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**2023 NEC CODE CHANGES**  
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## ANSWER SHEET • 2023 NEC CODE CHANGES

First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP: \_\_\_\_\_

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\*\* See instructions on the inside cover page to submit your exams and pay for your course

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# 2023 NEC Code Changes

**(NEW) 90.1 Scope.** This article covers use and application, arrangement, and enforcement of this Code. It also covers the expression of mandatory, permissive, and nonmandatory text, provides guidance on the examination of equipment and on wiring planning, and specifies the use and expression of measurements.

**(NEW) 90.4 (A) Application.** This Code is intended to be suitable for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors.

**(NEW) 90.4 (B) Interpretations.** The authority having jurisdiction for enforcement of the Code has the responsibility for making interpretations of the rules, for deciding on the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules.

**(NEW) 90.4 (C) Specific Requirements and Alternative Methods.** By special permission, the authority having jurisdiction may waive specific requirements in this Code or permit alternative methods where it is assured that equivalent objectives can be achieved by establishing and maintaining effective safety.



**(NEW) 90.4 (D) New Products, Constructions, or Materials.** This Code may require new products, constructions, or materials that may not yet be available at the time the Code is adopted. In such event, the authority having jurisdiction may permit the use of the products, constructions, or materials that comply with the most recent previous edition of this Code adopted by the jurisdiction.

**Informational Note:** See Informative Annex H, Administration and Enforcement, for a model of guidelines that can be used to create an electrical inspection and enforcement program and to adopt NFPA 70, National Electrical Code.

## ARTICLE 100 Definitions:

**(New) Scope.** This article contains only those definitions essential to the application of this Code. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. An article number in parentheses following the definition indicates that the definition only applies to that article.

**Informational Note:** A definition that is followed by a reference in brackets has been extracted from one of the following standards. Only editorial changes were made to the extracted text to make it consistent with this Code.

NFPA 30A-2021, Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 33-2021, Standard for Spray Application Using Flammable or Combustible Materials

NFPA 75-2020, Standard for the Fire Protection of Information Technology Equipment

NFPA 79-2021, Electrical Standard for Industrial Machinery

NFPA 99-2021, Health Care Facilities Code

NFPA 101®-2022, Life Safety Code®

NFPA 110-2019, Standard for Emergency and Standby Power Systems

NFPA 303-2021, Fire Protection Standard for Marinas and Boatyards

NFPA 307-2021, Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves

NFPA 499-2021, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified)

Locations for Electrical Installations in Chemical Process Areas

NFPA 501-2022, Standard on Manufactured Housing

NFPA 790-2021, Standard for Competency of Third-Party Field Evaluation Bodies

NFPA 1192-2021, Standard on Recreational Vehicles

**(Change) Accessible (as applied to wiring methods).** Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in or blocked by the structure, other electrical equipment, other building systems, or finish of the building.

**(NEW) Adapter.** A device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating.

**(CHANGE) Aircraft Painting Hangar.** An aircraft hangar constructed for the express purpose of spraying, coating, and/or dipping applications and provided with dedicated ventilation supply and exhaust.

**(NEW) Alternate Power Source.** One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises.



**(NEW) Ambulatory Health Care Occupancy.**

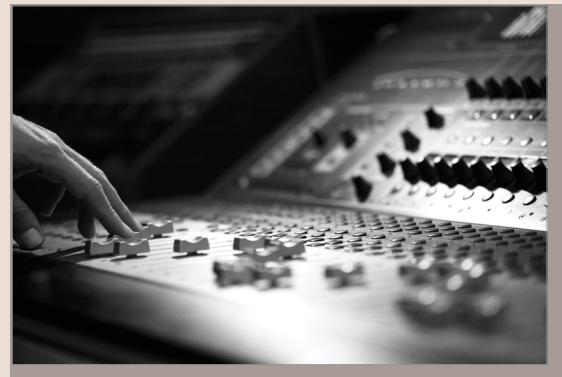
An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

Treatment for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

**(NEW) Amplifier (Audio Amplifier) (Pre-Amplifier).** Electronic equipment that increases the current or voltage, or both, of an audio signal intended for use by another piece of audio equipment. Amplifier is the term used to denote an audio amplifier.



**(CHANGE) Appliance.** Utilization equipment, generally other than industrial, that is fastened in place, stationary, or portable; is normally built in a standardized size or type; and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth.

**(NEW) Applicator.** The device used to transfer energy between the output circuit and the object or mass to be heated.

**(NEW) Array.** A mechanically and electrically integrated grouping of modules with support structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring.

## Exam Questions

- 1. What does Article 90.1 cover?**
  - A. It is intended for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors
  - B. It covers the requirements to address the fundamental principles of protection for safety
  - C. It covers use and application, arrangement, and enforcement of the Code.
  - D. All listed answers
  
- 2. What is the code intended to be suitable for?**
  - A. This document is suited for the use and application, arrangement, and enforcement of the code
  - B. It suitable for the requirements to address the fundamental principles of protection for safety
  - C. It is intended to be suitable for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors
  - D. All listed answers
  
- 3. In general, who is responsible for making interpretations of the rules, for deciding on the approval of equipment and materials, and for granting the special permission contemplated in several rules with regards to this code?**
  - A. The superintendent
  - B. The Building official
  - C. The authority having jurisdiction
  - D. The construction management contractor
  
- 4. Who can waive specific requirements in this code or permit alternative methods where it is assured that equivalent objectives can be achieved by establishing and maintaining effective safety?**
  - A. The Building official
  - B. The authority having jurisdiction
  - C. The superintendent
  - D. The construction management contractor
  
- 5. What annex can be used to create an electrical inspection and enforcement program and to adopt NFPA 70, National Electrical Code?**
  - A. H
  - B. A
  - C. F
  - D. C
  
- 6. What does Article 100 contain in the 2023 code?**
  - A. Article 100 contains a step-by-step guide for the installation of solar panels
  - B. Article 100 contains only those definitions essential to the application of this Code
  - C. Article 100 contains the annex portion of the code
  - D. Article 100 contains all requirements for sump pumps
  
- 7. What best defines something capable of being removed or exposed without damaging the building structure or finish or not permanently closed in or blocked by the structure, other electrical equipment, other building systems, or finish of the building?**
  - A. Readily accessible
  - B. Adapter
  - C. Amplifier
  - D. Accessible (as applied to wiring methods).
  
- 8. What is a device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating?**
  - A. A splitter
  - B. An adapter
  - C. An amplifier
  - D. A stimler
  
- 9. What do you call an aircraft hangar that is constructed for the express purpose of spraying, coating, and/or dipping applications and provided with dedicated ventilation supply and exhaust?**
  - A. Aircraft spray booth
  - B. Spray booth
  - C. Booth, aircraft
  - D. Aircraft painting hangar

10. \_\_\_\_\_ is one or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises.

- A primary power source
- An alternate power source
- A stand by power source
- A back up power source

11. How many patients does a facility need to have the ability to treat simultaneously and that complies with all listed requirements to be considered an ambulatory health care occupancy?

- Two or more patients
- Three or more patients
- Four or more patients
- All listed answers

12. What is electronic equipment that increases the current or voltage, or both, of an audio signal intended for use by another piece of audio equipment?

- A punch down
- A splitter
- An adapter
- An amplifier (Audio Amplifier) (Pre-Amplifier)

13. What best describes utilization equipment, generally other than industrial, that is fastened in place, stationary, or portable; is normally built in a standardized size or type; and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth?

- Adapters
- Array
- Associated apparatus
- Appliance

14. What is the device used to transfer energy between the output circuit and the object or mass to be heated known as?

- Array
- Applicator
- Associated apparatus
- Adapters

15. \_\_\_\_\_ is a mechanically and electrically integrated grouping of modules with support structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring.

- Array
- Applicator
- Associated apparatus
- Adapters

**(CHANGE) Associated Apparatus.** Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

**Informational Note No. 1:** Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also might have connections for nonintrinsically safe apparatus.

**Informational Note No. 2:** An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location under specified fault conditions.

**Informational Note No. 3:** See ANSI/UL 913, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations; ANSI/UL 60079-11, Explosive Atmospheres – Part 11: Equipment Protection by Intrinsic Safety “i”; and ANSI/ISA RP 12.06.01, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation – Part 1: Intrinsic Safety, for additional information.

**(CHANGE) 110.3 Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment.**

**(A) Examination.** In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with this Code

**Informational Note No. 1:** Equipment may be new, reconditioned, refurbished, or remanufactured.

**Informational Note No. 2:** Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.



(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

(3) Wire-bending and connection space

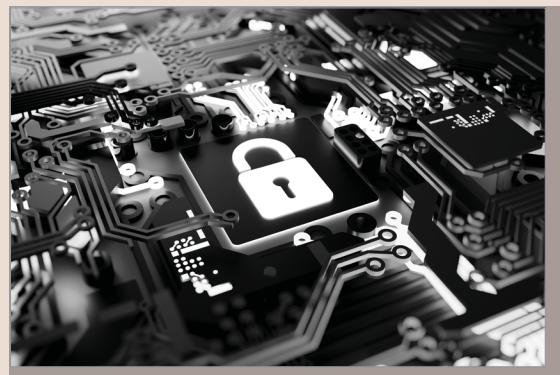
(4) Electrical insulation

(5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

(6) Arcing effects

(7) Classification by type, size, voltage, current capacity, and specific use

(8) Cybersecurity for network-connected life safety equipment to address its ability to withstand unauthorized updates and malicious attacks while continuing to perform its intended safety functionality



**Informational Note No. 3:** See the ANSI/ISA 62443 series of standards for industrial automation and control systems, the UL 2900 series of standards for software cybersecurity for network-connectable products, and UL 5500, Standard for Remote Software Updates, which are standards that provide frameworks to mitigate current and future security cybersecurity vulnerabilities and address software integrity in systems of electrical equipment.

(9) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

**(CHANGE) 110.3 (B) Installation and Use.** Equipment that is listed, labeled, or both, or identified for a use shall be installed and used in accordance with any instructions included in the listing, labeling, or identification.

