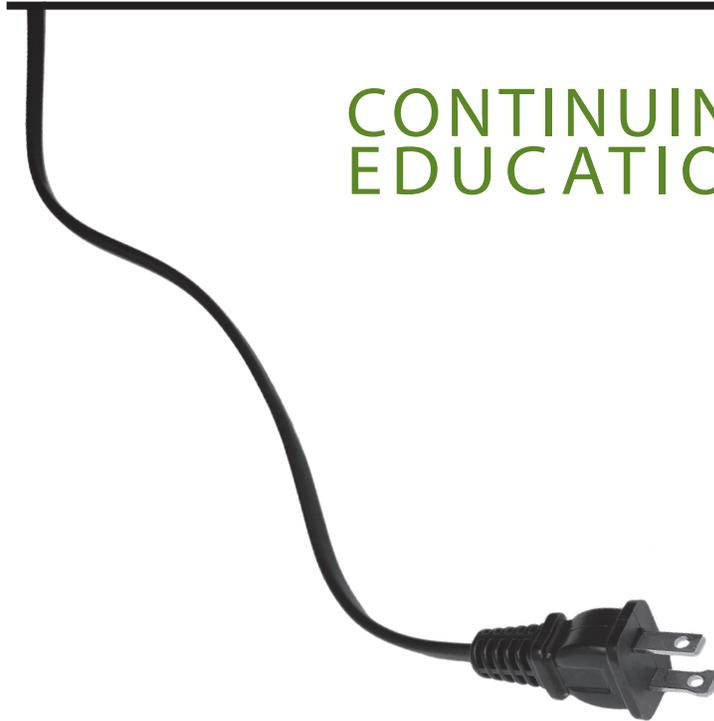




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2014 NEC Code Change
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DISCLAIMER NOTE: This course is APPROVED by the Alabama Board of Electrical Contractors for continuing education to renew your electrical license and is not intended to replace or supersede any state or local adopted codes.

2014 NEC Code Change

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

The 2014 code has added four new articles as listed below:

(NEW): Article 393. Low-Voltage Suspended Ceiling Power Distribution Systems: These systems are used as a support for a finished ceiling surface and contain a busbar and busbar support system to distribute power to utilization equipment supplied by a Class 2 power supply.

(NEW): Article 646. Modular Data Centers: These contain customizable equipment to provide data center operations that are not always permanently installed.

(NEW): Article 728. Fire-Resistive Cable Systems: These must be installed with very specific materials, requirements, and supports which are crucial for the survivability of life safety circuits.

(NEW): Article 750. Energy Management Systems: These systems provide general requirements and address the types of loads to be controlled through energy management.

(REVISED): 90(A) Practical Safeguarding. The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. This Code is not intended as a design specification or an instruction manual for untrained persons.



Article 100. Definitions:

(NEW): Adjustable Speed Drive. Power conversion equipment that provides a means of adjusting the speed of an electric motor.

Informational Notes

(NEW): Informational Note: A variable frequency drive is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency and voltage of the electrical power supplied to the motor.

(NEW): Adjustable Speed Drive System. A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment.

(NEW): Battery System. Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment.

Exam Questions:

- Energy management systems should have their systems installed as required by article _____ of the 2014 code.
 - 728
 - 750
 - 760
 - No listed answer
- A _____ is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency.
 - Variable frequency drive
 - Adjustable Speed Drive System
 - Variable speed Drive
 - Variable Speed Drive System

3. The NEC code _____ intended as a design instruction manual for untrained persons.
- Shall be
 - Is
 - Is not
 - No listed answer
4. A busbar and busbar support system used to distribute power utilization equipment supplied by a _____ power supply.
- All listed answers
 - Class 1
 - Class 3
 - Class 2
5. An interconnected battery subsystem consisting of one or more storage batteries and battery chargers would be defined as a _____.
- Capacitor bank
 - Battery system
 - Induction system
 - Hysteresis system
6. When using cable systems for the survivability of life safety circuits, article _____ should be used.
- 392
 - 393
 - 750
 - 728
7. Article _____ should be referenced when installing Low-Voltage Suspended Ceiling Power Distribution Systems.
- 646
 - 343
 - 393
 - 750
8. A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment is known as a _____.
- Variable speed Drive
 - Variable frequency drive
 - Adjustable Speed Drive System
 - Variable Speed Drive System
9. If you were installing electrical systems for a data center, article _____ should be referenced.
- 728
 - 646
 - 393
 - No listed answer
10. Power conversion equipment that provides a means of adjusting the speed of an electric motor is known as a _____.
- Variable Speed Drive System
 - Adjustable Speed Drive System
 - Variable speed Drive
 - Adjustable Speed Drive

(NEW): Cable Routing Assembly. A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2 and Class 3 cables, and power-limited fire alarm cables.

(NEW): Charge Controller. Equipment that controls dc voltage or dc current, or both, and that is used to charge a battery or other energy storage device.

(NEW): Communications Raceway. An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables, typically communications wires and cables and optical fiber and data (Class 2 and Class 3) in plenum, riser, and general-purpose applications.

(NEW): Control Circuit. The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current.



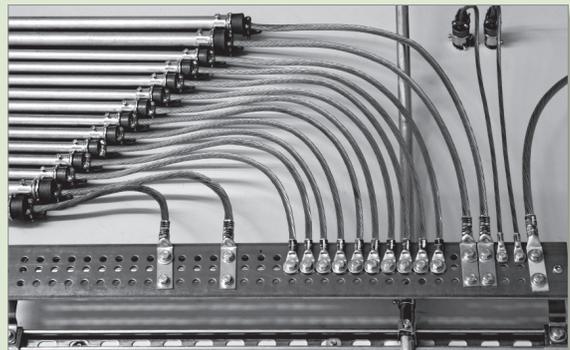
(REVISED): Coordination (Selective). Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.

(NEW): Effective Ground-Fault Current Path. An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors.

(NEW): Electric-Discharge Lighting. Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing.

(NEW): Electronically Actuated Fuse. An overcurrent protective device that generally consists of a control module that provides current-sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Such fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.

(MOVED TO ARTICLE 100): Ground-Fault Current Path: An electrically conductive path from the point of a ground fault on a wiring system through normally non–current-carrying conductors, equipment, or the earth to the electrical supply source.



Informational Notes

(NEW): Informational Note: Examples of ground-fault current paths are any combination of equipment grounding conductors, metallic raceways, metallic cable sheaths, electrical equipment, and

any other electrically conductive material such as metal, water, and gas piping; steel framing members; stucco mesh; metal ducting; reinforcing steel; shields of communications cables; and the earth itself.

Exam Questions:

11. A _____ controls an apparatus or system that carries electric signals directing the performance of a controller and does not carry main power current.
 - A. Signal Circuit
 - B. Rectifier Circuit
 - C. Control circuit
 - D. Relay Circuit
12. A type of fuse depending on the type of control selected may or may not operate in a current-limiting fashion.
 - A. Electronically Actuated Fuse
 - B. Edison Fuse
 - C. Fixed Trip Fuse
 - D. Adjustable Trip Fuse
13. A _____ is an enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables.
 - A. Communications Raceway
 - B. Din Rail Raceway
 - C. Panduit Raceway
 - D. ENT Raceway
14. A _____ is used to charge a battery or other energy storage device.
 - A. Battery pack
 - B. Charge Controller
 - C. Charge System
 - D. Rectifier Controller

15. The definition _____ could be described as the localization of an overcurrent condition to restrict outages to the circuit or equipment affected by the selection and installation of overcurrent protective devices and their ratings or settings.
- COPS
 - Selective Coordination
 - Darwinian Selection
 - Coordination Selective
16. A ground-fault current path could be a _____.
- Metal Duct
 - Metallic raceway
 - All Listed answers
 - Gas Pipe
17. An intentional low-impedance conductive path intended to carry current under ground-fault conditions from the point of a ground fault to the electrical supply source is best described as a?
- Ground Fault
 - Effective Ground-Fault Current Path
 - Grounded, Solidly
 - Solidly, Grounded
18. A structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment is known as a _____.
- All listed answers
 - Routing Assembly
 - Routing Cable Assembly
 - Cable Routing Assembly
19. A conductive path from the point of a ground fault through the normally non-current-carrying part of an electrical system to the electrical supply source is best described as a?
- Effective Ground-Fault Current Path
 - Ground-Fault Current Path
 - Ground Fault
 - Grounded, Solidly
20. Neon tubing is a type of _____.
- Resonance Gas Discharge Lighting (RGDL)
 - Inert Gas Discharge Lighting
 - Ion Discharge Lighting
 - Electric-Discharge Lighting

(NEW): Hermetic Refrigerant Motor-Compressor. A combination consisting of a compressor and motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, with the motor operating in the refrigerant.

(NEW): Industrial Control Panel: An assembly of two or more components consisting of one of the following: (1) power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers; (2) control circuit components only, such as push buttons, pilot lights, selector switches, timers, switches, and control relays; (3) a combination of power and control circuit components. These components, with associated wiring and terminals, are mounted on, or contained within, an enclosure or mounted on a subpanel. The industrial control panel does not include the controlled equipment.

(NEW): Lighting Track (Track Lighting): A manufactured assembly designed to support and energize luminaires that are capable of being readily repositioned on the track. Its length can be altered by the addition or subtraction of sections of track.

(NEW): Photovoltaic (PV) System: The total components and subsystem that, in combination, convert solar energy into electric energy suitable for connection to a utilization load.

(NEW): Retrofit Kit: A general term for a complete subassembly of parts and devices for field conversion of utilization equipment.

(REVISED): Separately Derived System: An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections.

(NEW): Substation: An enclosed assemblage of equipment (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics.

(NEW): Switchgear: An assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both.



Informational Notes

(NEW): Informational Note: All switchgear subject to NEC requirements is metal enclosed. Switchgear rated below 1000 V or less may be identified as “low-voltage power circuit breaker switchgear.” Switchgear rated over 1000 V may be identified as “metal-enclosed switchgear” or “metal-clad switchgear.” Switchgear is available in non-arc-resistant or arc-resistant constructions.

(REVISED): Part II contains definitions applicable only to the articles and parts of articles specifically covering installations and equipment operating at over 600 volts, nominal. The definitions in Part I are intended to apply wherever the terms are used throughout this Code. The definitions in Part II are applicable only to articles and parts of articles specifically covering installations and equipment operating at over 600 volts, nominal.

(REVISED): 110.21 Marking: (A) Manufacturer’s Markings: The manufacturer’s name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this Code. The marking or label shall be of sufficient durability to withstand the environment involved.

Exam Questions:

21. The general term used for a complete subassembly of parts and devices for field conversion of utilization equipment would be a _____.
 - A. Retro Kit
 - B. Retrofit Kit
 - C. Sub Assembly kit
 - D. Quality Assurance Kit
22. A descriptive marking by which an organization responsible for an electrical product is required to be identified on all electrical equipment is referenced in article _____ of the 2014 code.
 - A. 110.22 (A)
 - B. 110.21 (B)
 - C. 110.21 (C)
 - D. 110.21 (A)
23. True or False, An industrial control panel must include the controlled equipment or circuitry.
 - A. False
 - B. True
24. An example of a separately derived system could be a _____.
 - A. Photovoltaic System
 - B. Transformer
 - C. Generator
 - D. All listed answers
25. Luminaires that are capable of being readily repositioned on a track would be best defined as _____.
 - A. Lighting Rail
 - B. Light Rail
 - C. Lighting Track
 - D. Repositioning Fixtures

26. All switchgear subject to NEC requirements is _____ enclosed.
- Always
 - Metal
 - Partially
 - Never
27. A place through which electric energy is passed for the purpose of distribution and switching would be considered a _____.
- Switch Yard
 - MCC
 - Substation
 - Utility
28. Solar energy that is converted into electric energy for use in utilization loads is considered a _____.
- Fuel Cell System
 - Solar Cell System
 - Photovoltaic System
 - Energy Conversion System
29. Part II in Article 100, definitions, applies to equipment operating at _____.
- Under 600v
 - Over 600v
 - Under 575v
 - No listed answer
30. A compressor and motor housed together with the motor operating in the refrigerant would be best defined as a _____.
- Hermetic Motor
 - Hermetic Refrigerant Motor-Compressor
 - Hermetic Refrigerant Compressor
 - No listed answers
31. A completely enclosed assembly that contains primary power circuit switching, interrupting devices, or both with buses and connections would be considered _____.
- Gear
 - Switch Panels
 - Power Panels
 - Switchgear

(NEW): 110.21 Marking: (B) Field-Applied Hazard Markings: Where caution, warning, or danger signs or labels are required by this Code, the labels shall meet the following requirements:

- The marking shall adequately warn of the hazard using effective words and/or colors and/or symbols.

Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols, and location requirements for labels.

- The label shall be permanently affixed to the equipment or wiring method and shall not be hand written.

Exception to (2): Portions of labels or markings that are variable, or that could be subject to changes, shall be permitted to be hand written and shall be legible.

- The label shall be of sufficient durability to withstand the environment involved.

(NEW): 110.25 Lockable Disconnecting Means: Where a disconnecting means is required to be lockable open elsewhere in this Code, it shall be capable of being locked in the open position. The provisions for locking shall remain in place with or without the lock installed.

(NEW): 110.26 (E) (2) Outdoor. Outdoor installations shall comply with 110.26(E) (2)(a) and (b).

(a) Installation Requirements. Outdoor electrical equipment shall be installed in suitable enclosures and shall be protected from accidental contact by unauthorized personnel, or by vehicular traffic, or by accidental spillage or



Informational Notes

leakage from piping systems. The working clearance space shall include the zone described in 110.26(A). No architectural appurtenance or other equipment shall be located in this zone.

(b) **Dedicated Equipment Space.** The space equal to the width and depth of the equipment, and extending from grade to a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment foreign to the electrical installation shall be located in this zone.

Exception: Cord-and-plug connection locking provisions shall not be required to remain in place without the lock installed.



(New): 110.27 Guarding of Live Parts. (A) (4) Live Parts are required to be guarded against accidental contact by the elevation above the floor or other working surface as shown in (a) or (b) below:

- a. A minimum of 2.5 m (8 ft) for 50 to 300 volts
- b. A minimum of 2.6 m (8 1/2 ft) for 301 to 600 volts

(NEW/REVISED): 200.4 Neutral conductors shall be installed in accordance with 200.4(A) and (B).

(A) **Installation.** Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in this Code.

(B) **Multiple Circuits.** Where more than one neutral conductor associated with different circuits is in an enclosure, grounded circuit conductors of each circuit shall be identified or grouped to correspond with the ungrounded circuit conductor(s) by wire markers, cable ties, or similar means in at least one location within the enclosure.

