\_\_\_\_ of the combiner.

- A. 6 ft.
- B. 7 ft.
- C. 8 ft.
- D. 10 ft.

227. Labeled PV single conductor cable installed in cable trays is required to be supported at \_\_\_\_\_ intervals.

- A. 24 inch
- B. 16 inch
- C. 12 inch
- D. 36 inch

228. What is the maximum distance single conductor PV cable installed in a cable tray is to be tied down and secured?
- 3 ft.
  - 4.5 ft.
  - 24 inches
  - 10 ft.
229. What table is required to be used for the installation of 600 to 2000 volt direct burial PV wire?
- 310.16
  - 315.2(B)
  - 310.15(2)(B)
  - 300.50
230. An SPD is required to be installed on all \_\_\_\_\_ panelboards.
- Emergency
  - 3 wire
  - Computer
  - Communication
231. True or False, emergency lighting branch circuits are required to be of the multiwire type.
- False
  - True
232. A disconnect is not required for a \_\_\_\_\_ or less generator that has a plug type connection and the ungrounded conductors serve or pass through a building.
- 30 kW
  - 24 kW
  - 48 kW
  - 15 kW
233. The supply side service disconnecting means overcurrent protection for power production conductors is required to be installed within \_\_\_\_\_ of where the electric power production source conductors are connected to the service.
- 12 ft.
  - 10 ft.
  - 15 ft.
  - 18 ft.
234. What is the maximum distance (CI) cables can be supported?
- 30 inches
  - 12 inches
  - 18 inches
  - 24 inches
235. Cable supports and fasteners used to install type (CI) cable are required to be \_\_\_\_\_.
- Plastic
  - Steel
  - Copper
  - Fiberglass
236. The grounding electrode conductor for an optical fiber cable in a residential dwelling can be no longer than \_\_\_\_\_.
- 10 ft.
  - 20 ft.
  - 15 ft.
  - 30 ft.
237. A fiber optic cable routing assembly is required to be supported horizontally every \_\_\_\_\_ feet.
- 3
  - 6
  - 10
  - 8
238. What is the maximum distance a fiber optic cable routing assembly can be supported vertically?
- 4
  - 6
  - 3
  - 8
239. Communications service drops are required to have a minimum separation from 600 volt service drops of \_\_\_\_\_ inches.
- 14
  - 12
  - 10
  - 8
240. A cable tie used to support communications conductors that pass through a plenum are required to be \_\_\_\_\_ for low smoke and heat release.
- All listed answers
  - Rated
  - Engineered
  - Listed