**Informational Note:** The installation and use instructions may be provided in the form of printed material, quick response (QR) code, or the address on the internet where users can download the required instructions.

**(CHANGE) 110.4 Voltages.** The voltage considered shall be that at which the circuit operates. The voltage rating of electrical equipment shall not be less than the nominal voltage of a circuit to which it is connected.

**(CHANGE) 110.6 Conductor Sizes.** Conductor sizes are expressed in American Wire Gauge (AWG) or in circular mils.

**(CHANGE) 110.8 Wiring Methods.** Only wiring methods recognized as suitable are included in this Code. The recognized methods of wiring shall be permitted to be installed in any type of building, occupancy, or premises wiring system, except as otherwise provided in this Code.

**(CHANGE) 110.12 Mechanical Execution of Work.** Electrical equipment shall be installed in a professional and

skillful manner.

**Informational Note:** See ANSI/NECA 1-2015, Standard for Good Workmanship in Electrical Construction, and other ANSI-approved installation standards for information on accepted industry practices.

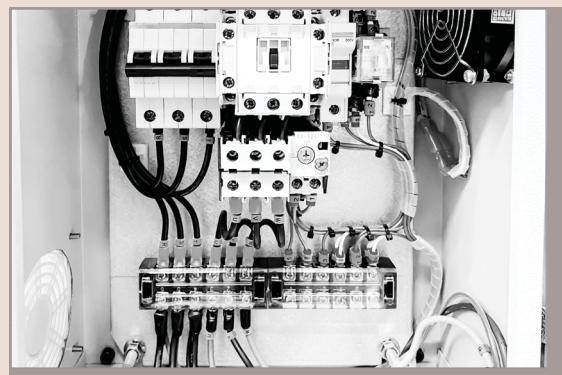
**(CHANGE) 110.12 (C) Cables and Conductors.** Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4 and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties.



**Informational Note No. 1:** See NFPA 90A-2021, Standard for the Installation of Air-Conditioning and Ventilating Systems, 4.3.11.2.6.5 and 4.3.11.5.5.6, for discrete combustible components installed in accordance with 300.22(C).

**Informational Note No. 2:** Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

**(CHANGE) 110.14 Electrical Connections.** Because of different characteristics of dissimilar metals, devices such as pressure terminal or pressure splicing connectors and soldering lugs shall be identified for the material of the conductor and shall be properly installed and used. Conductors of dissimilar metals shall not be intermixed in a terminal or splicing connector where physical contact occurs between dissimilar conductors unless the device is identified for the purpose and conditions of use. Materials such as solder, fluxes, inhibitors, and compounds, where employed, shall be suitable for the use and shall be of a type that will not adversely affect the conductors, installation, or equipment.



Connectors and terminals for conductors more finely stranded than Class B and Class C stranding as shown in Chapter 9, Table 10, shall be identified for the specific conductor class or classes.

## Exam Questions

16. In general, what is an apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety?

- Applicator
- Associated apparatus
- Associated field wiring apparatus
- Adapters

17. How many considerations are listed for the judging and identification, examination, installation, use, listing and product certification of equipment?

- 3
- 7
- 5
- 9

18. How might equipment installation instructions be provided?

- An address on the internet where users can download the required instructions
- Printed material
- Quick response (QR) code
- All listed answers

19. In Article 110.4, the voltage considered is required to be that at which the circuit \_\_\_\_\_?

- Is protected
- Operates
- Functions
- Is fused

20. In general, how are conductor sizes expressed in?

- American wire standard
- Wire gauge
- American wire gauge (AWG)
- Standard wire gauge

21. Article 110.8 states that only wiring methods recognized as \_\_\_\_\_ are included in this code.

- Listed
- Approved
- Suitable
- All listed answers

22. What ANSI/NECA has information regarding the standard for good workmanship in electrical construction?

- 1-2015
- 11-2015
- 4-2014
- 1V-2015

23. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air are required to be listed as having low smoke and \_\_\_\_\_ release properties.

- Tensile
- Heat
- Chemical
- All listed answers

24. What table in chapter 9 shows connectors and terminals for conductors more finely stranded than Class B and Class C stranding?

- Table 8
- Table 9
- Table 11
- Table 10

**(CHANGE) 110.14 (D) Terminal Connection Torque.** Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

**Informational Note No. 1:** Examples of approved means of achieving the indicated torque values include torque tools or devices such as shear bolts or breakaway-style devices with visual indicators that demonstrate that the proper torque has been applied.

**Informational Note No. 2:** See UL Standard 486A-486B, Standard for Safety-Wire Connectors, Informative Annex I for torque values in the absence of manufacturer's recommendations. The equipment manufacturer can be contacted if numeric torque values are not indicated on the equipment or if the installation instructions are not available.

**Informational Note No. 3:** See NFPA 70B-2019, Recommended Practice for Electrical Equipment Maintenance, Section 8.11 for additional information for torquing threaded connections and terminations.

**(CHANGE) 110.16 (B) Service Equipment and Feeder Supplied Equipment.** In other than dwelling units, in addition to the requirements in 110.16(A), a permanent arc flash label shall be field or factory applied to service equipment and feeder supplied equipment rated 1000 amperes or more. The arc flash



label shall be in accordance with applicable industry practice and include the date the label was applied. The label shall meet the requirements of 110.21(B).

**Informational Note No. 1:** See ANSI Z535.4-2011 (R2017), Product Safety Signs and Labels, for guidelines for the design of safety signs and labels for application to products.

**Informational Note No. 2:** See NFPA 70E-2021, Standard for Electrical Safety in the Workplace, for applicable industry practices for equipment labeling. This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, minimum required levels of personal protective equipment, and so forth.

**(NEW) 110.17 Servicing and Maintenance of Equipment.** Servicing and electrical preventive maintenance shall be performed by qualified persons trained in servicing and maintenance of equipment and shall comply with the following:

(1) The servicing and electrical preventive maintenance shall be performed in accordance with the original equipment manufacturer's instructions and information included in the listing information, applicable industry standards, or as approved by the authority having jurisdiction.

(2) The servicing and electrical preventive maintenance shall be performed using identified replacement parts that are verified under applicable product standards. The replacement parts shall comply with at least one of the following:

a. Be provided by the original equipment manufacturer

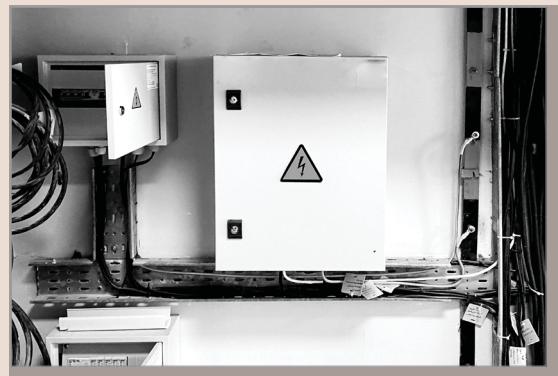
b. Be designed by an engineer experienced in the design of replacement parts for the type of equipment being serviced or maintained

c. Be approved by the authority having jurisdiction

**Informational Note No. 1:** For equipment that is not listed or field labeled, or for which components are no longer available from the original equipment manufacturer, one way to determine suitability is to review the documentation that accompanies the replacement parts.

**Informational Note No. 2:** See NFPA 70B, Recommended Practice for Electrical Equipment Maintenance, for information related to preventive maintenance for electrical, electronic, and communication systems and equipment.

**(NEW) 110.20 Reconditioned Equipment.** Reconditioned equipment shall be permitted except where prohibited elsewhere in this Code. Equipment that is restored to operating condition shall be reconditioned with identified replacement parts, verified under applicable standards, that are either provided by the original equipment manufacturer or that are designed by an engineer experienced in the design of replacement parts for the type of equipment being reconditioned.



**(NEW) 110.20 (A) Equipment Required to Be Listed.** Equipment that is reconditioned and required by this Code to be listed shall be listed or field labeled as reconditioned using available instructions from the original equipment manufacturer.

**(NEW) 110.20 (B) Equipment Not Required to Be Listed.** Equipment that is reconditioned and not required by this Code to be listed shall comply with one of the following:

(1) Be listed or field labeled as reconditioned

(2) Have the reconditioning performed in accordance with the original equipment manufacturer instructions

**(NEW) 110.20 (C) Approved Equipment.** If the options specified in 110.20(A) or (B) are not available, the authority having jurisdiction shall be permitted to approve reconditioned equipment, and the reconditioner shall provide the authority having jurisdiction with documentation of the changes to the product.

**(CHANGE) 110.21(2) Reconditioned Equipment.** Reconditioned equipment shall be marked with the following:

(1) Name, trademark, or other descriptive marking of the organization that performed the reconditioning

(2) The date of the reconditioning

(3) The term reconditioned or other approved wording or symbol indicating that the equipment has been reconditioned

The original listing mark shall be removed or made permanently illegible. The equipment nameplate shall not be required to be removed or made permanently illegible, only the part of the nameplate that includes the listing mark, if applicable. Approval of the reconditioned equipment shall not be based solely on the equipment's original listing.

**Exception:** In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

**Informational Note No. 1:** ANSI-approved standards are available for application of reconditioned and refurbished equipment.

**Informational Note No. 2:** The term reconditioned may be interchangeable with the terms rebuilt, refurbished, or remanufactured even though these are sometimes different processes.



## Exam Questions

25. What code annex has torque values if you are unable to find the manufacturers torque values?

- I
- F
- A
- C

26. According to Article 110.16(B), in other than dwelling units, in addition to the requirements in 110.16(A), a permanent arc flash label shall be field or factory applied to service equipment and feeder supplied equipment rated \_\_\_\_\_ amperes or more.

- 400
- 800
- 600
- 1000

27. What NFPA publication has information related to preventive maintenance for electrical, electronic, and communication systems and equipment?

- NFPA 70B
- NFPA 70E
- NFPA 50B
- NFPA 70D

28. What code section discusses reconditioned equipment and using only identified replacement parts verified under applicable standards for the equipment being reconditioned?