Exception No. 1: The requirement for grouping or identifying shall not apply if the branch-circuit or feeder conductors enter from a cable or a raceway unique to the circuit that makes the grouping obvious.

Exception No. 2: The requirement for grouping or identifying shall not apply where branch-circuit conductors pass through a box or conduit body without a loop as described in 314.16(B)(1) or without a splice or termination.

(NEW): 210.5 (C) (2) Branch Circuits Supplied From Direct-Current Systems. Where a branch circuit is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.



(a) **Positive Polarity, Sizes 6 AWG or Smaller.** Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

- (1) A continuous red outer finish
- (2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

- (3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)
- (b) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:
- (1) A continuous black outer finish
 - (2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red
 - (3) Imprinted minus signs (-) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Exam Questions:

32. Outdoor electrical equipment is required to be installed and protected from accidental contact by _____.
- A. Piping systems
 - B. Vehicular traffic
 - C. Accidental spillage
 - D. All listed answers
33. If a branch circuit is supplied from a dc system operating at more than _____ volts, each ungrounded conductor is required to be identified by polarity.
- A. 24
 - B. 40
 - C. 50
 - D. 12
34. Live parts are required to be guarded against accidental contact for a 240 circuit to a minimum height of _____.
- A. 8 1/2'
 - B. 8'
 - C. 6'8"
 - D. 72"
35. True or False, at no time is a field applied equipment hazard label allowed to be hand written.
- A. True
 - B. False
36. A field applied warning label is required to be of sufficient durability to withstand the _____ involved.
- A. Temperature
 - B. Environment
 - C. Location
 - D. All listed answers
37. A hazard sign applied in the field located on a piece of equipment is required to use _____ to identify the hazard.
- A. Colors
 - B. Symbols
 - C. Words
 - D. All listed answers
38. True or False, DC systems operating at over 50 volts are not required to indicate polarity markings so long as they are phased.
- A. False
 - B. True
39. As a general rule, would it be acceptable or a violation of this code to have 1 neutral conductor for 2 multiwire branch circuit conductors.
- A. Violation
 - B. Acceptable
40. When multiple neutrals share the same enclosure, they are required to be _____ with their corresponding phase conductors.
- A. Listed
 - B. Grouped
 - C. Marked white with a black stripe
 - D. Marked the same
41. The 2014 code requires that from grade to a height of _____ above electrical equipment, it shall be dedicated for the electrical installation.
- A. 18"
 - B. 24"
 - C. 6'
 - D. 7'

42. If a conductor is 6 AWG and smaller serving a DC branch circuit, the negative conductor is required to be _____ in color or have a _____ continuous stripe down its entire length.
- Black, Red
 - Red, Black
 - Black, Black
 - Yellow, Red
43. If a conductor is 6 AWG and smaller serving a DC branch circuit, the positive conductor is required to be _____ in color or have a _____ continuous stripe down its entire length.
- Yellow, Gray
 - Blue, Yellow
 - Orange, Red
 - Red, Red
44. Live parts are required to be guarded against accidental contact for a 480 circuit to a minimum height of _____.
- 6' 8"
 - 8'
 - 8 1/2'
 - 72"
45. If more than one neutral conductor and its phase conductors share an enclosure with different circuits, the grounded circuit conductors of each circuit are required to be _____.
- White with a yellow stripe
 - Listed
 - Identified
 - All listed answers
46. What 2014 code section requires that where a disconnecting means is required to be lockable elsewhere in this Code, it shall be capable of being locked in the open position?
- 240.36 (B)
 - 110.24 (A)
 - 110.25
 - 100.25

(NEW): 210.8 (D) Kitchen Dishwasher Branch Circuit. The 2014 Code added this section to 210.8. GFCI protection shall be provided for outlets that supply dishwashers installed in dwelling unit locations.

(NEW): 210.12 Arc-Fault Circuit-Interrupter Protection. Arcfault circuit-interrupter protection shall be provided as required in 210.12(A) (B), and (C). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(ADDED 3 NEW METHODS): 210.12 Arc-Fault Circuit-Interrupter Protection (A)(1) Through (A)(6):

(A) Dwelling Units. All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by any of the means described in 210.12(A)(1) through (6):

- (1) A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.
- (2) A listed branch/feeder-type AFCI installed at the origin of the branch-circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
- (3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:



- a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
 - b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
 - c. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
- (4) A listed outlet branch-circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
- a. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
 - b. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
 - c. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
 - d. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination–type AFCI and shall be listed as such.
- (5) If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
- (6) Where a listed metal or nonmetallic conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(REVISED): 210.12 Arc-Fault Circuit-Interrupter Protection (C) Dormitory Units. All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets installed in dormitory unit bedrooms, living rooms, hallways, closets, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

(NEW): 210.13 Ground-Fault Protection of Equipment. Each branch-circuit disconnect rated 1000 A or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to phase, shall be provided with ground-fault protection of equipment in accordance with the provisions of 230.95.

(NEW): 210.17 Electric Vehicle Branch Circuit. An outlet(s) installed for the purpose of charging electric vehicles shall be supplied by a separate branch circuit. This circuit shall have no other outlets.

(NEW): 210.22 Permissible Loads, Individual Branch Circuits. An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.



Exam Questions:

47. If using MC cable encased in at least _____ of concrete, it can be used to feed the first AFCI receptacle and provide protection for the rest of the branch.
- 4"
 - 2"
 - 6"
 - 3"
48. An ARC fault circuit interrupter is required to be instated where it is?
- Accessible
 - Readily accessible
 - Convenient
 - No requirement
49. An individual Branch circuit load is not allowed to exceed the branch-circuit _____ rating.
- Voltage
 - Ampere
 - Wattage
 - All listed answers
50. True or false, only metal raceway systems and cables are allowed to protect an AFCI circuit to the first box from its breaker.
- True
 - False
51. What is the maximum length allowed by the 2014 code when using 12 AWG wire to the first outlet box from the breaker if installing an AFCI?
- 65
 - 50
 - 75
 - 70
52. True or False, the 2014 Code requires Laundry facilities to be Arc Fault protected.
- True
 - False
53. What is the maximum length in feet allowed by the 2014 code when using 14 AWG wire to the first outlet box from the breaker if installing an AFCI?
- 60
 - 70
 - 50
 - No limit
54. A branch-circuit disconnect rated 1000 A or more and installed on solidly grounded wye electrical system is required to have _____ of equipment.
- Ground-fault protection
 - Arc-Fault Circuit-Interrupter Protection
 - No protection required
 - Both A and B
55. An Electric Vehicle Branch Circuit is required to be _____.
- Dedicated
 - Isolated
 - Engineered
 - Submitted for plan review
56. AFCI protection is permitted to be provided in one of _____ ways or methods.
- 5
 - 6
 - 12
 - 8
57. If using a _____ system, the first outlet is allowed to protect the rest of the branch when using an AFCI outlet.
- Newly Installed
 - Assured Grounding
 - Equipment Grounding
 - Metal wireway
58. The 2014 Code requires all dish washer outlets to be.
- Water proof
 - AFCI protected
 - GFCI protected
 - Weather proof
59. The 2014 Code requires that _____ also are required to have AFCI protection installed in specific area.
- Warehouses
 - Hospitals
 - Dormitory's
 - All Listed answers
60. A listed _____ arc-fault circuit interrupter is to provide protection for the entire branch circuit.
- All listed answers
 - Rated
 - Engineered
 - Combination-type

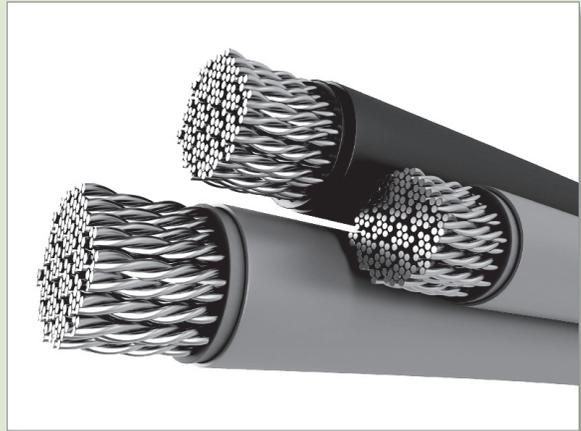
(NEW): 210.64 Electrical Service Areas. At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed within 15 m (50 ft) of the electrical service equipment.

(REVISED): 215.2 Minimum Rating and Size. (A) Feeders Not More Than 600 Volts.

(1) General. Feeder conductors shall have an ampacity not less than required to supply the load as calculated in Parts III, IV, and V of Article 220. Conductors shall be sized to carry not less than the larger of 215.2(A)(1)(a) or (b).

(a) Where a feeder supplies continuous loads or any combination of continuous and non-continuous loads, the minimum feeder conductor size shall have an allowable ampacity not less than the non-continuous load plus 125 percent of the continuous load.

(b) The minimum feeder conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.



(NEW): 215.12 Identification for Feeders (C)(2)(a) and (b).

(2) Feeders Supplied from Direct-Current Systems. Where a feeder is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

- (1) A continuous red outer finish
- (2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black
- (3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(b) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

- (1) A continuous black outer finish
- (2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red
- (3) Imprinted minus signs (-) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)



220.12 Lighting Load for Specified Occupancies. The 2014 has added an exception for calculating lighting loads based on energy codes.

(NEW): Exception: Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met:

- (1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.
- (2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code.
- (3) The demand factors specified in 220.42 are not applied to the general lighting load.

(NEW): 225.11 Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures. Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with the requirements of 230.52. Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with the requirements of 230.54.

(REVISED): 225.17 Masts as Supports (A) and (B). Only feeder or branch-circuit conductors specified within this section shall be permitted to be attached to the feeder and/or branch-circuit mast. Masts used for the support of final spans of feeders or branch circuits shall be installed in accordance with 225.17(A) and (B).

(A) Strength. The mast shall be of adequate strength or be supported by braces or guys to withstand safely the strain imposed by the overhead feeder or branch-circuit conductors. Hubs intended for use with a conduit that serves as a mast for support of feeder or branch-circuit conductors shall be identified for use with a mast.

(B) Attachment. Feeder and/or branch-circuit conductors shall not be attached to a mast between a weatherhead or the end of the conduit and a coupling where the coupling is located above the last point of securement to the building or other structure or is located above the building or other structure.



(REVISED): 225.36 Type. The disconnecting means specified in 225.31 shall be comprised of a circuit breaker, molded case switch, general-use switch, snap switch, or other approved means. Where applied in accordance with 250.32(B), Exception, the disconnecting means shall be suitable for use as service equipment. Section

225.31 simply states that a means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

Exam Questions:

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>61. How many conditions must be met by the 2014 code to use the article 220.12 exception?</p> <p>A. 5
B. 2
C. 3
D. 4</p> | <p>62. If installing overhead feeders that attach to a building, the 2014 code requires using _____.</p> <p>A. 225.12
B. 230.52
C. 230.54
D. 225.10</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|

63. Would using a snap switch to disconnect all ungrounded conductors be considered acceptable or a violation on this code for use with service equipment?
- A. Violation
 - B. Acceptable
64. Masts used for the support of final spans of feeders or branch circuits are required to be installed in accordance with _____.
- A. 225.17(A) and (B)
 - B. 225.11(A) and (B)
 - C. 225.15(A) and (B)
 - D. 225.11(B) and (C)
65. If a feeder is supplied from a dc system operating at more than _____ volts, each ungrounded conductor is required to be identified by polarity.
- A. 24
 - B. 40
 - C. 50
 - D. 12
66. A feeder _____ be attached to a mast between a weather head or the end of the conduit and a coupling where the coupling is located above the last point of securement to the building.
- A. Can
 - B. Shall
 - C. Shall not
 - D. Must
67. If a conductor is 6 AWG and smaller serving a DC feeder, the negative conductor is required to be _____ in color or have a _____ continuous stripe down its entire length.
- A. Black, Red
 - B. Red, Black
 - C. Black, Black
 - D. Yellow, Red
68. After all the adjustment correction factors for determining the minimum conductor feeder size have been done, the _____ feeder conductor size shall not be less than the maximum load to be served.
- A. The lesser
 - B. Maximum
 - C. Minimum
 - D. No listed answer
69. True or False, DC feeders operating at over 50 volts are required to indicate polarity markings so long as they are phase.
- A. True
 - B. False
70. If installing new feeders that exit the building you're in, the 2014 code requires the provisions of _____ be used.
- A. 225.12
 - B. 230.54
 - C. 225.10
 - D. 230.52
71. The minimum feeder conductor size is required to have an allowable ampacity not less than the non-continuous load plus _____ percent of the continuous load.
- A. 100
 - B. 125
 - C. 95
 - D. 115
72. If a conductor is 6 AWG and smaller serving a DC feeder, the positive conductor is required to be _____ in color or have a _____ continuous stripe down its entire length.
- A. Red, Red
 - B. Blue, Yellow
 - C. Orange, Red
 - D. Yellow, Gray
73. The 2014 code requires at least one receptacle to be installed within _____ of the electrical service equipment.
- A. No limit
 - B. 25 ft.
 - C. 15 ft.
 - D. 50 ft.
74. Hubs used with conduit that serves as a mast for support of feeder or branch-circuit conductors is required to be _____ for use with a mast.
- A. All listed answers
 - B. A single assembly
 - C. A listed assembly
 - D. Identified

(REVISED): 225.52 Disconnecting Means. (A) Location. A building or structure disconnecting means shall be located in accordance with 225.32, or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.

(REVISED): 225.56 Inspections and Tests. (A) Pre-Energization and Operating Tests. The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.



(REVISED): 230.6 (5) Conductors Considered Outside the Building. Where installed within rigid metal conduit (Type RMC) or intermediate metal conduit (Type IMC) used to accommodate the clearance requirements in 230.24 and routed directly through an eave but not a wall of a building.

(REVISED): 230.24 Clearances. Overhead service conductors shall not be readily accessible and shall comply with 230.24(A) through (E) for services not over 1000 volts, nominal.

(REVISED): 230.26 Point of Attachment. The point of attachment of the overhead service conductors to a building or other structure shall provide the minimum clearances as specified in 230.9 and 230.24. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

(REVISED): 230.28 Service Masts as Supports. Only power service drop or overhead service conductors shall be permitted to be attached to a service mast. Service masts used for the support of service-drop or overhead service conductors shall be installed in accordance with 230.28(A) and (B).

(A) Strength. The service mast shall be of adequate strength or be supported by braces or guys to withstand safely the strain imposed by the service-drop or overhead service conductors. Hubs intended for use with a conduit that serves as a service mast shall be identified for use with service-entrance equipment.

(B) Attachment. Service-drop or overhead service conductors shall not be attached to a service mast between a weatherhead or the end of the conduit and a coupling, where the coupling is located above the last point of securement to the building or other structure or is located above the building or other structure.

(NEW): 230.30 Installation (B) Wiring Methods. Underground service conductors shall be installed in accordance with the applicable requirements of this Code covering the type of wiring method used and shall be limited to the following methods:

- (1) Type RMC conduit
- (2) Type IMC conduit
- (3) Type NUCC conduit
- (4) Type HDPE conduit
- (5) Type PVC conduit
- (6) Type RTRC conduit
- (7) Type IGS cable
- (8) Type USE conductors or cables
- (9) Type MV or Type MC cable identified for direct burial applications
- (10) Type MI cable, where suitably protected against physical damage and corrosive conditions

Exam Questions:

75. Only power drop/overhead service conductors are allowed to be attached to the _____.
- Service mast
 - Service Pole
 - Eve
 - Guy wire
76. Overhead service conductors _____ be attached to a service mast between a weatherhead or the end of the conduit and coupling.
- Must
 - Will
 - Shall not
 - Will
77. A complete electrical system design, including settings for protective switching and control circuits is required to be prepared in advance and made available on request to the _____.
- Owner
 - GC
 - Building Codes Division
 - Authority having jurisdiction
78. What 2014 code section gives the installation requirements for installing service masts as supports?
- 230.26
 - 230.31
 - 230.28
 - 240.32
79. For industrial installations under single management, a disconnect is permitted to be electrically operated by a readily accessible, _____ device in a separate building or structure.
- Remote-control
 - Relay
 - Repeater
 - Solenoid
80. Would it be considered acceptable or a violation of this code to use Intermediate Metal Conduit as a raceway for service conductors if buried directly in the ground?
- Acceptable
 - Violation
81. How many requirements does the 2014 code require when installing service masts as supports.
- 4
 - 1
 - 3
 - 2
82. True or False, Service conductors are considered outside a building if installed in RMC and installed on the wall of a building.
- False
 - True
83. The point of attachment for overhead service conductors to a building shall be no less than _____ above finish grade.
- 10'
 - 12'
 - 15'
 - 25'
84. If a disconnect is not installed in a readily accessible location, then _____ must be provided making it operable from a readily accessible point.
- Electrical motors
 - Mechanical linkage
 - Servos
 - All listed answers
85. If using hubs and conduit when installing a service mast, the hubs are required to be identified for use with _____.
- Service Conductors
 - Service-entrance equipment
 - Service Raceway systems
 - All listed answers
86. Each disconnect and control circuit is required to be adjusted in accordance with the system design and tested by _____ using current injection.
- A soft start
 - Simulation
 - Actual operation
 - The program

87. Type _____ cable can be used as underground service conductors if protected against corrosive conditions and physical damage.

- A. MI
- B. MV
- C. MC
- D. All listed answers

88. Service conductors installed overhead are not required to be readily accessible if not operating over _____.

- A. 600
- B. 1000
- C. 300
- D. 240

(REVISED): 230.44 Cable Trays. The code requires cable trays with service entrance conductors to be identified with permanently affixed labels with the wording "Service-Entrance Conductors." The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

(REVISED): 230.82 Equipment Connected to the Supply Side of Service Disconnect. (3) Meter disconnect switches nominally rated not in excess of 1000 V that have a short-circuit current rating equal to or greater than the available short-circuit current, provided that all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250. A meter disconnect switch shall be capable of interrupting the load served. A meter disconnect shall be legibly field marked on its exterior in a manner suitable for the environment as follows:

METER DISCONNECT
NOT SERVICE EQUIPMENT

230.208 Protection Requirements. (B) Enclosed Overcurrent Devices. The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.

(REVISED): 230.212 Over 35,000 Volts. Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.

(REVISED): 240.1 Scope. Parts I through VII of this article provide the general requirements for overcurrent protection and overcurrent protective devices not more than 1000 volts, nominal. Part VIII covers overcurrent protection for those portions of supervised industrial installations operating at voltages of not more than 1000 volts, nominal. Part IX covers overcurrent protection over 1000 volts, nominal.

(REVISED): 240.87 Arc Energy Reduction. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.87(A) and (B) shall apply.

(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).

(B) Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:

- (1) Zone-selective interlocking
- (2) Differential relaying
- (3) Energy-reducing maintenance switching with local status indicator
- (4) Energy-reducing active arc flash mitigation system
- (5) An approved equivalent means

(NEW): 240.87 Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution



system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2012, Standard for Electrical Safety in the Workplace.

(REVISED): 250.10 Protection of Ground Clamps and Fittings. Ground clamps or other fittings exposed to physical damage shall be enclosed in metal, wood, or equivalent protective covering.

Exam Questions:

89. This article provides the general requirements for overcurrent protection and overcurrent devices not operating over 1000 volts.
- 250
 - 230
 - 225
 - 240
90. What is the maximum voltage rating of a meter disconnect switch that will comply with article 230.82?
- 300V
 - 600V
 - 1000V
 - 575V
91. The highest continuous current trip setting of _____ A or higher is specifically addressed in 240.87.
- 1200
 - 600
 - 800
 - 2000
92. A meter disconnect is required to be legibly field marked on its _____ in a manner suitable for the environment.
- Load Side
 - Interior
 - Exterior
 - Line Side
93. The 80 percent restriction rule does not apply for an enclosed overcurrent device with continuous loads operating at over _____.
- 600
 - 240
 - 1000
 - 575
94. The metal housing of a service enclosure is required to be grounded in accordance with Part _____ of article 250.
- V
 - VII
 - IV
 - III
95. What part of article 240 covers overcurrent protection for supervised industrial installations not operating at over 1000 volts?
- VII
 - XI
 - VIII
 - IV
96. A meter disconnect is required to be marked with the words _____.
- METER DISCONNECT NOT SERVICE EQUIPMENT
 - METER NOT SERVICE EQUIPMENT
 - METER DISCONNECT FOR SERVICE EQUIPMENT
 - METER DISCONNECT SERVICE EQUIPMENT
97. The metal housing of a service enclosure is required to be bonded in accordance with Part _____ of article 250.
- III
 - VII
 - IV
 - V
98. A ground clamp exposed to physical damage can be protected by a _____ encasement.
- Wood
 - Metal
 - All listed answers
 - Fiberglass

99. An _____ helps reduce arcing duration in an electrical distribution system.
- A. Energy active arc flash mitigation reducing system
 - B. Energy-reducing active arc flash mitigation system
 - C. Energy active arc flash mitigation system
 - D. Energy-reducing arc flash mitigation system
100. How many requirements does the 2014 code require with regards to arc energy reduction?
- A. 3
 - B. 7
 - C. 5
 - D. 2
101. What part of article 240 covers overcurrent protection for systems operating at over 1000 volts?
- A. XI
 - B. IX
 - C. V
 - D. IV

102. If installing cable tray Service-Entrance conductors labels on a cable tray system, the labels can be placed no further than _____ apart.
- A. 25 ft.
 - B. 15 ft.
 - C. 20 ft.
 - D. 10 ft.
103. If the voltage exceeds _____ volts between conductors and enter a building, they are required to terminate in a switchgear compartment or vault.
- A. 35,000
 - B. 1000
 - C. 600
 - D. 300

(REVISED): 250.21 Alternating-Current Systems of 50 Volts to 1000 Volts Not Required to Be Grounded (C) Marking. Ungrounded systems shall be legibly marked "Caution: Ungrounded System Operating — _____ Volts Between Conductors" at the source or first disconnecting means of the system. The marking shall be of sufficient durability to withstand the environment involved.

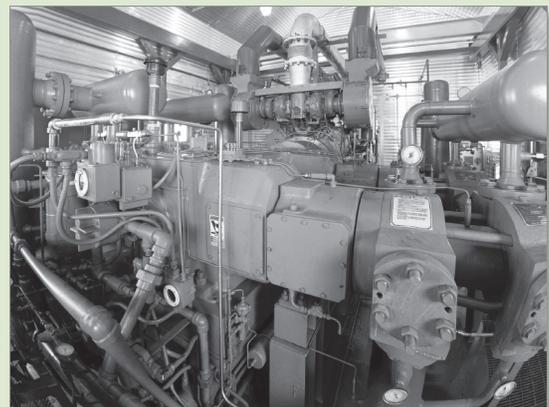
(REVISED): 250.24 Grounding Service-Supplied Alternating-Current Systems. (A)(1) General. The grounding electrode conductor connection shall be made at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to, including the terminal or bus to which the grounded service conductor is connected at the service disconnecting means.

(REVISED): 250.24 Grounding Service-Supplied Alternating-Current Systems. (C)(1) General. Sizing for a Single Raceway. The grounded conductor shall not be smaller than specified in Table 250.102(C)(1).

(REVISED): 250.24 Grounding Service-Supplied Alternating-Current Systems. (E) Ungrounded System Grounding Connections. A premises wiring system that is supplied by an ac service that is ungrounded shall have, at each service, a grounding electrode conductor connected to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be connected to a metal enclosure of the service conductors at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to the service disconnecting means.

(REVISED): 250.30 Grounding Separately Derived Alternating-Current Systems. In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20, 250.21, 250.22, or 250.26, as applicable. Multiple separately derived systems that are connected in parallel shall be installed in accordance with 250.30.

(REVISED): 250.36 High-Impedance Grounded Neutral Systems. (F) Grounding Electrode Conductor Connection Location. For services or separately derived systems, the grounding electrode conductor shall be connected



at any point from the grounded side of the grounding impedance to the equipment grounding connection at the service equipment or the first system disconnecting means of a separately derived system.

(REVISED): 250.62 Grounding Electrode Conductor Material. The grounding electrode conductor shall be of copper, aluminum, copper-clad aluminum, or the items as permitted in 250.68(C). The material selected shall be resistant to any corrosive condition existing at the installation or shall be protected against corrosion. Conductors of the wire type shall be solid or stranded, insulated, covered, or bare.

(REVISED): 250.64 Grounding Electrode Conductor Installation. (D) Building or Structure with Multiple Disconnecting Means in Separate Enclosures. For a service or feeder with two or more disconnecting means in separate enclosures supplying a building or structure, the grounding electrode connections shall be made in accordance with 250.64(D)(1), (D)(2), or (D)(3).

(REVISED): 250.64 Grounding Electrode Conductor Installation. (D)(1) Common Grounding Electrode Conductor and Taps. A common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded conductor(s) of each set of conductors that supplies the disconnecting means. If the service-entrance conductors connect directly to the overhead service conductors, service drop, underground service conductors, or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, note 1. A grounding electrode conductor tap shall extend to the inside of each disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance or feeder conductor serving the individual enclosure. The tap conductors shall be connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:



- (1) Exothermic welding.
- (2) Connectors listed as grounding and bonding equipment.
- (3) Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1/4 in. thick × 2 in. wide) and of sufficient length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. If aluminum busbars are used, the installation shall comply with 250.64(A).

Exam Questions:

104. A common grounding electrode conductor is required to be sized in accordance with _____.

- A. 250.52
- B. 250.122
- C. 250.66
- D. 250.64(D)

105. A grounding electrode conductor can be _____.

- A. All listed answers
- B. Solid
- C. Stranded
- D. Bare

106. Ungrounded systems are required to be legibly marked _____ at the source or first disconnecting means of the system.

- A. "Caution: Ungrounded System Operating — _____ Volts Per Conductor"
- B. "Caution: Ungrounded System With — _____ Volts Between Conductors"
- C. "Caution: System Operating — _____ Volts Between Conductors"
- D. "Caution: Ungrounded System Operating — _____ Volts Between Conductors"

- 107. How many approved ways does the 2014 code list when attaching a grounding electrode conductor tap?**
- 5
 - 2
 - 4
 - 3
- 108. The grounding electrode conductor is required to resist _____.**
- Faults
 - Theft
 - Lightning
 - Corrosion
- 109. An aluminum busbar used for multiple grounding electrode conductor taps is required to meet the requirements of _____.**
- 250.64(A)
 - 250.66
 - 250.122
 - 250.64(B)
- 110. The grounding electrode conductor is sized based on the sum of the _____ of the largest ungrounded conductor(s) of each set that supplies the disconnecting means.**
- Circular mil area
 - Lug size
 - Cross sectional area
 - Both A and C
- 111. What part of article 250 requires premises wiring systems that are supplied by an ac service and ungrounded to have a grounding electrode conductor at each service that is connected to the grounding electrode?**
- VI
 - IV
 - III
 - IX
- 112. A grounding electrode conductor tap is required to extend inside each _____ enclosure.**
- Service panel
 - Service
 - Sub panel
 - Disconnecting means
- 113. If you have multiple separately derived systems connected in parallel, they are required be installed in accordance with _____.**
- 450
 - 250.122
 - 250.40
 - 250.30
- 114. The 2014 code has _____ provisions when a grounding electrode connection for a service or feeder has two or more disconnecting means with separate enclosures.**
- 4
 - 2
 - 3
 - 1
- 115. A copper busbar used for multiple grounding electrode conductor taps must have a minimum width of _____.**
- 3/8 inch
 - 2 inches
 - 1 inch
 - 1 7/8 inches
- 116. What table is referenced in the 2014 with regards to the grounded conductor and its minimum size?**
- 250.122(C)(1)
 - 250.101(C)(1)
 - 250.102(C)(1)
 - 250.52(C)(1)
- 117. A _____ grounding electrode conductor is required to be connected between the grounded side of the grounding impedance and the equipment grounding connection at the service equipment.**
- Services
 - Separately derived systems
 - Industrial facilities
 - All listed answers
- 118. A common grounding electrode conductor that serves multiple taps is _____ by the 2014 Code.**
- A violation
 - Allowed
 - Required
 - Not allowed

119. A grounding electrode conductor connection is required to be made so it is _____.

- A. Accessible
- B. Readily accessible
- C. Exposed
- D. No requirement

120. An aluminum busbar used for multiple grounding electrode conductor taps must have a minimum thickness of _____.

- A. 1 inch
- B. 3/8 inch
- C. 1/4 inch
- D. 2 inches

(REVISED): 250.64 Grounding Electrode Conductor Installation. (D)(2) Individual Grounding Electrode Conductors. A grounding electrode conductor shall be connected between the grounding electrode system and one or more of the following, as applicable:

- (1) Grounded conductor in each service equipment disconnecting means enclosure
- (2) Equipment grounding conductor installed with the feeder
- (3) Supply-side bonding jumper

Each grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) supplying the individual disconnecting means.