- 110.20
- 110.21(2)
- 110.17
- 110.20 (B)

## Exam Questions

29. Where does the information for a field applied reconditioned equipment label come from?

- Annex B
- Original equipment manufacturer
- The AHJ
- Article 695

30. What code section covers equipment that is reconditioned and not required by this code to be listed?

- 110.17
- 110.21(2)
- 110.20 (B)
- 110.20

31. If the options specified in 110.20(A) or (B) are not available, who is also authorized to approve reconditioned equipment?

- The electrical contractor
- The building inspector
- The authority having jurisdiction
- All listed answers

32. How many items are reconditioned equipment required to be marked with?

- 2
- 3
- 5
- 9

**(CHANGE) 110.21 (B) Field-Applied Hazard Markings.** Where caution, warning, or danger hazard markings such as labels or signs are required by this Code, the markings shall meet the following requirements:

(1) The marking shall be of sufficient durability to withstand the environment involved and warn of the hazards using effective words, colors, symbols, or any combination thereof.

**Informational Note No. 1:** See ANSI Z535.2-2011 (R2017), Environmental and Facility Safety Signs, which describes the design, application, and use of safety signs in facilities and in the environment.

**Informational Note No. 2:** See ANSI Z535.4-2011 (R2017), Product Safety Signs and Labels, which details the design, application, use, and placement of safety signs and labels on a wide variety of products.

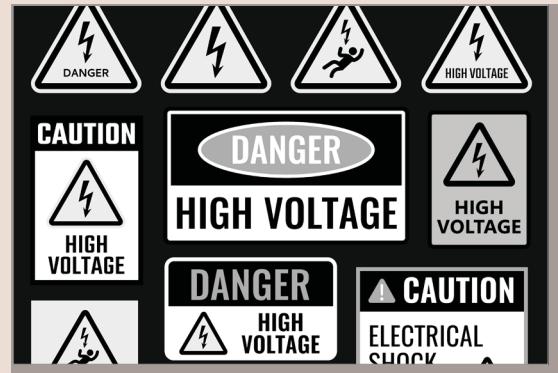
(2) The marking shall be permanently affixed to the equipment or wiring method and shall not be handwritten.

**Exception to (2):** Portions of the markings that are variable, or that could be subject to changes, shall be permitted to be handwritten and shall be legible.

**(CHANGE) 110.26 Spaces About Electrical Equipment.** Working space, and access to and egress from working space, shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment. Open equipment doors shall not impede access to and egress from the working space. Access or egress is impeded if one or more simultaneously opened equipment doors restrict working space access to be less than 610 mm (24 in.) wide and 2.0 m (61/2 ft) high.

**(NEW) 110.26 (A)(6) Grade, Floor, or Working Platform.** The grade, floor, or platform in the required working space shall be kept clear, and the floor, grade, or platform in the working space shall be as level and flat as practical for the entire required depth and width of the working space.

**(CHANGE) 110.26 (C) (3) Personnel Doors.** Where equipment rated 800 amperes or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open at least 90 degrees in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.



**Informational Note:** See UL 305, Standard For Panic Hardware, for additional information on panic hardware, and see UL 10C, Standard for Safety for Positive Pressure Fire Tests of Door Assemblies, for additional information.

**(NEW) 110.29 In Sight From (Within Sight From, Within Sight).** Where this Code specifies that one equipment shall be “in sight from,” “within sight from,” or “within sight of” another equipment, the specified equipment shall be visible and not more than 15 m (50 ft) distant from the other.



**(CHANGE) 110.33 (A) Entrance.** At least one entrance to enclosures for electrical installations as described in 110.31 not less than 610 mm (24 in.) wide and 2.0 m (61/2 ft) high shall be provided to give access to the working space about electrical equipment. Open equipment doors shall not impede access to and egress from the working space. Access or egress is impeded if one or more simultaneously opened equipment doors restrict working space access to be less than 610 mm (24 in.) wide and 2.0 m (61/2 ft) high.

**(CHANGE) 110.40 Temperature Limitations at Terminations.** Conductors shall be permitted to be terminated based on the 90°C (194°F) temperature rating and ampacity as given in Table 315.60(C)(1) through Table 315.60(C)(20), unless otherwise identified.

**(CHANGE) 110.53 Conductors.** High-voltage conductors in tunnels shall be installed in metal raceway, Type MC cable, or other approved multiconductor cable. Multiconductor portable cable shall be permitted to supply mobile equipment.

**(CHANGE) 110.58 Disconnecting Means.** A switch or circuit breaker that simultaneously opens all ungrounded conductors of the circuit shall be installed within sight of each transformer or motor location for disconnecting the transformer or motor. The switch or circuit breaker for a transformer shall have an ampere rating not less than the ampacity of the transformer supply conductors. The switch or circuit breaker for a motor shall comply with the applicable requirements of Part IX of Article 430.

**(CHANGE) 110.72 Cabling Work Space.** A clear work space not less than 900 mm (3 ft) wide shall be provided where cables are located on both sides, and not less than 750 mm (21/2 ft) where cables are only on one side. The vertical headroom shall be not less than 1.8 m (6 ft) unless the opening is within 300 mm (1 ft), measured horizontally, of the adjacent interior side wall of the enclosure.



**Exception:** A manhole containing only one or more of the following shall be permitted to have one of the horizontal work space dimensions reduced to 600 mm (2 ft) where the other horizontal clear work space is increased so the sum of the two dimensions is not less than 1.8 m (6 ft):

- (1) Optical fiber cables
- (2) Power-limited fire alarm circuits supplied in accordance with 760.121
- (3) Class 2 or Class 3 remote-control and signaling circuits, or both, supplied in accordance with 725.60

**(CHANGE) 110.75(A) Dimensions.** Rectangular access openings shall not be less than 650 mm × 550 mm (26 in. × 22 in.). Round access openings in a manhole shall be not less than 650 mm (26 in.) in diameter.

**Exception:** A manhole that has a fixed ladder that does not obstruct the opening or that contains only one or more of the following shall be permitted to reduce the minimum cover diameter to 600 mm (2 ft):

- (1) Optical fiber cables

(2) Power-limited fire alarm circuits supplied in accordance with 760.121

(3) Class 2 or Class 3 remote-control and signaling circuits, or both, supplied in accordance with 725.60

**(CHANGE) 200.2 General.** Grounded conductors shall comply with 200.2(A) and (B).

**(A) Insulation.** The grounded conductor, if insulated, shall have insulation that complies with either one of the following:

(1) Is suitably rated, other than color, for any ungrounded conductor of the same circuit for systems of 1000 volts or less.

(2) Is rated not less than 600 volts for solidly grounded neutral systems of over 1000 volts in accordance with 250.184(A)

**(CHANGE) 200.2 (B) Continuity.** The continuity of a grounded conductor shall not depend on a connection to a metal enclosure, raceway, or cable armor.

**Informational Note:** See 300.13(B) for the continuity of grounded conductors used in multiwire branch circuits.



## Exam Questions

33. What code section covers field-applied hazard markings?

- 110.17
- 110.21 (D)
- 110.21 (B)
- 110.20

34. Open equipment doors shall not impede access to and egress from the \_\_\_\_\_.

- Equipment
- Working space
- Gear
- All listed answers

35. What new code section discusses the working space grade, platform, and floor?

- 110.17
- 110.21 (D)
- 110.26 (A)(6)
- 110.20

36. What UL has additional information regarding the standard for safety for positive pressure fire tests of door assemblies?

- 8F
- 10C
- 305
- 27B

37. When the code specifies that one equipment shall be "in sight from," "within sight from," or "within sight of" another equipment, what is the maximum distance permitted from each piece of equipment?

- 25 ft
- 15 ft
- 50 ft
- 16 ft

38. How many entrances does the code require for giving access to the working space about electrical equipment?

- 1
- 2
- 3
- There are no requirements

39. In general, at what temperature are conductors permitted to be terminated based on the temperature rating?

- 40°C
- 60°C
- 75°C
- 90°C

40. Multiconductor portable cable is permitted to supply \_\_\_\_\_ equipment.

- Permanent
- Mobile
- Fixed
- Submerged

41. What part of Article 430 is the switch or circuit breaker for a motor required to comply with?

- Part X
- Part IX
- Part XI
- Part IV

42. How wide must the clear work space be where cables are located on both sides?

- 2ft
- 5ft
- 4ft
- 3ft

43. What is the minimum size diameter manhole cover required for access to electrical cables and equipment?

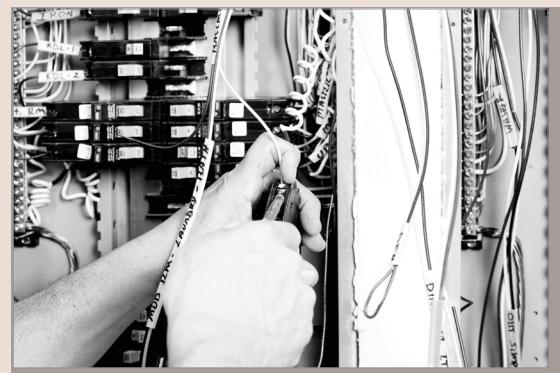
- 26 inches
- 28 inches
- 30 inches
- 32 inches

44. The continuity of a grounded conductor shall not depend on a connection to a \_\_\_\_\_.

- Cable armor
- Metal enclosure
- Raceway
- All listed answers

**(CHANGE) 200.6 Means of Identifying Grounded Conductors. (A) Sizes 6 AWG or Smaller.** The insulation of grounded conductors of 6 AWG or smaller shall be identified by one of the following means:

- A continuous white outer finish.
- A continuous gray outer finish.
- Three continuous white or gray stripes along the conductor's entire length on other than green insulation.
- Conductors with white or gray insulation and colored tracer threads in the braid identifying the source of manufacture.
- A single-conductor, sunlight-resistant, outdoor-rated cable used as a solidly grounded conductor in photovoltaic power systems, as permitted by 690.31(C)(1), shall be identified at the time of installation by markings at terminations in accordance with 200.6(A)(1) through (A)(4).
- The grounded conductor of a mineral-insulated, metal-sheathed cable (Type MI) shall be identified at the time of installation by a distinctive white or gray marking at its terminations. The marking shall encircle the conductor insulation.
- Fixture wire shall comply with the requirements for grounded conductor identification in accordance with 402.8.
- For aerial cable, the identification shall comply with one of the methods in 200.6(A)(1) through (A)(5), or by means of a ridge located on the exterior of the cable so as to identify it.