(REVISED): 250.64 Grounding Electrode Conductor Installation. (D)(3) Common Location. A grounding electrode conductor shall be connected in a wireway or other accessible enclosure on the supply side of the disconnecting means to one or more of the following, as applicable:

- (1) Grounded service conductor(s)
- (2) Equipment grounding conductor installed with the feeder
- (3) Supply-side bonding jumper

(REVISED): 250.64 Grounding Electrode Conductor Installation.(E) Raceways and Enclosures for Grounding Electrode Conductors. (1) General. Ferrous metal raceways and enclosures for grounding electrode conductors shall be electrically continuous from the point of attachment to cabinets or equipment to the grounding electrode and shall be securely fastened to the ground clamp or fitting. Ferrous metal raceways and enclosures shall be bonded at each end of the raceway or enclosure to the grounding electrode or grounding electrode conductor. Nonferrous metal raceways and enclosures shall not be required to be electrically continuous.

(2) Methods. Bonding shall be in compliance with 250.92(B) and ensured by one of the methods in 250.92(B)(2) through (B)(4).

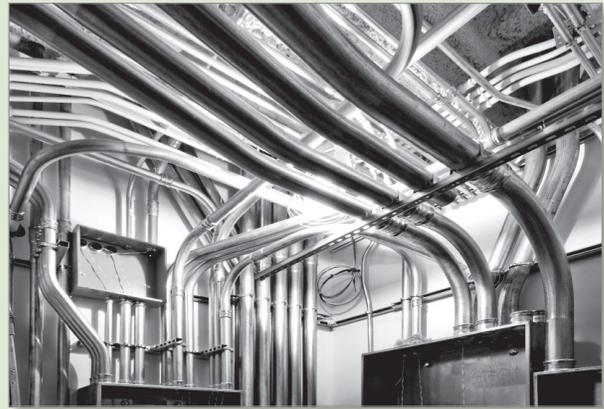
(3) Size. The bonding jumper for a grounding electrode conductor raceway or cable armor shall be the same size as, or larger than, the enclosed grounding electrode conductor.

(4) Wiring Methods. If a raceway is used as protection for a grounding electrode conductor, the installation shall comply with the requirements of the appropriate raceway article.

(5) Raceways. Raceways for grounding electrode conductors shall be electrically continuous from the point of attachment to cabinets or equipment to the grounding electrode and shall be securely fastened to the ground clamp or fitting. Raceways shall be bonded at each end of the raceway or enclosure to the grounding electrode or grounding electrode conductor.

(REVISED): 250.66 Size of Alternating-Current Grounding Electrode Conductor.

(A) Connections to a Rod, Pipe, or Plate Electrode(s). Where the grounding electrode conductor is connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as permitted in 250.52(A)(5) or (A)(7), that portion of the conductor that is the sole connection to the grounding electrode(s) shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire.



(B) Connections to Concrete-Encased Electrodes. Where the grounding electrode conductor is connected to a single or multiple concrete-encased electrode(s) as permitted in 250.52(A)(3), that portion of the conductor that is the sole connection to the grounding electrode(s) shall not be required to be larger than 4 AWG copper wire.

(REVISED): 250.68 Grounding Electrode Conductor and Bonding Jumper Connection to Grounding Electrodes.

(C) Grounding Electrode Connections. Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s):

(1) Interior metal water piping located not more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system.

Exception: In industrial, commercial, and institutional buildings or structures, if conditions of maintenance and supervision ensure that only qualified persons service the installation, interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted as a bonding conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor, if the entire length, other than short sections passing perpendicularly through walls, floors, or ceilings, of the interior metal water pipe that is being used for the conductor is exposed.

(2) The metal structural frame of a building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor.

(3) A concrete-encased electrode of either the conductor type, reinforcing rod or bar installed in accordance with 250.52(A)(3) extended from its location within the concrete to an accessible location above the concrete shall be permitted.



Exam Questions:

121. A grounding electrode conductor that is connected to a concrete-encased $\frac{1}{2}$ " diameter 20' long piece of rebar and the sole connection to the grounding electrode is not required to be larger than _____ AWG copper.
- 3
 - 6
 - 4
 - 2
122. _____ metal raceways and enclosures are required to be bonded at each end of the raceway or enclosure to the grounding electrode or grounding electrode conductor.
- Aluminum
 - Nonferrous
 - Nickel Clad
 - Ferrous
123. An individual grounding electrode conductor is required to be connected between the grounding electrode system and _____.
- Equipment grounding conductor installed with the feeder
 - Each service equipment disconnecting means enclosure
 - Supply-side bonding jumper
 - All listed answers
124. A grounding electrode conductor is required to be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) supplying an individual _____.
- Enclosure
 - Fuse
 - Disconnect
 - Gear section

125. A grounding electrode conductor is required to be connected in a wireway or other accessible enclosure on the supply side of the disconnecting means by _____.
 A. All listed answers
 B. Grounded service conductor(s)
 C. Supply-side bonding jumper
 D. Equipment grounding conductor installed with the feeder
126. In an industrial facility, the 250.68(C)(1) requirement can be ignored if they can ensure that only _____ service the installation.
 A. Supervisors
 B. Qualified persons
 C. Communication Techs
 D. No requirement
127. Within how many feet of entering a building does a metal water pipe have to be bonded?
 A. 7'
 B. 10'
 C. 5'
 D. 12"
128. The _____ of a building can be used to inter connect grounding electrodes.
 A. Mechanical system
 B. Metal structural frame
 C. Light poles
 D. All listed answers
129. _____ metal raceways and enclosures are not required to be electrically continuous.
 A. Ferrous
 B. Nonferrous
 C. Nickel Clad
 D. Aluminum
130. A grounding electrode conductor that is connected to a single ground rod and the sole connection to the grounding electrode is not required to be larger than _____ AWG copper.
 A. 2
 B. 4
 C. 3
 D. 6
131. The _____ for a grounding electrode conductor raceway or cable armor is required to be the same size as, or larger than, the enclosed grounding electrode conductor.
 A. Conductor
 B. Bonding jumper
 C. Area
 D. Cross section
132. True or False, there are no exceptions to 250.68(C)(1) with regards to bonding a water pipe within the specified footage.
 A. True
 B. False
133. Ferrous metal raceways used for grounding electrode conductors are required to be electrically continuous from the point of _____ to cabinets or equipment to the grounding electrode.
 A. Connection
 B. Attachment
 C. Service
 D. Utility

(NEW TABLE/REVISED): 250.102 Bonding Conductors and Jumpers. (C) Size — Supply-Side Bonding Jumper.

(1) Size for Supply Conductors in a Single Raceway or Cable. The supply-side bonding jumper shall not be smaller than specified in Table 250.102(C)(1).

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

*Informational
Notes*

(NEW): Informational Note: The term supply conductors includes ungrounded conductors that do not have overcurrent protection on their supply side and terminate at service equipment or the first disconnecting means of a separately derived system.

(NEW): Informational Note: See Chapter 9, Table 8, for the circular mil area of conductors 18 AWG through 4/0 AWG.

(REVISED): 250.104 Bonding of Piping Systems and Exposed Structural Metal. (B) Other Metal Piping. If installed in, or attached to, a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

- (1) Equipment grounding conductor for the circuit that is likely to energize the piping system
- (2) Service equipment enclosure
- (3) Grounded conductor at the service
- (4) Grounding electrode conductor, if of sufficient size
- (5) One or more grounding electrodes used



(REVISED): 250.112 Specific Equipment Fastened in Place (Fixed) or Connected by Permanent Wiring Methods.

The normally non-current-carrying metal parts of equipment and enclosures described in 250.112(L) and (M), are required to be connected to an equipment grounding conductor. 250.112(A) has added "Switchgear and Switchboard" to the article.

(A) Switchgear and Switchboard Frames and Structures. Switchgear or switchboard frames and structures supporting switching equipment, except frames of 2-wire dc switchgear or switchboards where effectively insulated from ground.

(REVISED): 250.119 Identification of Equipment Grounding Conductors. The 2014 code allows an equipment grounding conductor to be bare, covered, or insulated. Article 250.119 has added 2 new exceptions and an informational note.

(NEW): Exception No. 2: Flexible cords having an integral insulation and jacket without an equipment grounding conductor shall be permitted to have a continuous outer finish that is green.

*Informational
Notes*

(NEW): Informational Note: An example of a flexible cord with integral-type insulation is Type SPT-2, 2 conductor.

(NEW): Exception No. 3: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors where installed between the output terminations of traffic signal control and traffic signal indicating heads. Signaling circuits installed in accordance with this exception shall include an equipment grounding conductor in accordance with 250.118. Wire-type equipment grounding conductors shall be bare or have insulation or covering that is green with one or more yellow stripes.

(REVISED): 250.119 Identification of Equipment Grounding Conductors. (A) Conductors 4 AWG and Larger. Equipment grounding conductors 4 AWG and larger shall comply with 250.119(A)(1) and (A)(2).



(1) An insulated or covered conductor 4 AWG and larger shall be permitted, at the time of installation, to be permanently identified as an equipment grounding conductor at each end and at every point where the conductor is accessible. Exception: Conductors 4 AWG and larger shall not be required to be marked in conduit bodies that contain no splices or unused hubs.

250.121 Use of Equipment Grounding Conductors. An equipment grounding conductor shall not be used as a grounding electrode conductor.

(NEW): Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.

Exam Questions:

134. The 2014 code allows conductors with green insulation to be used as _____.
- Service Conductors
 - Phase conductors
 - Grounded conductors
 - Ungrounded signal conductors
135. Table 250.102(C)(1) indicates _____ different scenarios with regards to sizing the supply side bonding jumper.
- 2
 - 3
 - 4
 - 6
136. If using 250.119 exception 3, a traffic signal indicating head is required to have a?
- Green phase conductors
 - Grounded Conductor
 - Equipment grounding conductor
 - All listed answers
137. A single _____ can be run with parallel sets of phase conductors.
- Supply-side bonding jumper
 - Grounded conductor
 - Circuit
 - Both A and C
138. What chapter contains helpful tables to find the circular mil area of conductors up to 4/0?
- 10
 - 8
 - 9
 - 9 annex J
139. The switchgear frame for a DC 2 wire system is _____ to be connected to an equipment grounding conductor if insulated from ground.
- Required
 - Not Required
 - Sometimes required
 - Suggested
140. A wire-type equipment grounding conductor installed as per _____ and meeting the requirements of part II, III, and VI of article 250 can be used as both an equipment grounding conductor and a grounding electrode conductor.
- 250.122
 - 250.5(A)
 - 250.66
 - 250.6(A)
141. A Flexible cord that has an integral insulation and jacket without an equipment grounding conductor is allowed to have a continuous outer finish that is _____.
- Green
 - Gray
 - White
 - Orange
142. If an equipment grounding conductor _____ and larger is installed, it must be marked at each end and at every point where the conductor is accessible.
- 6 AWG
 - 4 AWG
 - 2 AWG
 - 8 AWG

143. True or False, an equipment grounding conductor 4 AWG and larger is required to be marked in conduit bodies that contain no splices or unused hubs.

- A. False
- B. True

144. An equipment grounding conductor _____ be used as a grounding electrode conductor under normal circumstances.

- A. May
- B. Shall
- C. Must
- D. Shall not

145. A type of flexible cord you would see with integral-type insulation is _____.

- A. USE, 2 conductor
- B. STP-2, 2 conductor
- C. SPT-2, 2 conductor
- D. All listed answers

146. A metal natural gas pipe installed in a 15 story building needs to be bonded to _____.

- A. The grounding electrode system
- B. The service equipment enclosure
- C. The grounding electrode conductor
- D. All listed answers

(REVISED): 250.122 Size of Equipment Grounding Conductors. (B) Increased in Size. Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors, where installed, shall be increased in size proportionately according to the circular mil area of the ungrounded conductors.

(REVISED): 250.146 Connecting Receptacle Grounding Terminal to Box. (B) Contact Devices or Yokes. Contact devices or yokes designed and listed as self-grounding shall be permitted in conjunction with the supporting screws to establish equipment bonding between the device yoke and flush-type boxes.

(REVISED): 250.166 Size of the Direct-Current Grounding Electrode Conductor. The size of the grounding electrode conductor for a dc system shall be as specified in 250.166(A) and (B), except as permitted by 250.166(C) through (E). The grounding electrode conductor for a dc system shall meet the sizing requirements in this section but shall not be required to be larger than 3/0 copper or 250 kcmil aluminum.

(NEW): 250.167 Direct-Current Ground-Fault Detection.

(A) Ungrounded Systems. Ground-fault detection systems shall be required for ungrounded systems.

(B) Grounded Systems. Ground-fault detection shall be permitted for grounded systems.

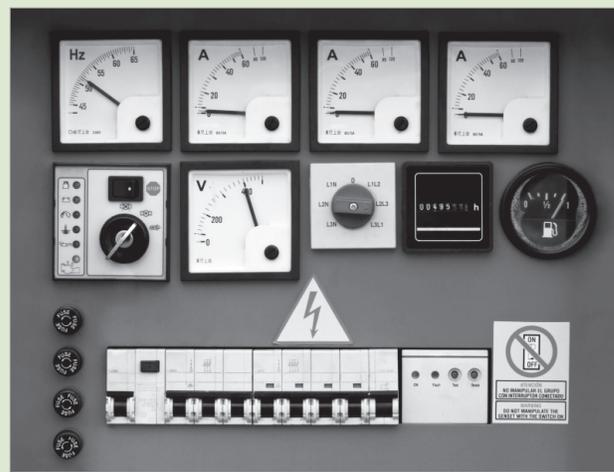
(C) Marking. Direct-current systems shall be legibly marked to indicate the grounding type at the dc source or the first disconnecting means of the system. The marking shall be of sufficient durability to withstand the environment involved.

(REVISED): 250.170 Instrument Transformer Circuits.

Secondary circuits of current and potential instrument transformers shall be grounded where the primary windings are connected to circuits of 300 volts or more to ground and, where installed on or in switchgear and on switchboards, shall be grounded irrespective of voltage.

(REVISED): 250.174 Cases of Instruments, Meters, and Relays Operating at 1000 Volts or Less. Instruments, meters, and relays operating with windings or working parts at 1000 volts or less shall be connected to the equipment grounding conductor as specified in 250.174(A), (B), or (C)

(A) Not on Switchgear or Switchboards. Instruments, meters, and relays not located on switchgear or switchboards operating with windings or working parts at 300 volts or more to ground, and accessible



to other than qualified persons, shall have the cases and other exposed metal parts connected to the equipment grounding conductor.

(B) On Switchgear or Dead-Front Switchboards. Instruments, meters, and relays (whether operated from current and potential transformers or connected directly in the circuit) on switchgear or switchboards having no live parts on the front of the panels shall have the cases connected to the equipment grounding conductor.