**(CHANGE) 200.10 Identification of Terminals. (A) Device Terminals.** All devices, excluding panelboards, provided with terminals for the attachment of conductors and intended for connection to more than one side of the circuit shall have terminals marked for identification, unless the electrical connection of the terminal intended to be connected to the grounded conductor is clearly evident.

**Exception:** Terminal identification shall not be required for devices that have a current rating of over 30 amperes, other than polarized attachment plugs and polarized receptacles for attachment plugs in accordance with 200.10(B).

**(CHANGE) 200.10 Identification of Terminals. (B) Receptacles, Plugs, and Connectors.** Receptacles, polarized attachment plugs, and cord connectors for plugs and polarized plugs shall have the terminal intended for connection to the grounded conductor identified as follows:

(1) Identification shall be by a metal or metal coating that is white or silver in color or by the word “white” or the letter “W” located adjacent to the identified terminal.

(2) If the terminal is not visible, the conductor entrance hole for the connection shall be colored white or marked with the word “white” or the letter “W.”

**Informational Note:** See 250.126 for identification of wiring device equipment grounding conductor terminals.

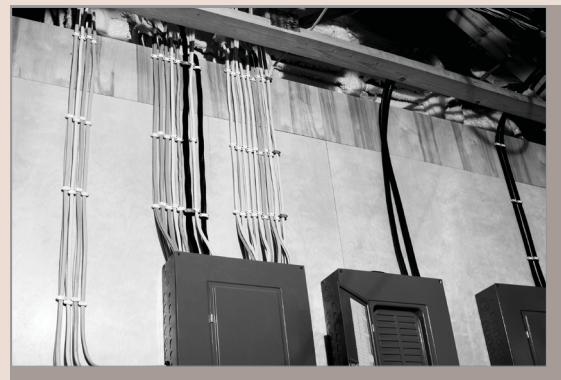
**(CHANGE) 210.1 Scope.** This article provides the general requirements for branch circuits not over 1000 volts ac, 1500 volts dc, nominal.

**Informational Note:** See Part II of Article 235 for requirements for branch circuits over 1000 volts ac, 1500 volts dc, nominal.

**(CHANGE) 210.2 Reconditioned Equipment.** The following shall not be reconditioned:

(1) Equipment that provides ground-fault circuit-interrupter protection for personnel

(2) Equipment that provides arc-fault circuit-interrupter protection



**(CHANGE) 210.4 Multiwire Branch Circuits. (A) General.** Branch circuits recognized by this article shall be permitted as multiwire circuits. A multiwire circuit shall be permitted to be considered as multiple circuits. Except as permitted in 300.3(B)(4), all conductors of a multiwire branch circuit shall originate from the equipment containing the branch-circuit overcurrent protective device or protective devices.

**Informational Note No. 1:** A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads might necessitate that the power system design allow for the possibility of high harmonic currents on the neutral conductor.

**Informational Note No. 2:** See 300.13(B) for continuity of grounded conductors on multiwire circuits.

**(CHANGE) 210.4 Multiwire Branch Circuits. (C) Line-to-Neutral Loads.** Multiwire branch circuits shall supply only line-to-neutral loads.

**Exception No. 1:** A multiwire branch circuit that supplies only one utilization equipment shall be permitted to supply line-to-line loads.

**Exception No. 2:** A multiwire branch circuit shall be permitted to supply line-to-line loads if all ungrounded conductors of the multiwire branch circuit are opened simultaneously by the branch-circuit overcurrent device.

**(CHANGE) 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.** A listed Class A GFCI shall provide protection in accordance with 210.8(A) through (F). The GFCI shall be installed in a readily accessible location.

**Informational Note:** See 215.9 for GFCI protection on feeders.



For the purposes of this section, the distance from receptacles shall be measured as the shortest path the power supply cord connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier.

**(CHANGE) 210.8 (A) Dwelling Units.** All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

- (1) Bathrooms
- (2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use
- (3) Outdoors
- (4) Crawl spaces – at or below grade level
- (5) Basements
- (6) Kitchens
- (7) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking
- (8) Sinks – where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink
- (9) Boathouses
- (10) Bathtubs or shower stalls – where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall
- (11) Laundry areas
- (12) Indoor damp and wet locations

**Exception No. 1:** Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

**Exception No. 2:** A receptacle supplying only a permanently installed premises security system shall be permitted to omit ground-fault circuit-interrupter protection.

**Exception No. 3:** Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of supporting a ceiling luminaire or ceiling-suspended fan shall be permitted to omit ground-fault circuit-interrupter protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.

**Exception No. 4:** Factory-installed receptacles that are not readily accessible and are mounted internally to bathroom exhaust fan assemblies shall not require GFCI protection unless required by the installation instructions or listing.

**Informational Note:** See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.



## Exam Questions

**45. What section describes how to identify the insulation of grounded conductors of 6 AWG or smaller?**

- A. 200.6
- B. 200.10
- C. 210.6
- D. 210.1

**46. What is the minimum current rating where terminal identification is not required for devices?**

- A. 20 amperes
- B. 30 amperes
- C. 40 amperes
- D. 10 amperes

**47. What section should be referenced with regards to the identification of wiring device equipment grounding conductor terminals?**

- A. 250.122
- B. 210.1
- C. 250.66
- D. 250.126

**48. What part of Article 235 has the requirements for branch circuits over 1000 volts ac and 1500 volts dc nominal?**

- A. Part II
- B. Part III
- C. Part IV
- D. Part VI

**49. What section lists equipment that should not be reconditioned?**

- A. 250.126
- B. 210.1
- C. 210.2
- D. 200.6

**50. What section is referenced for more information on the continuity of grounded conductors on multiwire circuits?**

- A. 220.6
- B. 300.3(B)(4)
- C. 215.9
- D. 300.13(B)

**51. In general, what are multiwire branch circuits required to supply?**

- A. Only receptacle loads
- B. Only line-to-line loads
- C. Only lighting loads
- D. Only line-to-neutral loads

**52. What section is referenced for the GFCI protection on feeders?**

- A. 215.9
- B. 300.3(B)(4)
- C. 300.13(B)
- D. 220.6

**53. In general, how many areas are listed for dwelling units where all 125-volt through 250-volt receptacles 150 volts or less to ground are required to have ground-fault circuit-interrupter protection for personnel?**

- A. 5
- B. 2
- C. 12
- D. 15

**(CHANGE) 210.8 (B) Other Than Dwelling Units.** All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

- (1) Bathrooms
- (2) Kitchens
- (3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall



**Exception No. 1:** Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

**Exception No. 2:** Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

**Exception No. 3:** Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial establishments where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program in accordance with 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or that has a design not compatible with GFCI protection.

**Exception No. 4:** Receptacles or cord-and-plug-connected fixed and stationary appliances installed within 1.8 m (6 ft) from the top inside edge of a bowl of a sink shall not be required to be GFCI protected in industrial laboratories where the receptacles are used to supply equipment if removal of power would introduce a greater hazard.

**Exception No. 5:** Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with 517.21.

**Exception No. 6:** Listed weight-supporting ceiling receptacles (WSCR) utilized in combination with compatible weight-supporting attachment fittings (WSAF) installed for the purpose of serving a ceiling luminaire or ceiling-suspended fan shall be permitted to omit GFCI protection. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling-suspended fan, GFCI protection shall be provided.



**(CHANGE) 210.8 (D) Specific Appliances.** GFCI protection shall be provided for the branch circuit or outlet supplying the following appliances rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase:

- (1) Automotive vacuum machines
- (2) Drinking water coolers and bottle fill stations
- (3) High-pressure spray washing machines
- (4) Tire inflation machines
- (5) Vending machines
- (6) Sump pumps
- (7) Dishwashers
- (8) Electric ranges
- (9) Wall-mounted ovens
- (10) Counter-mounted cooking units
- (11) Clothes dryers
- (12) Microwave ovens

**(CHANGE) 210.8 (F) Outdoor Outlets.** For dwellings, all outdoor outlets, other than those covered in 210.8(A), Exception No. 1, including outlets installed in the following locations, and supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, shall be provided with GFCI protection:

- (1) Garages that have floors located at or below grade level
- (2) Accessory buildings
- (3) Boathouses

If equipment supplied by an outlet covered under the requirements of this section is replaced, the outlet shall be supplied with GFCI protection.

**Exception No. 1:** GFCI protection shall not be required on lighting outlets other than those covered in 210.8(C).

**Exception No. 2:** GFCI protection shall not be required for listed HVAC equipment. This exception shall expire September 1, 2026.

**(CHANGE) 210.11 (C) (4) Garage Branch Circuits.** In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets, including those required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets. Additional branch circuits rated 15 amperes or greater shall be permitted to serve receptacle outlets other than those required by 210.52(G)(1).

**Exception No. 1:** This circuit shall be permitted to supply outdoor receptacle outlets.

**Exception No. 2:** Where the 20-ampere circuit supplies a single vehicle bay garage, outlets for other equipment within the same garage shall be permitted to be supplied in accordance with 210.23(B)(1) and (B)(2).

**(CHANGE) 210.12 Arc-Fault Circuit-Interrupter Protection.** Arc-fault circuit-interrupter (AFCI) protection shall be installed in accordance with 210.12(B) through (E) by any of the means described in 210.12(A)(1) through (A)(6). The AFCI shall be listed and installed in a readily accessible location.

**(NEW) 210.12 (B) Dwelling Units.** All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

- (1) Kitchens
- (2) Family rooms
- (3) Dining rooms



- (4) Living rooms
- (5) Parlors
- (6) Libraries
- (7) Dens
- (8) Bedrooms
- (9) Sunrooms
- (10) Recreation rooms
- (11) Closets
- (12) Hallways
- (13) Laundry areas
- (14) Similar areas



**Exception No. 1:** AFCI protection shall not be required for an individual branch circuit supplying a fire alarm system installed in accordance with 760.41(B) or 760.121(B). The branch circuit shall be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, or Type MC or Type AC cable meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures.

**Exception No. 2:** AFCI protection shall not be required for the individual branch circuit supplying an outlet for arc welding equipment in a dwelling unit until January 1, 2025.

**Informational Note No. 1:** See NFPA 72-2022, National Fire Alarm and Signaling Code, 29.9.4(5), for information on secondary power source requirements for smoke alarms installed in dwelling units.

**Informational Note No. 2:** See 760.41(B) and 760.121(B) for power source requirements for fire alarm systems.

**(CHANGE) 210.12 (C) Dormitory Units.** All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

- (1) Bedrooms
- (2) Living rooms
- (3) Hallways
- (4) Closets
- (5) Bathrooms
- (6) Similar rooms

## Exam Questions

54. In general, how many areas are listed for other than dwelling units where all 125-volt through 250-volt receptacles 150 volts or less to ground are required to have ground-fault circuit-interrupter protection for personnel?

- A. 12
- B. 2
- C. 5
- D. 15

55. When does the exception expire that allows listed HVAC equipment to not require GFCI protection?

- A. January 1, 2025
- B. October 1, 2026
- C. August 1, 2026
- D. September 1, 2026

56. What section covers garage branch circuits?

- A. 210.1 (C)(4)
- B. 211.10 (B)(4)
- C. 211.11 (B)(4)
- D. 210.11 (C)(4)

57. What type of location are arc-fault circuit-interrupters required to be installed in?

- Accessible location
- Readily accessible location
- Locked location
- Guarded location

58. When does the exception expire that allows arc welding equipment in dwelling units to no longer require AFCI protection?

- January 1, 2025
- October 1, 2026
- August 1, 2026
- September 1, 2024

59. How many areas does the code require arc-fault circuit-interrupters to be installed with regards to dormitory units?

- 2
- 6
- 15
- 12

**(CHANGE) 210.12 (D) Other Occupancies.** All 120-volt, single-phase, 10-, 15-, and 20-ampere branch circuits supplying outlets or devices installed in the following locations shall be protected by any of the means described in 210.12(A)(1) through (A)(6):

- Guest rooms and guest suites of hotels and motels
- Areas used exclusively as patient sleeping rooms in nursing homes and limited-care facilities
- Areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations

**(CHANGE) 210.12 (E) Branch Circuit Wiring Extensions, Modifications, or Replacements.** If branch-circuit wiring for any of the areas specified in 210.12(B), (C), or (D) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

- By any of the means described in 210.12(A)(1) through (A)(6)
- A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit

**Exception:** AFCI protection shall not be required where the extension of the existing branch-circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

**(CHANGE) 210.17 Guest Rooms and Guest Suites.** Guest rooms and guest suites in the following occupancies that are provided with permanent provisions for cooking shall have branch circuits installed to meet the rules for dwelling units:

- Hotels
- Motels
- Assisted living facilities

**Informational Note No. 1:** See 210.11(C)(2) and 210.52(F), Exception No. 2, for information on laundry branch circuits and receptacle outlets.

**Informational Note No. 2:** See NFPA 101-2021, Life Safety Code, 3.3.198.12 and A.3.3.198.12(5), for the definition of assisted living facilities.

**210.19 Conductors — Minimum Ampacity and Size.** Branch-circuit conductors for circuits not exceeding 1000 volts ac or 1500 volts dc shall be sized in accordance with 210.19(A) through (D).

**Informational Note:** Conductors for branch circuits as defined in Article 100, sized to prevent a voltage drop



exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, provide reasonable efficiency of operation. See 215.2(A)(2), Informational Note No. 2, for information on voltage drop on feeder conductors.

**(CHANGE) 210.20 Overcurrent Protection.** Branch-circuit conductors and equipment for circuits not exceeding 1000 volts ac or 1500 volts dc shall be protected by overcurrent protective devices that have a rating or setting that complies with 210.20(A) through (D).

**(NEW) 210.23 (A) 10-Ampere Branch Circuits.** A 10-ampere branch circuit shall comply with the requirements of 210.23(A)(1) and (A)(2).

**(NEW) 210.23 (A) (1) Loads Permitted for 10-Ampere Branch Circuits.** A 10-ampere branch circuit shall be permitted to supply one or more of the following:

- (1) Lighting outlets
- (2) Dwelling unit exhaust fans on bathroom or laundry room lighting circuits
- (3) A gas fireplace unit supplied by an individual branch circuit

**(NEW) 210.23 (A) (2) Loads Not Permitted for 10-Ampere Branch Circuits.** A 10-ampere branch circuit shall not supply any of the following:

- (1) Receptacle outlets
- (2) Fixed appliances, except as permitted for individual branch circuits
- (3) Garage door openers
- (4) Laundry equipment



**(CHANGE) 210.52 (C) (3) Receptacle Outlet Location.** Receptacle outlets shall be located in one or more of the following:

- (1) On or above, but not more than 500 mm (20 in.) above, a countertop or work surface
- (2) In a countertop using receptacle outlet assemblies listed for use in countertops
- (3) In a work surface using receptacle outlet assemblies listed for use in work surfaces or listed for use in countertops

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception No. 1, or appliances occupying assigned spaces shall not be considered as these required outlets.

**Informational Note No. 1:** See 406.5(E) for installation of receptacles in countertops and 406.5(F) for installation of receptacles in work surfaces. See 380.10 for installation of multioutlet assemblies.

**Informational Note No. 2:** See Informative Annex J and ANSI/ICC A117.1-2009, Standard on Accessible and Usable Buildings and Facilities, for additional information.

**(CHANGE) 210.52 (G) Basements, Garages, and Accessory Buildings.** For one- and two-family dwellings, and multifamily dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G)(1) through (G)(3). These receptacles shall be in addition to receptacles required for specific equipment. Receptacles supplying only a permanently installed premises security system shall not be considered as meeting these



requirements.

(1) Garages. In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (51/2 ft) above the floor.

**Exception:** Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.

(2) Accessory Buildings. In each accessory building with electric power.

(3) Basements. In each separate unfinished portion of a basement.

**(CHANGE) 210.62 Show Windows.** At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed within 450 mm (18 in.) of the top of each show window. No point along the top of the window shall be farther than 1.8 m (6 ft) from a receptacle outlet.

**(CHANGE) 215.1 Scope.** This article covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders not over 1000 volts ac or 1500 volts dc, nominal.

**Informational Note:** See Part III of Article 235 for feeders over 1000 volts ac or 1500 volts dc.

**(CHANGE) 215.2 Minimum Rating and Size. (A) General.** Feeder conductors shall have an ampacity not less than the larger of 215.2(A)(1) or (A)(2) and shall comply with 110.14(C).

**(NEW) 215.2 (A) (1) Continuous and Noncontinuous Loads.** Where a feeder supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum feeder conductor size shall have an ampacity not less than the noncontinuous load plus 125 percent of the continuous load.

**Exception No. 1:** If the assembly, including the overcurrent devices protecting the feeder(s), is listed for operation at 100 percent of its rating, the ampacity of the feeder conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.

**Exception No. 2:** Where a portion of a feeder is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an ampacity not less than the sum of the continuous load plus the noncontinuous load. No portion of a feeder installed under this exception shall extend into an enclosure containing either the feeder supply or the feeder load terminations, as covered in 110.14(C)(1).

**Exception No. 3:** Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.



## Exam Questions

60. What type of protection are branch circuits required to have in areas designed for use exclusively as sleeping quarters in fire stations, police stations, ambulance stations, rescue stations, ranger stations, and similar locations?

- AFCI
- GFCI
- Inverse time circuit breaker
- Intermittent duty circuit breaker

61. In general, how far can you move a single family dwelling electrical panel and still be exempt from updating all AFCI required circuits to the codes most current requirements?

- 3 ft
- 5 ft
- 4 ft
- 6 ft

62. What NFPA publication is dedicated to the life safety code?

- NFPA 98
- NFPA 70
- NFPA 70E
- NFPA 101

63. Branch-circuit conductors for circuits not exceeding 1000 volts ac or 1500 volts dc shall be sized in accordance with what section(s)?

- 210.3
- 220.6
- 210.19(A) through (D)
- 215.3(B) through (D)

64. What section(s) is a 10-ampere branch circuit required to comply with?

- 220.23(A)(1) or (A)(2)
- 210.22(A)(2) and (A)(4)
- 210.23(A)(1) and (A)(2)
- 210.23(A)(1) or (A)(2)

65. What does the code consider as acceptable for a 10-ampere branch circuit to supply?

- A gas fireplace unit supplied by an individual branch circuit
- Dwelling unit exhaust fans on bathroom or laundry room lighting circuits
- Lighting outlets
- All listed answers

66. What is a 10-ampere branch circuit not allowed to supply?

- Receptacle outlets
- Laundry equipment
- Garage door openers
- All listed answers

67. At what maximum height is a countertop or work surface receptacle required to be installed when called for?

- 24 inches
- 18 inches
- 20 inches
- There are no height requirements

68. How many receptacles are required to be installed in a 3-car garage?

- 1
- 2
- 3
- 4

69. How many 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlets are required to be installed within 18 inches of the top of each show window?

- 1
- 2
- 3
- 4

70. What part of Article 235 should be referenced for feeders over 1000 volts ac or 1500 volts dc?

- Part II
- Part III
- Part IV
- Part V

71. At what percentage are grounded conductors that are not connected to an overcurrent device permitted to be sized at for continuous and noncontinuous load?

- 100%
- 125%
- 150%
- 60%

**(NEW) 215.2 (A) (2) Ampacity Adjustment or Correction Factors.** The minimum feeder conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.14.

**Informational Note No. 1:** See Informative Annex D for Examples D1 through D11.

**Informational Note No. 2:** Conductors for feeders, as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting



loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, will provide reasonable efficiency of operation.