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (A) Systems with a Grounded Conductor at the Service Point. Where an ac system operating at over 1000 volts is grounded at any point and is provided with a grounded conductor at the service point, a grounded conductor(s) shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment.

(A) Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the grounded conductor(s) to the assembly common grounded conductor(s) terminal or bus. The assembly shall include a main bonding jumper for connecting the grounded conductor(s) to the assembly enclosure.

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (A) (1) Sizing for a Single Raceway or Overhead Conductor. The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service-entrance conductor(s). In addition, for sets of ungrounded service-entrance conductors larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor shall not be smaller than 12 1/2 percent of the circular mil area of the largest set of service-entrance ungrounded conductor(s).

Exam Questions:

147. AC systems operating at over _____ volts and are grounded at any point with a grounded conductor at the service point, a grounded conductor is also required to be installed and routed with the ungrounded conductors to each service disconnect.
- 600
 - 1000
 - 300
 - 50
148. If the size of phase conductors are increased from an existing service, the size of the equipment grounding conductor _____ proportionately to the circular mil area of the phase conductors.
- Must parallel
 - Remains the same
 - Must also increase
 - No listed answer
149. A single assembly used as service equipment operating at over 1000 volts containing 2 or more disconnects can connect the grounded conductor to a _____ terminal.
- All listed answers
 - Equipment
 - Isolated
 - Common
150. Instrument transformers are required to be grounded where the primary windings are connected to circuits of _____ volts or more to ground.
- 240
 - 50
 - 300
 - 100

151. To size the grounding electrode conductor for a _____ system, 250.166(A) and (B) Shall be used.
- Capacitive
 - AC
 - Induction
 - DC
152. The case of a meter on the dead-front of a panel with no exposed live parts _____ to be connected to the equipment grounding conductor.
- Is required
 - Is not required
 - No such requirement
 - Is suggested, but optional
153. An ungrounded DC system is required to have _____.
- Current detectors
 - Ground-fault detection
 - Ground Spike monitors
 - Voltage regulators
154. Yokes listed as _____ shall be permitted in conjunction with the supporting screws to establish equipment bonding between the device yoke.
- Grounded
 - Isolated
 - Self-grounding
 - Grounding
155. True or False, ground-fault detection systems are required to be installed on grounded DC systems.
- True
 - False
156. If you were to install sets of ungrounded service-entrance conductors larger than 1100 kcmil copper, you would be required to size the grounded conductor no less than _____ percent of the service conductors.
- 25
 - 12 ½
 - 15
 - 18
157. Direct-current systems are required to be marked to indicate the grounding type at the dc _____.
- Source
 - All listed answers
 - First disconnect
 - System Origination
158. Article 250.174 deals with the cases of Instruments, meters, and relays operating at _____ Volts or Less.
- 50
 - 600
 - 300
 - 1000
159. What table is used in the 2014 code to size the grounding electrode conductor for systems over 1000 volts,
- 250.102 (C)(1)
 - 250.122
 - 250.66
 - 250.185(C)
160. The case of an instrument not located in the switchgear of an industrial facility with exposed metal parts is required to be connected to the equipment grounding conductor if operating at over _____ volts to ground.
- 50
 - 1000
 - 600
 - 300
161. In systems over 1000 volts, a _____ is required to connect the grounded conductor(s) to each service disconnecting means enclosure.
- Current transformer
 - Main bonding jumper
 - Grounding Conductor
 - Grounding electrode conductor
162. The grounding electrode conductor _____ be required to be larger than the largest ungrounded service-entrance conductor.
- Shall not
 - Shall
 - Must
 - Is to
163. What is the maximum size according to the 2014 code that a copper grounding electrode conductor for a direct current system has to be?
- 1/0
 - 2/0
 - 250
 - 3/0

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (A)(2) Parallel Conductors in Two or More Raceways or Overhead Conductors. If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (A)(3) & (4) Delta-Connected Service. The grounded conductor of a 3-phase, 3-wire delta service shall have an ampacity not less than that of the ungrounded conductors. Impedance Grounded Neutral Systems. Impedance grounded neutral systems shall be installed in accordance with 250.187.

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (B) Systems without a Grounded Conductor at the Service Point. Where an ac system operating at greater than 1000 volts is grounded at any point and is not provided with a grounded conductor at the service point, a supply-side bonding jumper shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The supply-side bonding jumper shall be installed in accordance with 250.186(B)(1) through (B)(3).

Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the supply-side bonding jumper to the assembly common equipment grounding terminal or bus.

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (B) (1) Sizing for a Single Raceway or Overhead Conductor. The supply-side bonding jumper shall not be smaller than the required grounding electrode conductor specified in Table 250.66 but shall not be required to be larger than the largest ungrounded service-entrance conductor(s). In addition, for sets of ungrounded service-entrance conductors larger than 1100 kcmil copper or 1750 kcmil aluminum, the supply-side bonding jumper shall not be smaller than 121/2 percent of the circular mil area of the largest set of service-entrance ungrounded conductor(s).

(NEW): 250.186 Ground-Fault Circuit Conductor Brought to Service Equipment. (B) (2) Parallel Conductors in Two or More Raceways or Overhead Conductors. If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the supply-side bonding jumper shall also be installed in parallel. The size of the supply-side bonding jumper in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(REVISED): 250.188 Grounding of Systems Supplying Portable or Mobile Equipment. (D) Ground-Fault Detection and Relaying. Ground-fault detection and relaying shall be provided to automatically de-energize any component of a system over 1000 volts that has developed a ground fault. The continuity of the equipment grounding conductor shall be continuously monitored so as to automatically de-energize the circuit of the system over 1000 volts to the portable or mobile equipment upon loss of continuity of the equipment grounding conductor.



Exam Questions:

164. What is the minimum size supply-side bonding jumper allowed by the 2014 code for systems operating over 1000 volts.
- 1/0
 - 2/0
 - 3/0
 - 4/0
165. On parallel systems operating over 1000 volts, the size of the grounded conductor shall be based on the total _____ of the parallel ungrounded conductors.
- All listed answers
 - Length
 - Total diameter
 - Circular mil area
166. What is the minimum size grounded conductor allowed by the 2014 code for systems operating over 1000 volts.
- 3/0
 - 2/0
 - 1/0
 - 4/0
167. What table is used in the 2014 code to size the supply-side bonding jumper for systems over 1000 volts,
- 250.185(C)
 - 250.122
 - 250.102 (C)(1)
 - 250.66
168. For systems operating at over 1000 volts, the grounded conductor of a 3-phase, 3-wire _____ system is required to have the same ampacity as the ungrounded conductors.
- Grounded
 - Wye
 - Delta
 - Ungrounded
169. A _____ is required to be installed and routed with all ungrounded conductors to each service disconnecting means on systems operating over 1000 volts if a grounded conductor is not supplied.
- High leg
 - Grounded conductor
 - Grounding Conductor
 - Supply-side bonding jumper
170. The 2014 code lists _____ provisions for systems operating over 1000 volts that require a supply-side bonding jumper.
- 3
 - 2
 - 4
 - 5
171. If you were to install sets of ungrounded service-entrance conductors larger than 1100 kcmil copper, you would be required to size the supply-side bonding jumper no less than _____ percent of the service conductors.
- 18
 - 25
 - 15
 - 12 ½
172. For systems over 1000 volts with ground fault detectors, the continuity of the _____ shall be continuously monitored.
- Grounding conductor
 - Grounded conductor
 - Equipment grounding conductor
 - Bond jumper
173. A single assembly used as service equipment operating at over 1000 volts containing 2 or more disconnects can connect the supply-side bonding to a _____ terminal.
- All listed answers
 - Dedicated
 - Isolated
 - Common
174. If installing 3 parallel runs of 2000 kcmil overhead with an operating voltage of 4160, the 2014 code requires the _____ to also be paralleled.
- Grounding conductor
 - Grounded conductor
 - Equipment grounding conductor
 - Bond
175. A 4160 impedance grounded neutral system is required to be installed as per the requirements of _____.
- 250.187
 - 250.186
 - 250.174
 - 250.66

176. The supply-side bonding jumper _____ be required to be larger than the largest ungrounded service-entrance conductor.
- Shall
 - Shall not
 - Must
 - Is to
177. If installing 3 parallel runs of 2200 kcmil overhead with an operating voltage of 4160, the 2014 code requires the _____ to also be paralleled.
- Grounding conductor
 - Supply-side bonding jumper
 - Equipment grounding conductor
 - Bond
178. On parallel systems operating over 1000 volts, the size of the supply-side bonding jumper shall be based on the total _____ of the parallel ungrounded conductors.
- Length
 - Circular mil area
 - Total diameter
 - All listed answers
179. Ground-fault detectors and relaying _____ be provided to automatically de-energize any component of a system over 1000 volts that has developed a ground fault.
- Shall
 - Shall not
 - Will
 - May

(NEW): 250.194 Grounding and Bonding of Fences and Other Metal Structures. Metallic fences enclosing, and other metal structures in or surrounding, a substation with exposed electrical conductors and equipment shall be grounded and bonded to limit step, touch, and transfer voltages.

(NEW): 250.194 Grounding and Bonding of Fences and Other Metal Structures. (A) Metal Fences. Where metal fences are located within 5 m (16 ft) of the exposed electrical conductors or equipment, the fence shall be bonded to the grounding electrode system with wire-type bonding jumpers as follows:

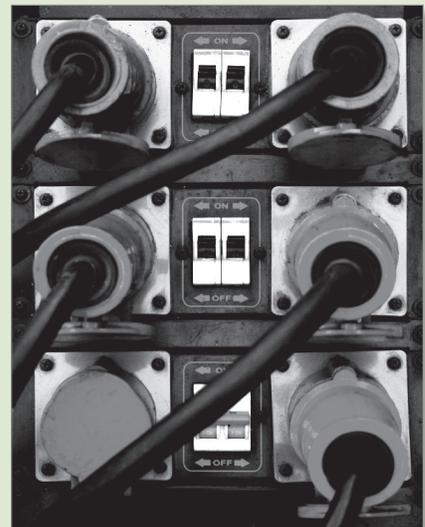
- Bonding jumpers shall be installed at each fence corner and at maximum 50 m (160 ft) intervals along the fence.
- Where bare overhead conductors cross the fence, bonding jumpers shall be installed on each side of the crossing.
- Gates shall be bonded to the gate support post, and each gate support post shall be bonded to the grounding electrode system.
- Any gate or other opening in the fence shall be bonded across the opening by a buried bonding jumper.
- The grounding grid or grounding electrode systems shall be extended to cover the swing of all gates.
- The barbed wire strands above the fence shall be bonded to the grounding electrode system. Alternate designs performed under engineering supervision shall be permitted for grounding or bonding of metal fences.

(NEW): 250.194 Grounding and Bonding of Fences and Other Metal Structures. (B) Metal Structures. All exposed conductive metal structures, including guy wires within 2.5 m (8 ft) vertically or 5 m (16 ft) horizontally of exposed conductors or equipment and subject to contact by persons, shall be bonded to the grounding electrode systems in the area.

(REVISED): 285.1 Scope. This article covers general requirements, installation requirements, and connection requirements for surge-protective devices (SPDs) permanently installed on premises wiring systems of 1000 volts or less.

(REVISED): 285.4 Number Required. Where used at a point on a circuit, the SPD shall be connected to each ungrounded conductor.

(NEW): 285.13 Type 4 and Other Component Type SPDs. Type 4 component assemblies and other component type SPDs shall only be installed by the equipment manufacturer.



(REVISED): 285.25 Type 3 SPDs. Type 3 SPDs shall be permitted to be installed on the load side of branch-circuit overcurrent protection up to the equipment served. If included in the manufacturer's instructions, the Type 3 SPD connection shall be a minimum 10 m (30 ft) of conductor distance from the service or separately derived system disconnect.

(REVISED): 300.2 Limitations. (C) Conductors of Different Systems. (1) 1000 Volts, Nominal, or Less. Conductors of ac and dc circuits, rated 1000 volts, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway. Secondary wiring to electric-discharge lamps of 1000 volts or less, if insulated for the secondary voltage involved, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

(REVISED): 300.5 Underground Installations. (C) Underground Cables and Conductors under Buildings. Underground cable and conductors installed under a building shall be in a raceway.

Exam Questions:

180. If bare overhead conductors cross the fence of a substation within the specified distance, _____ are required to be installed on each side of the crossing.
- Insulators
 - Warning signs
 - Caution signs
 - Bonding jumpers
181. True or False, the barbed wire strands above the fence of a substation are required to be bonded to the grounding electrode system.
- False
 - True
182. The secondary wiring to electric-discharge lamps of 1000 volts or less, and insulated for the secondary voltage involved, _____ be permitted to occupy the same luminaire.
- No such provision
 - Shall not
 - Must
 - Shall
183. All exposed conductive metal structures within _____ vertically of exposed conductors operating at over 1000 volts subject to contact by people is required to be bonded to the grounding electrode system.
- 10 ft.
 - 16 ft.
 - 12 ft.
 - 8 ft.
184. All exposed conductive metal structures within _____ horizontally of exposed conductors operating at over 1000 volts subject to contact by people is required to be bonded to the grounding electrode system.
- 8 ft.
 - 16 ft.
 - 12 ft.
 - 10 ft.
185. What is the maximum interval allowed by the 2014 code when bonding a substations metal fence.
- 50 ft.
 - 150 ft.
 - 100 ft.
 - 160 ft.
186. Article 285 covers _____.
- Surge-protective devices
 - Surge-arrestor devices
 - Standard-protective devices
 - Surge-personnel devices
187. An SPD is required to be connected to the _____ when used at a point on a circuit.
- Grounded conductor
 - Ungrounded conductor
 - Grounding conductor
 - Equipment grounding conductor

188. A type _____ can be installed on the load side of branch-circuit overcurrent protection up to the equipment served.
- 2 SPD
 - 4 SPD
 - 1 SPD
 - 3 SPD
189. What is the maximum voltage covered in article 285?
- No maximum voltage listed
 - 600 Volts
 - 300 volts
 - 1000 volts
190. The metal fence surrounding a substation is required to be bonded to limit _____.
- Step voltages
 - Transfer voltages
 - Touch voltages
 - All listed answers
191. Substation fence posts are _____ to be bonded to the grounding electrode system.
- Not
 - Prohibited
 - Required
 - No listed answers
192. A type 4 SPD can only be installed by the _____.
- Equipment manufacturer
 - Electrician
 - Maintenance personnel
 - Qualified individual
193. True or False, can AC and DC systems of 1000 volts occupy the same raceway?
- True
 - False
194. In most cases, conductors run under a building are required to be in _____.
- A vault
 - Concrete
 - A raceway
 - All listed answers
195. If a substations metal fence is located within _____ of the exposed electrical conductors, the fence is required to be bonded to the grounding electrode system with wire-type bonding jumpers.
- 10 ft.
 - 12 ft.
 - 16 ft.
 - 15 ft.