**Informational Note No. 3:** See 210.19, Informational Note for voltage drop for branch circuits.

**(NEW) 215.15 Barriers.** Barriers shall be placed such that no energized, uninsulated, ungrounded busbar or terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations in panelboards, switchboards, switchgear, or motor control centers supplied by feeder taps in 240.21(B) or transformer secondary conductors in 240.21(C) when the disconnecting device, to which the tap conductors are terminated, is in the open position.

**(NEW) 215.18 Surge Protection. (A) Surge-Protective Device.** Where a feeder supplies any of the following, a surge-protective device (SPD) shall be installed:

- (1) Dwelling units
- (2) Dormitory units
- (3) Guest rooms and guest suites of hotels and motels
- (4) Areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms

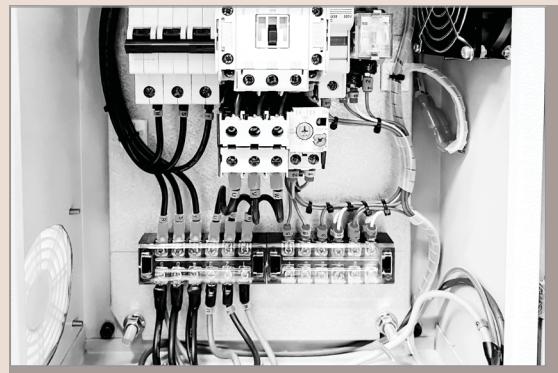
**(NEW) 215.18 Surge Protection. (B) Location.** The SPD shall be installed in or adjacent to distribution equipment, connected to the load side of the feeder, that contains branch circuit overcurrent protective device(s) that supply the locations specified in 215.18(A).

**Informational Note:** Surge protection is most effective when closest to the branch circuit. Surges can be generated from multiple sources including, but not limited to, lightning, the electric utility, or utilization equipment.

**(NEW) 215.18 (C) Type.** The SPD shall be a Type 1 or Type 2 SPD.

**(NEW) 215.18 (D) Replacement.** Where the distribution equipment supplied by the feeder is replaced, all of the requirements of this section shall apply.

**(NEW) 215.18 (E) Ratings.** SPDs shall have a nominal discharge current rating ( $I_{n}$ ) of not less than 10kA.



**(CHANGE) 220.1 Scope.** This article provides requirements for calculating branch-circuit, feeder, and service loads. Part I provides general requirements for calculation methods. Part II provides calculation methods for branch-circuit loads. Part III and Part IV provide calculation methods for feeder and service loads. Part V provides calculation methods for farm loads. Part VI provides calculation methods for health care facilities. Part VII provides calculation methods for marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities.

**Informational Note No. 1:** See Informative Annex D for examples.

**Informational Note No. 2:** See Informational Note Figure 220.1 for information on the organization of this article.

**(NEW) 220.5 (C) Floor Area.** The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches or unfinished areas not adaptable for future use as a habitable room or occupiable space.

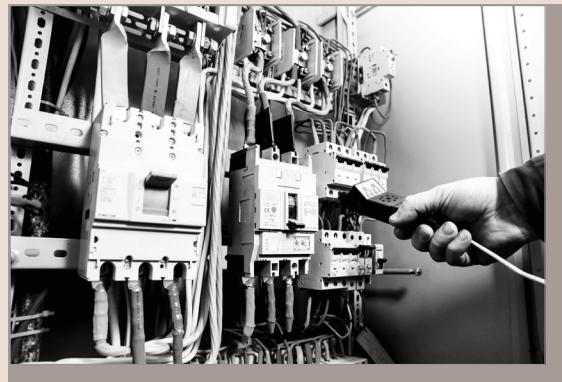
**(CHANGE) 220.10 General.** Branch-circuit loads shall be calculated in accordance with the following sections:

- (1) 220.14 for other loads – all occupancies
- (2) 220.16 for additions to existing installations
- (3) 220.41 for dwelling units

- (4) 220.42 for lighting loads for non-dwelling occupancies
- (5) 220.44 for hotel and motel occupancies

**(NEW) 220.11 Maximum Load.** The total load on a branch circuit shall not exceed the rating of the branch circuit nor the maximum loads specified in 220.11(A) through (C) under the conditions specified therein.

**(NEW) 220.11 (A) Motor-Operated and Combination Loads.** Where a circuit supplies only motor-operated loads, the conductor sizing requirement specified in 430.22 shall apply. Where a circuit supplies only air-conditioning equipment, refrigerating equipment, or both, the requirements of 440.6 shall apply. For circuits supplying loads consisting of motor-operated utilization equipment that is fastened in place and has a motor larger than 1/8 hp in combination with other loads, the total calculated load shall be based on 125 percent of the largest motor load plus the sum of the other loads in accordance with 430.24.



**(NEW) 220.11 (B) Inductive and LED Lighting Loads.** For circuits supplying lighting units that have ballasts, transformers, autotransformers, or LED drivers, the calculated load shall be based on the total ampere ratings of such units and not on the total watts of the lamps.

**(NEW) 220.11 (C) Electric Cooking Appliances.** Applying demand factors for ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliance loads in excess of 1 3/4 kW shall be permitted in accordance with Table 220.55, including Notes 4, 5, and 6.

**(NEW) 220.14 (J) Receptacle Outlets in Office Buildings.** In office buildings, the receptacle loads shall be calculated to be the larger of the following:

- (1) The calculated load from 220.14(l)
- (2) 11 volt-amperes/m<sup>2</sup> (1 volt-ampere/ft<sup>2</sup>)

**(CHANGE) 220.40 General.** The calculated load of a feeder or service shall not be less than the sum of the loads on the branch circuits supplied, as determined by Part II of this article, after any applicable demand factors permitted or required by Part III, IV, V, VI, or VII have been applied.



**Informational Note No. 1:** See Informative Annex D, Examples D1(a) through D10, for examples of feeder and service load calculations.

**Informational Note No. 2:** See 220.11(B) for the maximum load in amperes permitted for lighting units operating at less than 100 percent power factor.

**(CHANGE) 220.41 Dwelling Units, Minimum Unit Load.** In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 33 volt-amperes/m<sup>2</sup> (3 volt-amperes/ft<sup>2</sup>). Unit loads include the following lighting and receptacle outlets, and no additional load calculations shall be required:

- (1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits specified in 210.11(C)(3) and (C)(4)
- (2) The receptacle outlets specified in 210.52(E) and (G)
- (3) The lighting outlets specified in 210.70

The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.5(C) for dwelling occupancies. Motors rated less than 1/8 hp and connected to a lighting circuit shall be considered part of the minimum lighting load.

## Exam Questions

**72. What annex has examples of ampacity adjustment or correction factors for feeders?**

- A. A
- B. J
- C. D
- D. C

**73. Why are barriers required to be placed around energized, uninsulated, ungrounded busbar or terminals?**

- A. To prevent dust
- B. To prevent inadvertent contact by persons or maintenance equipment
- C. To prevent heat buildup
- D. To control air flow

**74. With regards to feeders, how many areas does the code call for an SPD to be installed?**

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

**75. When is surge protection most effective?**

- A. When closest to the load
- B. When furthest from the branch circuit
- C. When closest to the branch circuit
- D. When furthest from the load

**76. What type of SPD is installed on feeders?**

- A. Type III SPD
- B. Type 1 or type 2 SPD
- C. Type 9 SPD
- D. Fast acting SPD

**77. What is an SPD's minimum nominal discharge current rating required to be?**

- A. 5kA
- B. 15kA
- C. 10kA
- D. 20kA

**78. What does Article 220 cover?**

- A. The requirements for calculating feeders
- B. The requirements for calculating branch-circuits
- C. The requirements for calculating service loads
- D. All listed answers

**79. In general, how is the floor area required to be calculated?**

- A. Using the spearman rank order correlation coefficient
- B. It is calculated from the inside dimensions of the dwelling
- C. It is calculated from the centerline dimensions of the dwelling
- D. It is calculated from the outside dimensions of the dwelling

**80. What code section is required to be used to calculate the branch circuit loads for hotel and motel occupancies?**

- A. 220.42
- B. 220.16
- C. 220.44
- D. 220.41

**81. The total load on a branch circuit shall not exceed the rating of the branch circuit nor the maximum loads specified in \_\_\_\_\_.**

- A. 220.42
- B. 220.11(A) through (C)
- C. 220.44
- D. 220.16(C) through (E)

**82. What section is used to determine inductive and LED lighting loads?**

- A. 220.11(B)
- B. 430.22
- C. 220.55
- D. 220.56

**83. What table is required to be used when applying demand factors for ranges, wall-mounted ovens, counter-mounted cooking units more than 1 3/4 kW?**

- A. 220.56
- B. 430.22
- C. 221.55
- D. 220.55

**84. What annex has examples of feeder and service load calculations?**

- A. B
- B. A
- C. D
- D. C

**85. What are motors rated less than 1/8 hp and connected to a lighting circuit considered?**

- A. Part of the minimum receptacle load
- B. Part of the maximum lighting load
- C. Part of the minimum lighting load
- D. Part of the maximum receptacle load

**(NEW) 220.50(B) Air-Conditioning Equipment.** The conductor sizing requirements specified in Part IV of Article 440 shall be used to determine air-conditioning loads for hermetic refrigerant motor-compressors.

**(NEW) 220.57 Electric Vehicle Supply Equipment (EVSE) Load.** The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger.

**(NEW) 220.61 (B) (1) Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Dryers.** A feeder or service supplying household electric ranges, wall-mounted ovens, counter-mounted cooking units, and electric dryers, where the maximum unbalanced load has been determined in accordance with Table 220.55 for ranges and Table 220.54 for dryers.

**(NEW) 220.61 (B) (2) Unbalanced Load in Excess of 200 Amperes.** That portion of the unbalanced load in excess of 200 amperes where the feeder or service is supplied from a 3-wire dc or single-phase ac system; a 4-wire, 3-phase system; a 3-wire, 2-phase system; or a 5-wire, 2-phase system.

**Informational Note:** See Informative Annex D, Examples D1(a), D1(b), D2(b), D4(a), and D5(a) for examples of unbalanced feeder or service neutral loads.

**(NEW) 220.70 Energy Management Systems (EMSSs).** If an energy management system (EMS) is used to limit the current to a feeder or service in accordance with 750.30, a single value equal to the maximum ampere setpoint of the EMS shall be permitted to be used in load calculations for the feeder or service. The setpoint value of the EMS shall be considered a continuous load for the purposes of load calculations.

**(NEW) 220.110 Receptacle Loads.** Receptacle loads calculated in accordance with 220.14(H) and (I) and supplied by branch circuits not exceeding 150 volts to ground shall be permitted to be subjected to the demand factors provided in Table 220.110(1) and Table 220.110(2) for health care facilities.



**Informational Note No. 1:** See Article 100 for the definitions of patient care space categories.

**Informational Note No. 2:** See 220.14(I) for the calculation of receptacle outlet loads.

**(NEW) 220.120 Receptacle Loads.** General lighting and other loads in marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities shall be calculated in accordance with Part III of this article and, in addition, the demand factors set forth in Table 220.120 shall be permitted for each service or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in Notes (1) and (2) of Table 220.120. Where demand factors of Table 220.120 are applied, the demand factor specified in 220.61(B) shall not be permitted.

**Informational Note:** These demand factors could be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

**(NEW) 225.1 Scope.** This article covers requirements for outside branch circuits and feeders not over 1000 volts ac or 1500 volts dc, nominal, run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles.

**Informational Note:** See Part IV of Article 235 for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc.

**(CHANGE) 225.6 Conductor Size and Support. (A) Overhead Spans.** Open individual conductors shall not be smaller than 10 AWG copper or 8 AWG aluminum for spans up to 15 m (50 ft) in length, and 8 AWG copper or 6 AWG aluminum for a longer span unless supported by a messenger wire.

**(CHANGE) 225.27 Raceway Seal.** Where a raceway enters a building or structure from outside, it shall be sealed in accordance with 300.5(G) and 300.7(A). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

**(NEW) 225.41 Emergency Disconnects.** For one-and two-family dwelling units, an emergency disconnecting means shall be installed (A) General.

(1) Location. The disconnecting means shall be installed in a readily accessible outdoor location on or within sight of the dwelling unit.

(2) Rating. The disconnecting means shall have a short-circuit current rating equal to or greater than the available fault current.

(3) Grouping. If more than one disconnecting means is provided, they shall be grouped.

**(NEW) 225.41 (B) Identification of Other Isolation Disconnects.** Where equipment for isolation of other energy source systems is not located adjacent to the emergency disconnect required by this section, a plaque or directory identifying the location of all equipment for isolation of other energy sources shall be located adjacent to the disconnecting means required by this section.

**Informational Note:** See 445.18, 480.7, 705.20, and 706.15 for examples of other energy source system isolation means.

**(NEW) 225.41 (C) Marking.** The disconnecting means shall be marked as EMERGENCY DISCONNECT. Markings shall comply with 110.21(B) and all of the following:

(1) The marking or labels shall be located on the outside front of the disconnect enclosure with red background and white text.

(2) The letters shall be least 13 mm (1/2 in.) high.

**(NEW) 225.42 Surge Protection. (A) Surge-Protective Device.** Where a feeder supplies any of the following, a surge-protective device (SPD) shall be installed:

(1) Dwelling units

(2) Dormitory units

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

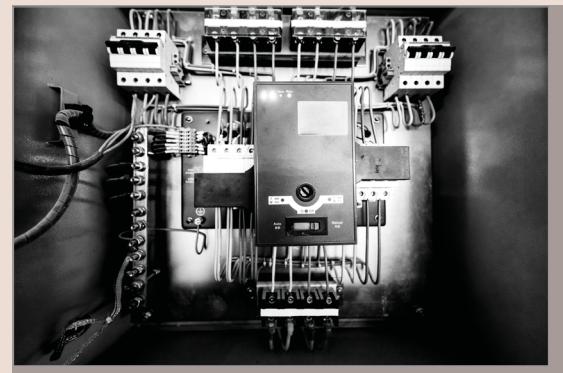
(4) Areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms

**(NEW) 225.42 (B) Location.** The SPD shall be installed in or adjacent to the distribution equipment that is connected to the load side of the feeder and contains branch circuit overcurrent protective device(s) that supply the location specified in 225.42(A).

**Informational Note:** Surge protection is most effective when closest to the branch circuit. Surges can be generated from multiple sources including, but not limited to, lightning, the electric utility, or utilization equipment.

**(NEW) 225.42 (C) Type.** The SPD shall be a Type 1 or Type 2 SPD.

**(NEW) 225.42 (D) Replacement.** Where the distribution equipment supplied by the feeder is replaced, all of the requirements of this section shall apply.



## Exam Questions

86. The conductor sizing requirements specified in \_\_\_\_\_ of Article 440 is required to be used to determine air-conditioning loads for hermetic refrigerant motor-compressors.

- Part VI
- Part I
- Part IV
- Part V

87. What table is used to determine the maximum unbalanced load for dryers?

- 220.56
- 220.55
- 221.55
- 220.54

88. What Annex has examples of unbalanced feeder or service neutral loads?

- D
- A
- B
- C

89. For the purposes of load calculations, what type of load is an EMS system considered?

- An intermittent duty load
- A continuous load
- A neutral load
- A back up load

90. What section is used for the calculation of receptacle outlet loads?

- 221.55
- 220.55
- 220.14(I)
- 220.56

91. What part of Article 220 are general lighting and other loads in marinas, boatyards, floating buildings, and commercial and noncommercial docking facilities required to be calculated in accordance with?

- Part II
- Part III
- Part IV
- Part V

92. What part of Article 235 is used for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc?

- Part III
- Part II
- Part IV
- Part V

93. What is the minimum size aluminum overhead open individual conductor that can be used for spans up to 50 ft in length?

- 10 AWG
- 6 AWG
- 8 AWG
- 12 AWG

94. What does the code require for spare or unused raceways?

- Install a pull string
- They are identified
- They are sealed
- All listed answers

95. What section(s) in the code have examples of other energy source system isolation means?

- 705.20
- 445.18
- 480.7
- All listed answers

96. How tall do the letters that mark an emergency disconnect need to be?

- 1/4 inch
- 1/2 inch
- 3/4 inch
- 1 inch

97. With regards to outside branch circuits and feeders, how many areas does the code require an SPD to be installed for feeders?

- 2
- 3
- 5
- 4

98. When is surge protection most effective when installed on outside branch circuits or feeders???

- When furthest from the branch circuit
- When closest to the branch circuit
- When closest to the load
- When furthest from the load

99. What type of SPD is installed on outdoor feeders?

- Type III SPD
- Type 1 or type 2 SPD
- Type 9 SPD
- Fast acting SPD

**(NEW) 225.42 (E) Ratings.** SPDs shall have a nominal discharge current rating ( $I_{n}$ ) of not less than 10kA.

**Informational Note:** Lead lengths of conductors to the SPD should be kept as short as possible to reduce let-through voltages.

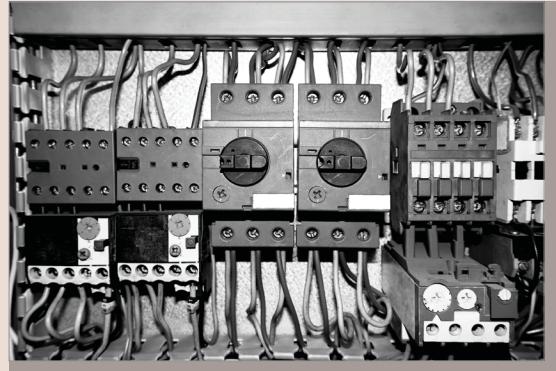
**(CHANGE) 230.1 Scope.** This article covers service conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements.

**Informational Note No. 1:** See Informational Note Figure 230.1.

**(CHANGE) 230.7 Other Conductors.** Circuit conductors other than service conductors, shall not be installed in the same raceway, cable, handhole enclosure, or underground box as the service conductors.

**Exception No. 1:** Grounding electrode conductors or supply side bonding jumpers or conductors shall be permitted within service raceways.

**Exception No. 2:** Load management control conductors having overcurrent protection shall be permitted within service raceways.



**(CHANGE) 230.23 Size and Ampacity(A) General.** Conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Parts II through V of Article 220 and shall have adequate mechanical strength.

**(CHANGE) 230.31 Size and Ampacity. (A) General.** Underground service conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Parts II through V of Article 220.

**(NEW) 230.42 Minimum Size and Ampacity (A)(1) Continuous and Noncontinuous Loads.** Where the service-entrance conductors supply continuous loads or any combination of noncontinuous and continuous loads, the minimum service-entrance conductor size shall have an ampacity not less than the sum of the noncontinuous loads plus 125 percent of continuous loads.

**Exception No. 1:** Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the sum of the continuous and noncontinuous load.

**Exception No. 2:** The sum of the noncontinuous load and the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating shall be permitted.

**(NEW) 230.42 Minimum Size and Ampacity (A)(2) Application of Adjustment or Correction Factors.** The minimum service-entrance conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

**(CHANGE) 230.67 Surge Protection. (A) Surge-Protective Device.** All services supplying the following occupancies shall be provided with a surge-protective device (SPD):

- Dwelling units
- Dormitory units
- Guest rooms and guest suites of hotels and motels

(4) Areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms

**Informational Note:** See 517.10(B)(2).

**(CHANGE) 230.71 Maximum Number of Disconnects. (B) Two to Six Service Disconnecting Means.** Two to six service disconnects shall be permitted for each service permitted by 230.2 or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:

(1) Separate enclosures with a main service disconnecting means in each enclosure

(2) Panelboards with a main service disconnecting means in each panelboard enclosure

(3) Switchboard(s) where there is only one service disconnect in each separate vertical section with barriers provided between each vertical section to maintain the inadvertent contact protection required in 230.62 based on access from the adjacent section(s)

(4) Service disconnects in switchgear, transfer switches, or metering centers where each disconnect is located in a separate compartment



(5) Metering centers with a main service disconnecting means in each metering center

(6) Motor control center(s) where there is only one service disconnect in a motor control center unit and a maximum of two service disconnects provided in a single motor control center with barriers provided between each motor control center unit or compartment containing a service disconnect to maintain the inadvertent contact protection required in 230.62 based on access from adjacent motor control center unit(s) or compartment(s)

**Exception to (2), (3), (4), (5), and (6):** Existing service equipment, installed in compliance with previous editions of this Code that permitted multiple service disconnecting means in a single enclosure, section, or compartment, shall be permitted to contain a maximum of six service disconnecting means.