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

300.22 Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums). (C)(1)

*Informational
Notes*

(NEW): Informational Note: One method to determine low smoke and heat release properties is that the nonmetallic cable ties and other nonmetallic cable accessories exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

(NEW): 300.38 Raceways in Wet Locations Above Grade. Where raceways are installed in wet locations above grade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations above grade shall comply with 310.10(C).

(NEW): 300.45 Warning Signs. Warning signs shall be conspicuously posted at points of access to conductors in all conduit systems and cable systems. The warning sign(s) shall be legible and permanent and shall carry the following wording:

DANGER—HIGH VOLTAGE—KEEP OUT

(NEW): 300.50 Underground Installations. (A)(2) Industrial Establishments.

In industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installed cable, non-shielded single-conductor cables with insulation types up to 2000 volts that are listed for direct burial shall be permitted to be directly buried.

(REVISED): 310.10 Uses Permitted. (H)(5)(6) Conductors in Parallel.

Equipment Bonding Conductors. Where parallel equipment bonding conductors are used, they shall be sized in accordance with 250.122. Sectioned equipment bonding conductors smaller than 1/0 AWG shall be permitted in multi-conductor cables, provided that the combined circular mil area of the sectioned equipment bonding conductors in each cable complies with 250.122.

(6) Bonding Jumpers. Where parallel equipment bonding jumpers or supply-side bonding jumpers are installed in raceways, they shall be sized and installed in accordance with 250.102.

(REVISED): 310.15 Ampacities for Conductors Rated 0–2000 Volts.**(B)(7) 120/240-Volt, Single-Phase Dwelling Services and Feeders.**

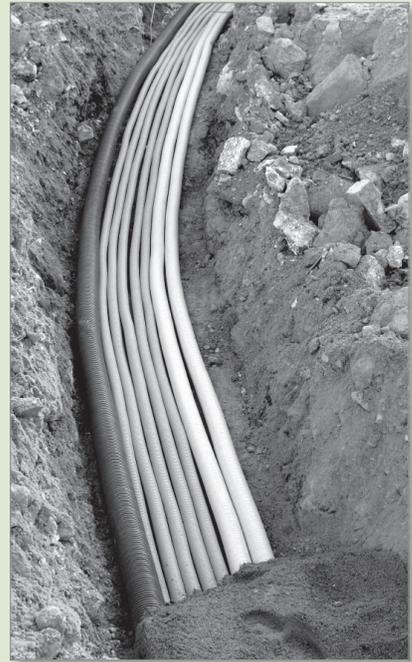
For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.15(B)(7)(1) through (4).

(1) For a service rated 100 through 400 A, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating.

(2) For a feeder rated 100 through 400 A, the feeder conductors supplying the entire load associated with a one-family dwelling, or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the feeder rating.

(3) In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that specified in 310.15(B)(7)(1) or (2).

(4) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, provided that the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.



Exam Questions:

196. Non-shielded single-conductor cables with insulation types of up to _____ volts are allowed in industrial establishments where qualified persons service the installed cable.

- A. 2000
- B. 1000
- C. 600
- D. 10,000

197. Service conductors rated 100 to 400 amps supplying an entire single family dwelling are permitted to have an ampacity not less than _____ percent of the service rating.

- A. 90
- B. 75
- C. 85
- D. 83

198. What is the maximum allowable heat release rate for nonmetallic cable ties according to ANSI standards?
- A. 75 kW
 - B. 100 W
 - C. 50 kW
 - D. 100 kW
199. _____ are required to be posted at the points of access to conductors in all raceway systems.
- A. Location markers
 - B. Warning signs
 - C. Voltage ratings
 - D. Current ratings
200. A conductor warning sign is required by the 2014 code to read:
- A. HIGH VOLTAGE—KEEP OUT—DANGER
 - B. HIGH VOLTAGE—DANGER—KEEP OUT
 - C. DANGER—HIGH VOLTAGE—KEEP OUT
 - D. No such requirement
201. 310.15(B)(7)(1) through (4) _____ grounded conductors to be sized smaller than the ungrounded conductors.
- A. Allow
 - B. Require
 - C. Suggest
 - D. Deter
202. True or False, the 2014 code allows paralleling equipment bonding conductors only if smaller than 1/0 AWG.
- A. False
 - B. True
203. Raceways that house insulated conductors and cables installed in wet locations are required to meet the requirements of _____.
- A. 310.13(D)
 - B. 310.10(B)
 - C. 310.12(C)
 - D. 310.10(C)
204. Parallel equipment bonding conductors are sized using _____.
- A. 250.122 (D)
 - B. 250.105
 - C. 250.66
 - D. 250.122
205. Feeder conductors rated 100 to 400 amps supplying an entire single family dwelling or multifamily dwelling are permitted to have an ampacity not less than _____ percent of the service rating.
- A. 85
 - B. 75
 - C. 83
 - D. 90
206. Raceways that are installed in wet locations above grade are considered to have their interior classified as a _____.
- A. Damp location
 - B. Dry location
 - C. Wet location
 - D. Classified location
207. The low smoke and heat release properties of nonmetallic cable ties should exhibit a maximum peak optical density of _____ or less.
- A. 0.25
 - B. 0.15
 - C. 0.50
 - D. 0.30
208. Nonmetallic cable ties should have an average optical density of _____ or less.
- A. 0.12
 - B. 0.15
 - C. 0.25
 - D. 0.50
209. How many provisions are listed for sizing multifamily dwellings service and feeder conductors supplied by a single-phase 120/240-volt system.
- A. 4
 - B. 5
 - C. 3
 - D. 6
210. If conduit may be subject to physical damage when run underground, type _____ is required to be used.
- A. All listed answers
 - B. Rigid metal conduit
 - C. RTRC-XW
 - D. Intermediate metal conduit

(REVISED): 314.15 Damp or Wet Locations. In damp or wet locations, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, and fittings installed in wet locations shall be listed for use in wet locations. Approved drainage openings not larger than 6 mm (1/4 in.) shall be permitted to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations. For installation of listed drain fittings, larger openings are permitted to be installed in the field in accordance with manufacturer's instructions.

(REVISED): 314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies (B)(2) Clamp Fill. Where one or more internal cable clamps, whether factory or field supplied, are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest conductor present in the box. No allowance shall be required for a cable connector with its clamping mechanism outside the box. A clamp assembly that incorporates a cable termination for the cable conductors shall be listed and marked for use with specific nonmetallic boxes. Conductors that originate within the clamp assembly shall be included in conductor fill calculations covered in 314.16(B)(1) as though they entered from outside the box. The clamp assembly shall not require a fill allowance, but the volume of the portion of the assembly that remains within the box after installation shall be excluded from the box volume as marked in 314.16(A)(2).

(REVISED): 314.25 Covers and Canopies. In completed installations, each box shall have a cover, faceplate, lampholder, or luminaire canopy, except where the installation complies with 410.24(B). Screws used for the purpose of attaching covers, or other equipment, to the box shall be either machine screws matching the thread gauge or size that is integral to the box or shall be in accordance with the manufacturer's instructions.

(REVISED): 314.25 Covers and Canopies. (C) Flexible Cord Pendants. Covers of outlet boxes and conduit bodies having holes through which flexible cord pendants pass shall be provided with identified bushings or shall have smooth, well-rounded surfaces on which the cords may bear. So-called hard rubber or composition bushings shall not be used.

(REVISED): 314.27 Outlet Boxes. (A)(2) Boxes at Luminaire or Lampholder Outlets. (2) Ceiling Outlets. At every outlet used exclusively for lighting, the box shall be designed or installed so that a luminaire or lampholder may be attached. Boxes shall be required to support a luminaire weighing a minimum of 23 kg (50 lb). A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed and marked on the interior of the box to indicate the maximum weight the box shall be permitted to support.

(REVISED): 314.28 Pull and Junction Boxes and Conduit Bodies. (A)(3) Minimum Size. (3) Smaller Dimensions. Listed boxes or listed conduit bodies of dimensions less than those required in 314.28(A)(1) and (A)(2) shall be permitted for installations of combinations of conductors that are less than the maximum conduit or tubing fill (of conduits or tubing being used) permitted by Table 1 of Chapter 9. Listed conduit bodies of dimensions less than those required in 314.28(A)(2), and having a radius of the curve to the centerline not less than that indicated in Table 2 of Chapter 9 for one-shot and full-shoe benders, shall be permitted for installations of combinations of conductors permitted by Table 1 of Chapter 9. These conduit bodies shall be marked to show they have been specifically evaluated in accordance with this provision. Where the permitted combinations of conductors for which the box or conduit body has been listed are less than the maximum conduit or tubing fill permitted by Table 1 of Chapter 9, the box or conduit body shall be permanently marked with the maximum number and maximum size of conductors permitted.



Exam Questions:

211. Weep holes not larger than _____ inches are allowed to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations.
- 1/16
 - 1/4
 - 3/8
 - 3/16
212. True or False, conduit bodies smaller than what is specified in 314.28(A)(1) and (A)(2) are not allowed to be used.
- False
 - True
213. True or False, no fill allowance is required to be made for a cable connector with its clamping mechanism outside a box.
- False
 - True
214. A _____ that incorporates a cable termination for cable conductors is required to be listed and marked for use with specific nonmetallic boxes.
- Clamp rating
 - Clamp assembly
 - Termination lug
 - Equipment terminal
215. Conductors that originate within a clamp assembly shall be included in the conductor fill calculations covered in _____.
- 314.16(B)(1)
 - 314.16(B)(2)
 - 316.14(B)(1)
 - 314.15(B)(1)
216. Where is a box required to be marked with its maximum weight rating?
- Nail or screw side
 - Outside
 - Inside
 - All listed answers
217. What type of screws does the 2014 code require for attaching the faceplate of a receptacle?
- Self tapping
 - Self drilling
 - Machine screws
 - Bi-metal
218. Holes through which flexible cord pendants pass is required to have _____.
- Rated
 - Identified bushings
 - Listed
 - Integral
219. The holes that flexible cord pendants pass _____ use hard rubber or composition bushings.
- May
 - Shall
 - Shall not
 - Will
220. A smaller conduit body than what is listed in 314.28(A)(1) and (A)(2) is required to be _____ to show they have been specifically evaluated in accordance with this provision.
- Listed
 - Marked
 - Rated
 - Manufactured
221. A box or conduit body that is smaller than the requirements of 314.28(A)(1) and (A)(2) is required to be permanently marked with the maximum number and maximum size of _____ permitted.
- Conductors
 - Conduits
 - Hubs
 - Entrances
222. If one or more internal cable clamps are in a box, a single volume allowance can be made based on the _____ conductor present in the box.
- Grounded
 - Smallest
 - Largest
 - Grounding
223. A _____ that incorporates a cable termination for cable conductors is required to be listed and marked for use with specific nonmetallic boxes.
- Clamp rating
 - Clamp assembly
 - Termination lug
 - Equipment terminal

REVISED): 320.23 In Accessible Attics. (A) Cables Run Across the Top of Floor Joists. Where run across the top of floor joists, or within 2.1 m (7 ft) of the floor or floor joists across the face of rafters or studding, the cable shall be protected by guard strips that are at least as high as the cable. Where this space is not accessible by permanent stairs or ladders, protection shall only be required within 1.8 m (6 ft) of the nearest edge of the scuttle hole or attic entrance.

(REVISED): 324.41 Floor Coverings. Floor-mounted Type FCC cable, cable connectors, and insulating ends shall be covered with carpet squares not larger than 1.0 m (39.37 in.) square. Carpet squares that are adhered to the floor shall be attached with release-type adhesives.

(REVISED): 330.30 Securing and Supporting. Type MC (B) Securing. Unless otherwise provided, cables shall be secured at intervals not exceeding 1.8 m (6 ft). Cables containing four or fewer conductors sized no larger than 10 AWG shall be secured within 300 mm (12 in.) of every box, cabinet, fitting, or other cable termination. In vertical installations, listed cables with ungrounded conductors 250 kcmil and larger shall be permitted to be secured at intervals not exceeding 3 m (10 ft).

(NEW): 330.30 Securing and Supporting. (D)(3) Unsupported Cables. Type MC of the interlocked armor type in lengths not exceeding 900 mm (3 ft) from the last point where it is securely fastened and is used to connect equipment where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation.

338.10 Uses Permitted. (B)(4)(b) Branch Circuits or Feeders.

(NEW): Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.

Exam Questions:

224. USE conductors are not subject to the ampacity limitations of Part _____ of Article 340.
- III
 - II
 - IV
 - V
225. Carpet squares used to cover type FCC cable are required to use _____ adhesives.
- Permanent
 - Release-type
 - Velcro
 - All listed answers
226. If a cable is run across the top of floor joists, or across the face of rafters or studding, the cable is required to be protected by _____.
- Planking
 - Guard rails
 - Guard strips
 - Blocking
227. What is the maximum distance apart for supports when using MC cable?
- 5 ft.
 - 8 ft.
 - 10 ft.
 - 6 ft.
228. What is the maximum size carpet squares that can be used to cover type FCC cable?
- 39.73" square
 - 38.37" square
 - 39.37" square
 - 37.97" square
229. If running a cable across an attic that is not accessible by stairs or a ladder, the cable protection is only required to be within _____ of the nearest edge of the attic entrance.
- 8 ft.
 - 5 ft.
 - 6 ft.
 - 10 ft.

- 230. Interlocked armor type MC cable is allowed to be supported within _____ of a motor termination enclosure.**
- A. 36"
 - B. 24"
 - C. 18"
 - D. 48"

(REVISED): 344.30 Securing and Supporting. (A) Securely Fastened. RMC shall be secured in accordance with one of the following:

- (1) RMC shall be securely fastened within 900 mm (3 ft) of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.
- (2) Fastening shall be permitted to be increased to a distance of 1.5 m (5 ft) where structural members do not readily permit fastening within 900 mm (3 ft).
- (3) Where approved, conduit shall not be required to be securely fastened within 900 mm (3 ft) of the service head for above-the-roof termination of a mast.

(NEW): 344.100 Construction. RMC shall be made of one of the following:

- (1) Steel (ferrous), with or without protective coatings
- (2) Aluminum (nonferrous)
- (3) Red brass
- (4) Stainless steel

348.30 Securing and Supporting (FMC). (A) Securely Fastened.

(REVISED): Exception No. 4: 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 purposes of this exception, listed flexible metal conduit fittings shall be permitted as a means of support.

(REVISED): 350.42 Couplings and Connectors. Only fittings listed for use with LFMC shall be used. Angle connectors shall not be concealed. Straight LFMC fittings shall be permitted for direct burial where marked.



(REVISED): 352.24 Bends (PVC) — How Made. Bends shall be so made that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Field bends shall be made only with identified bending equipment. The radius of the curve to the centerline of such bends shall not be less than shown in Table 2, Chapter 9.

(REVISED): 354.2 Definition. Nonmetallic Underground Conduit with Conductors

(NUCC). A factory assembly of conductors or cables inside a nonmetallic, smooth wall raceway with a circular cross section.

(REVISED): 355.2 Definition. Reinforced Thermosetting Resin Conduit (RTRC). A rigid nonmetallic raceway of circular cross section, with integral or associated couplings, connectors, and fittings for the installation of electrical conductors and cables.

Exam Questions:

231. PVC field bends shall be made only with _____ bending equipment.
- Listed
 - Manufactured
 - Identified
 - Rated
232. The radius of the curve to the centerline of PVC pipe bends shall not be less than shown in Table _____, Chapter 9.
- 3
 - 2
 - 1
 - 7
233. RMC needs to be securely fastened within _____ of an outlet box.
- 7'
 - 6'
 - 4'
 - 3'
234. Type _____ is a rigid nonmetallic raceway with integral or associated couplings, connectors, and fittings for the installation of electrical conductors and cables.
- RNC
 - NUCC
 - RTRC
 - ENT
235. Exception number _____ of article 348.30 allows listed flexible metal conduit fittings to be permitted as a means of support.
- 5
 - 3
 - 4
 - 2
236. RMC can be made of _____.
- Stainless steel
 - All listed answers
 - Red brass
 - Steel
237. Type _____ is a factory assembly of conductors inside a nonmetallic smooth wall raceway with a circular cross section.
- NUCC
 - RTRC
 - LFNC
 - XTTR
238. Straight _____ fittings are allowed to be used for direct burial if marked.
- NMC
 - MC
 - All listed answers
 - LFMC
239. RMC can be supported at _____ from a box if structural members do not readily permit fastening,
- 5'
 - 6'
 - 8'
 - 7'
240. LFMC angle connectors _____ be concealed.
- May
 - Can
 - Shall
 - Shall not

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.



Exam Questions:

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

(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.

Exam Questions:

252. 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".

- A. 480
- B. 600
- C. 300
- D. 240

253. 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.

254. Surface metal raceways are required to be identified in accordance with _____.

- A. 110.22(B)
- B. 110.22(A)
- C. 110.21(B)
- D. 110.21(A)

255. If you were to install a cable tray system, article _____ should be referenced.

- A. 394
- B. 388
- C. 386
- D. 392

256. 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
257. When supporting cablebus conductors, the conductors are required to be supported every _____ for horizontal runs.
- 5 ft.
 - 3 ft.
 - 4 ft.
 - 8 ft.
258. Cable trays that are required to have danger signs posted need to be placed every _____.
- 15 ft
 - 20 ft.
 - 10 ft.
 - 8 ft.
259. Surface nonmetallic raceways are required to be identified in accordance with _____.
- 110.21(A)
 - 110.22(A)
 - 110.21(B)
 - 110.22(B)
260. The maximum voltage listed in Table 310.60(C)(69) and Table 310.60(C)(70) for cablebus is?
- 1000
 - 35,000
 - 600
 - 300
261. When supporting cablebus conductors, the conductors are required to be supported every _____ for vertical runs.
- 3 ft.
 - 1 ½ ft.
 - 8 ft.
 - 11 ft.
262. The spacing between supported cablebus conductors cannot be less than _____ diameter at the points of support.
- 15/16"
 - 1"
 - One conductor
 - No requirement
263. 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
264. 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

Exam Questions:

265. Flexible cords or cables consisting of integral insulation and a jacket without a nonintegral grounding conductor shall be permitted to be _____.

- A. Yellow
- B. Green
- C. White
- D. Gray

266. Table _____ provides the ampacities for flexible cords and cables with not more than three current-carrying conductors.

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

267. Equipment grounding conductors are sized using _____.
 A. 250.105
 B. 250.66
 C. 250.122
 D. 250.105(D)
268. The _____ can allow flexible cables other than those in Table 400.4
 A. Qualified individual
 B. Customer
 C. GC
 D. AHJ
269. True or False, as a general rule, the grounded conductor for a lighting circuit is required to be at all switch locations.
 A. True
 B. False
270. How many conditions does the 2014 code list where the grounded conductor is not required to be at the switch location of the circuit?
 A. 4
 B. 5
 C. 2
 D. 7
271. 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)
272. Flexible conductors that have a continuous green color cannot be used for other than _____.
 A. Equipment grounding conductors
 B. Grounding electrode conductor
 C. Grounding Conductor
 D. Grounded conductor
273. 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.
 A. 75°C
 B. 90°C
 C. 60°C
 D. 105°C
274. 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 _____.
 A. Table 400.5(A)(1)
 B. Table 400.5(A)(2)
 C. Table 400.5(A)(3)
 D. No such requirement
275. 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.
 A. Grounding electrode conductor
 B. Equipment grounding conductor
 C. High leg conductor
 D. Single phase conductor
276. An equipment grounding conductor is required when three or more conductors are present in a portable cable operating at over _____ volts.
 A. 300
 B. 575
 C. 480
 D. 600
277. 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?
 A. Violation
 B. 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.

Exam Questions:

278. 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

279. A receptacle installed in a wet location is required to be installed in a _____ enclosure.

- A. Waterproof
- B. Weatherproof
- C. Weather resistant
- D. Watertight

280. Machine screws used to mount flush-type snap switches are required to have _____ threads.

- A. 10-24
- B. 24
- C. 48
- D. 32

281. 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

282. A receptacle installed in a kitchen countertop face up is required to be _____ for the application.

- A. Listed
- B. Rated
- C. Identified
- D. Approved

283. When replacing receptacles, the 2014 code lists _____ requirements to follow.

- A. 2
- B. 4
- C. 5
- D. 6

284. Machine screws used to mount receptacles are required to have _____ threads.

- A. 10-24
- B. 32
- C. 24
- D. 48

285. The box used to mount a receptacle must be _____.

- A. All listed answers
- B. Listed
- C. Rated
- D. Identified

286. Standard receptacles _____ be installed face up on a kitchen countertop.

- A. Shall
- B. Shall not
- C. May
- D. Can

287. 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.

- A. Tab
- B. Screw
- C. Yoke
- D. Bolt

288. True or False, receptacles are not allowed to be installed face up in seating areas.

- A. False
- B. True

289. 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

290. 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

291. 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

292. 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.

Exam Questions:

293. True or False, Child care facilities do not require tamper resistant receptacles to be installed.
- False
 - True
294. What article does the 2014 code reference with regards to the clearances required around switchgear?
- 110.24
 - 110.26
 - 110.26(B)
 - 110.30
295. A dc bus system is required to be marked by _____.
- Grounding system
 - Polarity
 - Voltage
 - All listed answers
296. Would it be considered acceptable or a violation of this code to install a standard receptacle on a dimmer switch.
- Acceptable
 - Violation
297. What is the minimum distance switchgear can be placed from a combustible ceiling?
- 4 ft.
 - 5 ft.
 - 3 ft.
 - No requirement
298. 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
299. 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
300. 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
301. How many provisions does the 2014 code list for installing tamper resistant receptacles?
- 5
 - 2
 - 4
 - 3
302. What article does the 2014 code reference when installing switchgear in damp or wet locations?
- 250.34(C)(1)
 - 312
 - 312.2
 - 314.2
303. 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

(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.

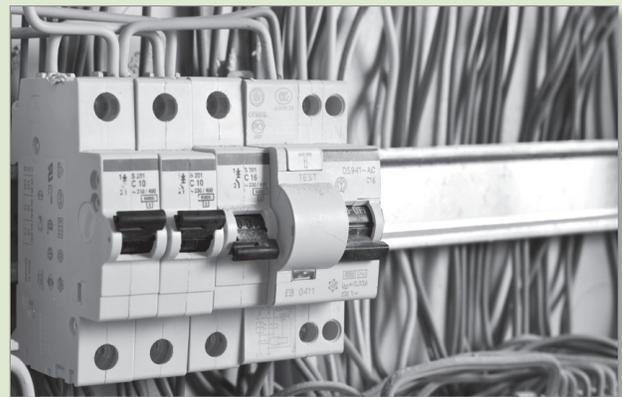
(NEW): 408.55 Wire-Bending Space Within an Enclosure Containing a Panelboard. (C) BackWire-Bending Space. Where a raceway or cable entry is in the wall of the enclosure opposite a removable cover, the distance from that wall to the cover shall be permitted to comply with the distance required for one 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 mm² (180 in.²) 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.

Exam Questions:

304. 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
305. 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
306. 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
307. The switch of a luminaire can be lockable if installed as per _____.
- 101.25
 - 110.25
 - 115.25
 - 410.23
308. 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)
309. 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%
310. 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)
311. 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
312. 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)
313. The switch of a luminaire is required to be installed within _____ of the luminaire.
- 15 ft.
 - 25 ft.
 - Sight
 - 50 ft.
314. 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

315. Supply conductors for an industrial control panel are required to have an ampacity of _____ the full-load current rating of the highest rated motor.

- A. 100%
- B. 125%
- C. 25%
- D. 75%

316. What is the minimum distance a luminaire can installed under metal-corrugated sheet roof decking to the top of the luminaire.

- A. 1"
- B. 1 ½"
- C. 2"
- D. ¾"

(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

Exam Questions:

317. How many tables does the 2014 code list for low voltage lighting equipment compliance?
- 2
 - 1
 - 3
 - 4
318. The caution sign required by 410.146 is required to have the letters a minimum of _____ high.
- $\frac{3}{4}$ "
 - $\frac{1}{2}$ "
 - $\frac{1}{4}$ "
 - $\frac{3}{8}$ "
319. How many requirements does the 2014 code list for the protection of resistance-type immersion electric heating elements?
- No requirements
 - 4
 - 2
 - 3
320. 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
321. What is the maximum voltage that article 411 covers with regards to lighting systems?
- 300
 - 30
 - 50
 - 600
322. Article 411 covers lighting equipment connected to class _____ power sources.
- 3
 - 1
 - 2
 - 4
323. The power supply used for low voltage lighting systems needs to be rated for _____ amps.
- 20
 - 10
 - 30
 - 25
324. 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
325. A luminaire having an open-circuit voltage of over _____ volts is required to have a caution sign.
- 1000
 - 600
 - 300
 - 575
326. The rating of class 2 lighting equipment is required to conform with Chapter _____.
- 9
 - 4
 - 6
 - 5
327. 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)
328. What is the maximum size branch circuit allowed by the 2014 code to supply a low voltage lighting system?
- 30
 - 20
 - 15
 - 40
329. How many amps does the 2014 code allow resistance-type immersion electric heating elements to be subdivided into?
- 130
 - 125
 - 120
 - 150

330. GFCI protection for appliances is required to be

- A. In line
- B. Accessible
- C. Readily accessible
- D. Integral

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

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

(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.

Exam Questions:

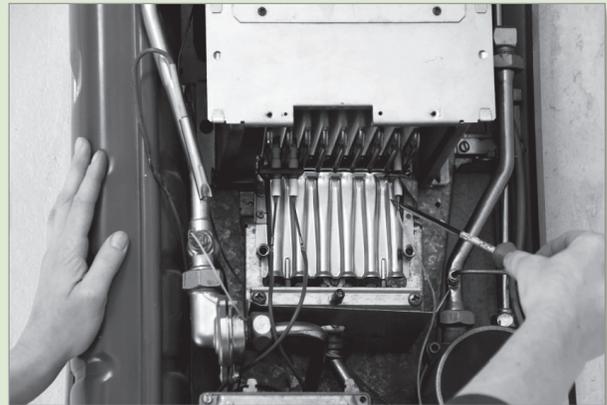
332. The tire air machine at your local convenience store is required to be _____.
- All listed answers
 - Accessible
 - Isolated
 - GFCI protected
333. A high pressure spray washer is required to have a _____ integral to the cord.
- Waterproofing
 - Green color
 - SOOW insulation
 - GFCI
334. The canopies of ceiling suspended paddle fans are required to have enough space for conductors as required in _____.
- 300.68
 - 422.20
 - 312.45
 - 314.16
335. 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
336. 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
337. The disconnect placement of a motor rated over 1/8 horsepower has _____ listed requirements in the 2014 code.
- 1
 - 2
 - 3
 - 4
338. 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
339. 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
340. A lockable breaker is acceptable to disconnect an appliance rated over _____ if it is within sight.
- 300 A
 - 300 VA
 - 150 VA
 - 200 A
341. What section of the 2014 code is referenced with regards to lockable disconnects?
- 240.34
 - 110.23
 - 240.8
 - 110.25
342. 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
343. A vending machine cord made after _____ is required to be GFCI protected.
- 2005
 - 2007
 - 2006
 - 2013

(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).

Exam Questions:

344. 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
345. An electrode boiler is required to be marked by _____ different pieces of information.
- A. 3
 - B. 6
 - C. 4
 - D. 5
346. A duct heater is required to be installed by the _____ instructions.
- A. Electricians
 - B. Architects
 - C. Engineers
 - D. Manufacturers
347. Space heating equipment is required to have a _____.
- A. Current transformer
 - B. Disconnect
 - C. Induction coil
 - D. Capacitive coil
348. A duct heater is required to be _____.
- A. 240v
 - B. Readily Accessible
 - C. Accessible
 - D. Installed by the manufacturer
349. 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
350. 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
351. A vending machine that is hard wired is required to be?
- A. Dedicated
 - B. AFCI protected
 - C. GFCI Protected
 - D. Listed
352. 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
353. A duct heater is required to provide _____ airflow over the face of the heater.
- A. Uniform
 - B. No
 - C. Partial
 - D. 35 cfm
354. 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

(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).

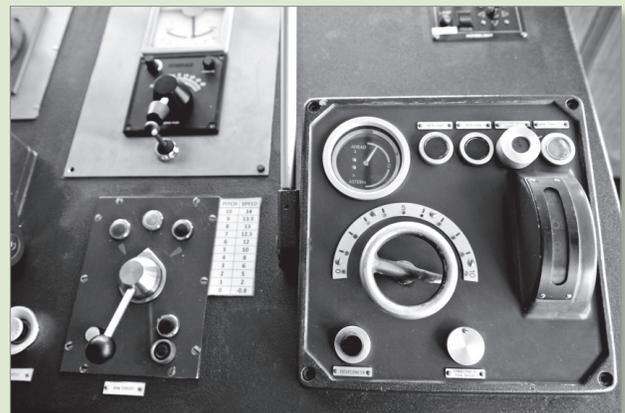
(NEW): 430.130 Branch-Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment. (A) Circuits Containing Power Conversion Equipment. Circuits containing power conversion equipment shall be protected by a branch-circuit short-circuit and ground-fault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



Exam Questions:

355. Part II of article 430 does not apply to motor circuits rated over _____ volts.
- 575
 - 600
 - 300
 - 1000
356. A bypass circuit is required to be _____ protected.
- Fuse
 - AFCI
 - GFCI
 - No requirement
357. A Class 20 overload relay will provide a longer motor acceleration time than a Class _____.
- 10 B
 - 10
 - 30
 - 40
358. A Class 30 overload relay will provide a longer motor acceleration time than a Class _____ overload relay.
- 50 A
 - 35
 - 40
 - 20
359. True or False, power conversion equipment can exceed the manufacturers values if allowed by 430.130(A)(1).
- False
 - True
360. 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
361. Another name for an instantaneous trip circuit breaker is?
- Motor-surge protectors
 - Motor-circuit protectors
 - Motor-circuit overload
 - Motor-circuit fuse
362. A self-protected combination controller is only permitted where specifically _____ in the manufacturer's instructions.
- Designed
 - Listed
 - Rated
 - Identified
363. Outdoor snow melting equipment is required to have its disconnecting means capable of being locked in the _____ position.
- Reset
 - On
 - Tripped
 - Off

(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



Exam Questions:

364. 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

365. A terminal bar installed for a transformer is required to be bonded in accordance with _____.

- A. 250.66
- B. 450.12
- C. 250.12
- D. 250.122

366. A generators nameplate is required to list the _____.
- All listed answers
 - Manufacturers name
 - Number of phases
 - Rated frequency
367. A terminal bar for all grounding and bonding conductor connections is required to be installed _____ a transformer enclosure.
- Next to
 - Outside
 - Inside
 - Separate from
368. A transformers nameplate is required to indicate its impedance if _____ and over.
- 20 KVA
 - 25 KVA
 - 15 KVA
 - 10 KVA
369. 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
370. 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
371. A transformer ventilation system is required to dispose its full-load _____ losses.
- Hysteresis
 - Power
 - Copper
 - Heat
372. 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
373. 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
374. A transformer nameplate is required to display _____ different pieces of information.
- 6
 - 9
 - 7
 - 8
375. 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

(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.



Exam Questions:

376. 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
377. 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
378. A transformer can be supplied at the marked secondary voltage if installed by the _____ instructions.
- Engineers
 - Manufacturers
 - Architects
 - Electricians
379. The roof and walls of a transformer vault are required to be constructed of an _____ material.
- Fireproof
 - Identified
 - Approved
 - Engineered
380. An electrically conductive bar or cable used to connect adjacent cells would be defined as a?
- Intertier Connector
 - Intercellular Connector
 - Intercell Connector
 - Container
381. What is the minimum allowable fire resistance rating of a transformer vaults wall and roof?
- 2 hours
 - 3 hours
 - 4 hours
 - No requirement

382. 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
383. The floor of a transformer vault is required to be constructed of _____ if in contact with the earth.
- Brick
 - Cinder Block
 - Concrete
 - Asphalt
384. What is the minimum height of a transformer vaults door sill?
- 3 inches
 - 4 inches
 - 5 inches
 - 2 inches
385. 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
386. 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
387. 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
388. Battery connections can be made using dissimilar metals so long as you use an _____ material suitable for the battery connection.
- Thermal
 - Conductive
 - Insulating
 - Antioxidant
389. 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

(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.

Exam Questions:

390. The terminals of multi-cell units are required to be _____.

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

391. A disconnect is required to be _____ for stationary DC battery systems.

- A. Accessible
- B. Readily accessible
- C. Guarded
- D. No requirement

392. 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

393. 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

394. Transparent battery containers are required to have one side _____ for inspection of the internal components.

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

395. True or False, terminal plates cannot be used for battery terminations.

- A. True
- B. False

396. 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

397. 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

398. 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

399. 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

400. 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

(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.

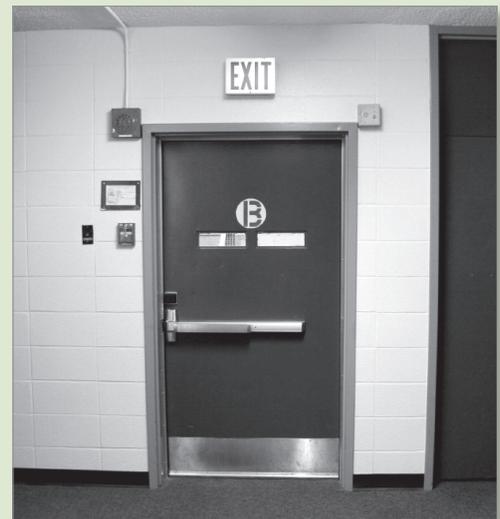
(NEW): 480.9 Battery Locations. (D) Top Terminal Batteries. Where top terminal batteries are installed on tiered racks, working space in accordance with the battery manufacturer's instructions shall be provided between the highest point on a cell and the row or ceiling above that point.

(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.

Exam Questions:

401. 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
402. The working space about a battery system is required to be measured from the _____ of the battery cabinet.
- Edge
 - Center
 - Door
 - Battery storage area
403. Where is the warning sign required 490.35(A) to be posted?
- Switchyard Gate
 - Service disconnect
 - Compartment door
 - Substation Control room
404. 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
405. A battery room door is required to have _____ panic hardware.
- UL 2365
 - Simple pressure
 - Fireproof
 - Listed
406. The light installed in a dedicated battery room cannot be controlled by _____ means only.
- Motion sensing
 - Manual
 - Automatic
 - All listed answers
407. 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
408. 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

409. The 2014 code lists _____ specific locations where luminaires cannot be installed in a dedicated battery room.
- 3
 - 2
 - 4
 - 5
410. What section of the 2014 code is referenced for the working space about battery systems?
- 480.24
 - 110.24
 - 110.27
 - 480.9
411. A fuse holder for systems over 1000 volts are designed to be _____ while the fuse is being replaced.
- Closed
 - De-energized
 - Open
 - Energized
412. 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)
413. 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

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.

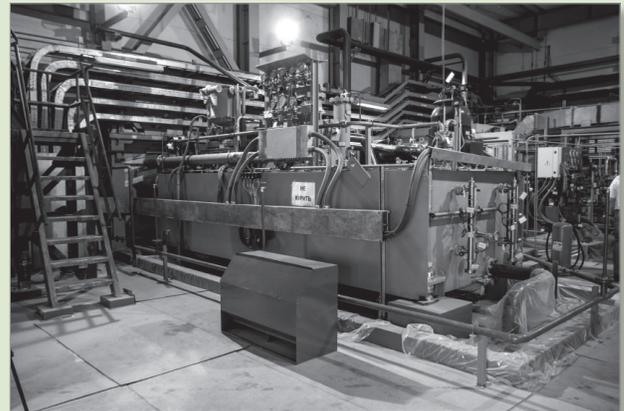
(NEW): 504.30 Separation of Intrinsically Safe Conductors. (C) From Grounded Metal. The clearance between the un-insulated parts of field wiring conductors connected to terminals and grounded metal or other conducting parts shall be at least 3 mm (0.125 in.).

(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.



Exam Questions:

414. What is the maximum conductor fill allowed for a conduit seal?
- 50%
 - 25%
 - 70%
 - 30%
415. What size particle is defined as combustible according to the 2014 code?
- 500 microns
 - 500 millicrons
 - 300 microns
 - 400 millicrons
416. 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
417. A conduit seal is required on any conduit leaving a _____ location.
- Classified
 - Petrochemical
 - Division 1
 - All listed answers
418. A sealing fitting that contains sealing compound is required to be _____.
- Zone rated
 - Readily accessible
 - Accessible
 - Watertight
419. A flexible cord can be used to power a process control instrument if the current does not exceed _____ amperes at 120 volts.
- 6
 - 4
 - 5
 - 3
420. 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
421. What is the maximum distance a power-supply cord can be when used to power a process control instrument?
- No requirement
 - 2 ft.
 - 4 ft.
 - 3 ft.
422. 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
423. 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
424. Process control instruments can be connected by attachment plugs provided they meet _____ listed provisions in the 2014 code.
- 4
 - 6
 - 5
 - 3
425. 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

426. What is the minimum melting point of sealing compound as required by the 2014 code?

- A. 500°F
- B. 300°F
- C. 100°F
- D. 200°F

427. What zone location can type “mc” encapsulation designator be used in?

- A. 2
- B. 1
- C. 3
- D. 4

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.

Exam Questions:

- 428. 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
- 429. 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
- 430. 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
- 431. 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
- 432. 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
- 433. 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
- 434. 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
- 435. 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
- 436. 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
- 437. 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?**
- Patient Care Vicinity
 - Support Space
 - Basic Care Space
 - Critical Care Space
- 438. 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

439. 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

440. 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?

- A. Unenclosed Spray Area
- B. Spray Room
- C. Limited Finishing Workstation
- D. Enclosed Spray Area

(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.

Exam Questions:

441. What is the maximum number of interconnected 15 amp receptacle outlets allowed for office furnishing groups?

- A. 10
- B. 15
- C. 13
- D. 5

442. The receptacles installed at each patient bed location are required to be _____.

- A. Commercial grade
- B. Hospital grade
- C. Isolated
- D. Double duplex

443. 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?

- A. Proscenium
- B. Stage Lighting Hoist
- C. Stage Panel Equipment
- D. Stage Switchboard

444. What is the minimum amount of critical care receptacles required at each patient bed location?

- A. 14
- B. 8
- C. 10
- D. 6

445. What is the minimum amount of receptacles required in an operating room?

- A. 30
- B. 14
- C. 26
- D. 36

446. 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?

- A. Stage Switchboard
- B. Stage Lighting Hoist
- C. Stage boom
- D. Proscenium

447. Interlocks for electric vehicles are not required for DC supplies less than _____ volts.
- 50
 - 100
 - 150
 - 300
448. The essential electrical system life safety branch circuit is required to meet the provisions of article _____.
- 800
 - 600
 - 250
 - 700
449. What is the minimum amount of general care receptacles required at each patient bed location?
- 2
 - 6
 - 4
 - 8
450. 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
451. 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
452. 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
453. 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
454. 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

(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 mm² (9 in.²) 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.



Exam Questions:

455. What is the minimum distance from the inside wall of a storable hot tub that a receptacle can be installed?

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

456. 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

457. The labeling for a rapid PV system shutdown initiation is required to be done as described in _____.

- A. 690.56(B)
- B. 110.24
- C. 110.56
- D. 690.65(B)

458. 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

459. 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.
460. Water in a pool is required to be bonded by a plate that is _____.
- A. 8x8 in.
 - B. 9 in.2
 - C. 5x5 in.
 - D. No such requirement
461. What is the maximum height allowed from grade for a receptacle that serves a permanently installed pool?
- A. 36 in.
 - B. 6 ft.
 - C. 48 in.
 - D. 6 ft. 6 in.
462. A PV system overcurrent device cannot be less than _____ of the maximum currents calculated in 690.8(A).
- A. 150%
 - B. 100%
 - C. 125%
 - D. 225%
463. A listed low voltage light not requiring grounding is allowed to be located less than _____ from the inside walls of the pool.
- A. 4 ft.
 - B. 6 ft.
 - C. 5 ft.
 - D. 8 ft.
464. The 2014 code requires PV system circuits that are installed on _____ to have a rapid shutdown function.
- A. No requirement
 - B. Floating platforms
 - C. Arrays
 - D. Buildings
465. 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

(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.

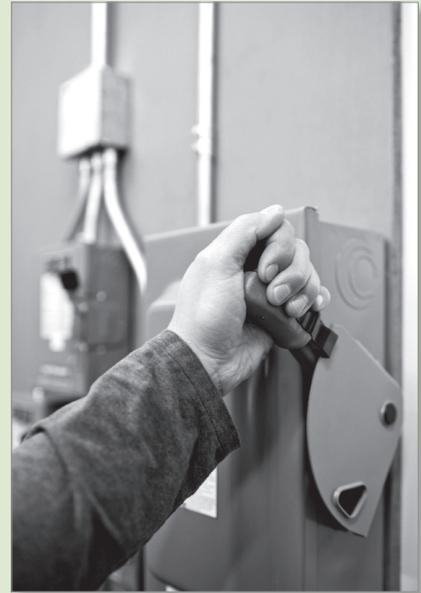
(NEW): 700.8 Surge Protection. A listed SPD shall be installed in or on all emergency systems switchboards and panelboards.

(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.

Exam Questions:

466. 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.

- A. 30 kW
- B. 24 kW
- C. 48 kW
- D. 15 kW

467. The grounding electrode conductor for an optical fiber cable in a residential dwelling can be no longer than _____.

- A. 10 ft.
- B. 20 ft.
- C. 15 ft.
- D. 30 ft.

468. An SPD is required to be installed on all _____ panelboards.
- A. Emergency
 - B. 3 wire
 - C. Computer
 - D. Communication
469. 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.
470. A cable tie used to support communications conductors that pass through a plenum are required to be _____ for low smoke and heat release.
- A. All listed answers
 - B. Rated
 - C. Engineered
 - D. Listed
471. What is the maximum distance single conductor PV cable installed in a cable tray is to be tied down and secured?
- A. 3 ft.
 - B. 4.5 ft.
 - C. 24 inches
 - D. 10 ft.
472. Communications service drops are required to have a minimum separation from 600 volt service drops of _____ inches.
- A. 14
 - B. 12
 - C. 10
 - D. 8
473. What table is required to be used for the installation of 600 to 2000 volt direct burial PV wire?
- A. 310.16
 - B. 315.2(B)
 - C. 310.15(2)(B)
 - D. 300.50
474. True or False, emergency lighting branch circuits are required to be of the multiwire type.
- A. False
 - B. True
475. 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.
- A. 12 ft.
 - B. 10 ft.
 - C. 15 ft.
 - D. 18 ft.
476. Cable supports and fasteners used to install type (CI) cable are required to be _____.
- A. Plastic
 - B. Steel
 - C. Copper
 - D. Fiberglass
477. A fiber optic cable routing assembly is required to be supported horizontally every _____ feet.
- A. 3
 - B. 6
 - C. 10
 - D. 8
478. What is the maximum distance a fiber optic cable routing assembly can be supported vertically?
- A. 4
 - B. 6
 - C. 3
 - D. 8
479. What is the maximum distance (CI) cables can be supported?
- A. 30 inches
 - B. 12 inches
 - C. 18 inches
 - D. 24 inches
480. 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

ANSWER SHEET – 2014 NEC CODE CHANGE (ALABAMA)

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- 8. A B C D
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