**Informational Note No. 1:** See UL 67, Standard for Panelboards, for information on metering centers.

**Informational Note No. 2:** Examples of separate enclosures with a main service disconnecting means in each enclosure include but are not limited to motor control centers, fused disconnects, and circuit breaker enclosures.

**Informational Note No. 3:** Transfer switches are provided with one service disconnect or multiple service disconnects in separate compartments.

**(CHANGE) 230.85 Emergency Disconnects.** For one- and two-family dwelling units, an emergency disconnecting means shall be installed.

**(NEW) 230.85 (A)(1) Location.** The disconnecting means shall be installed in a readily accessible outdoor location on or within sight of the dwelling unit.

Exception: Where the requirements of 225.41 are met, this section shall not apply.

(2) Rating. The disconnecting means shall have a short-circuit current rating equal to or greater than the available fault current.

(3) Grouping. If more than one disconnecting means is provided, they shall be grouped.

**(NEW) 230.85 (B) Disconnects.** Each disconnect shall be one of the following:

(1) Service disconnect

(2) A meter disconnect integral to the meter mounting equipment not marked as suitable only for use as service equipment installed in accordance with 230.82

(3) Other listed disconnect switch or circuit breaker that is marked suitable for use as service equipment, but not

marked as suitable only for use as service equipment, installed on the supply side of each service disconnect  
**Informational Note 1:** Conductors between the emergency disconnect and the service disconnect in 230.85(2) and 230.85(3) are service conductors.

**Informational Note 2:** Equipment marked “Suitable only for use as service equipment” includes the factory marking “Service Disconnect”.

## Exam Questions

**100. What is an SPD's minimum nominal discharge current rating required to be when installed on outside branch circuits or feeders?**

- A. 5kA
- B. 15kA
- C. 10kA
- D. 20kA

**101. What does Article 230 cover?**

- A. Article 230 covers branch circuit conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements
- B. Article 230 covers service conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements
- C. Article 230 covers motor conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements
- D. Article 230 covers transformer conductors and equipment for control and protection of services not over 1000 volts ac or 1500 volts dc, nominal and their installation requirements

**102. At what percentage are grounded conductors that are not connected to an overcurrent device permitted to be sized at?**

- A. 100 percent of the sum of the continuous load
- B. 125 percent of the sum of the continuous and noncontinuous load
- C. 100 percent of the sum of the continuous and noncontinuous load
- D. 125 percent of the sum of the noncontinuous load

**103. The minimum service-entrance conductor size shall have an \_\_\_\_\_ not less than the maximum load to be served after the application of any adjustment or correction factors.**

- A. Voltage
- B. Ampacity
- C. Wattage
- D. Power factor

**104. How many areas does the code require an SPD to be installed for services?**

- A. 5
- B. 3
- C. 4
- D. 2

**105. What are examples of separate enclosures with a main service disconnecting means in each enclosure?**

- A. Circuit breaker enclosures
- B. Motor control centers
- C. Fused disconnects
- D. All listed answers

**106. What type of location is the emergency disconnect for one- and two-family dwelling units required to be installed?**

- A. Readily accessible indoor location
- B. An accessible outdoor location
- C. Readily accessible outdoor location
- D. An accessible indoor location

**107. Each emergency disconnect for one- and two-family dwelling units is required to be which of the following?**

- A. Service disconnect
- B. Other listed disconnect switch or circuit breaker that is marked suitable for use as service equipment, but not marked as suitable only for use as service equipment, installed on the supply side of each service disconnect
- C. A meter disconnect integral to the meter mounting equipment not marked as suitable only for use as service equipment installed in accordance with 230.82
- D. All listed answers

**(NEW) 230.85 (C) Replacement.** Where service equipment is replaced, all of the requirements of this section shall apply.

**Exception:** Where only meter sockets, service entrance conductors, or related raceways and fittings are replaced, the requirements of this section shall not apply.

**(NEW) 230.85 (D) Identification of Other Isolation Disconnects.** Where equipment for isolation of other energy source systems is not located adjacent to the emergency disconnect required by this section, a plaque or directory identifying the location of all equipment for isolation of other energy sources shall be located adjacent to the disconnecting means required by this section.

Informational Note: See 445.18, 480.7, 705.20, and 706.15 for examples of other energy source system isolation means.

**(NEW) 230.85 (E) (1) Marking Text.** The disconnecting means shall be marked as follows:

(1) Service disconnect

EMERGENCY DISCONNECT, SERVICE DISCONNECT

(2) Meter disconnects installed in accordance with 230.82(3) and marked as follows:

EMERGENCY DISCONNECT, METER DISCONNECT, NOT SERVICE EQUIPMENT

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are marked suitable for use as service equipment and marked as follows: EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT

**(NEW) 230.85 (E)(2) Marking Location and Size.**

Markings shall comply with 110.21(B) and both of the following:

(1) The marking or labels shall be located on the outside front of the disconnect enclosure with red background and white text.

(2) The letters shall be at least 13 mm (1/2 in.) high.

**(CHANGE) 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.

**Informational Note No. 1:** Overcurrent protection for conductors and equipment is provided to open the circuit if the current reaches a value that will cause an excessive or dangerous temperature in conductors or conductor insulation.



**Informational Note No. 2:** See 110.9 for requirements for interrupting ratings and 110.10 for requirements for protection against fault currents.

**(NEW) 240.2 Reconditioned Equipment. (A) Reconditioning Not Permitted.** The following equipment shall not be reconditioned:

- (1) Equipment providing ground-fault protection of equipment
- (2) Ground-fault circuit interrupters
- (3) Low-voltage fuseholders and low-voltage nonrenewable fuses
- (4) Molded-case circuit breakers
- (5) Low-voltage power circuit breaker electronic trip units.

**(NEW) 240.2(B) Reconditioning Permitted.** The following equipment shall be permitted to be reconditioned:

- (1) Low-voltage power circuit breakers
- (2) Electromechanical protective relays and current transformers

Reconditioned equipment shall be listed as reconditioned and comply with 110.21(A)(2).

**(NEW) 240.4(D)(3). 14 AWG Copper-Clad Aluminum.** 10 amperes, provided all the following conditions are met:

- (1) Continuous loads do not exceed 8 amperes
- (2) Overcurrent protection is provided by one of the following:

- a. Branch-circuit-rated circuit breakers are listed and marked for use with 14 AWG copper-clad aluminum conductor.
- b. Branch-circuit-rated fuses are listed and marked for use with 14 AWG copper-clad aluminum conductor.

**(NEW) 240.4 (H) Dwelling Unit Service and Feeder Conductors.** Dwelling unit service and feeder conductors shall be permitted to be protected against overcurrent at the ampacity values in 310.12.

**(NEW) 240.6 (D) Remotely Accessible Adjustable-Trip Circuit Breakers.** A circuit breaker(s) that can be adjusted remotely to modify the adjusting means shall be permitted to have an ampere rating(s) that is equal to the adjusted current setting (long-time pickup setting). Remote access shall be achieved by one of the following methods:

- (1) Connected directly through a local nonnetworked interface.
- (2) Connected through a networked interface complying with one of the following methods:
  - a. The circuit breaker and associated software for adjusting the settings are identified as being evaluated for cybersecurity.
  - b. A cybersecurity assessment of the network is completed. Documentation of the assessment and certification shall be made available to those authorized to inspect, operate, and maintain the system.

**Informational Note No. 1:** See ANSI/ISA 62443, Cybersecurity Standards series, UL 2900 Cybersecurity Standard series, or the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1 for assessment requirements.

**Informational Note No. 2:** Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

- (1) The ISA Security Compliance Institute (ISCI) conformity assessment program
- (2) Certification of compliance by a nationally recognized test laboratory
- (3) Manufacturer certification for the specific type and brand of system provided

**Informational Note No. 3:** Cybersecurity is a specialized field requiring constant, vigilant attention to security vulnerabilities that could arise due to software defects, system configuration changes, or user interactions. Installation of devices that can be secured is an important first step but not sufficient to guarantee a secure system.

**(NEW) 240.7 Listing Requirements.** The following shall be listed:

- (1) Branch-circuit overcurrent protective devices
- (2) Relays and circuit breakers providing ground-fault protection of equipment
- (3) Ground-fault circuit interrupter devices

**(NEW) 240.11 Selective Coordination.** If one or more feeder overcurrent protective devices are required to be selectively coordinated with a service overcurrent protective device by other requirements in this Code, all feeder overcurrent protective devices supplied directly by the service overcurrent protective device shall be selectively coordinated with the service overcurrent protective device.

**(NEW) 240.16 Interrupting Ratings.** Branch-circuit overcurrent protective devices shall have an interrupting rating no less than 5000 amperes.

**(CHANGE) 240.21 Location in Circuit. (C) Transformer Secondary Conductors.** A set of conductors feeding a single load, or each set of conductors feeding separate loads, shall be permitted to be connected to a transformer secondary, without overcurrent protection at the secondary, as specified in 240.21(C)(1) through (C)(6). Section 240.4(B) shall not be permitted for transformer secondary conductors.



**Informational Note:** See 450.3 for overcurrent protection requirements for transformers.

**(CHANGE) 240.24 (A) Accessibility.** Circuit breakers and switches containing fuses shall be readily accessible and installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, unless one of the following applies:

- (1) For busways, as provided in 368.17(C).
- (2) For supplementary overcurrent protection, as described in 240.10.
- (3) For overcurrent protective devices, as described in 225.40 and 230.92.
- (4) For overcurrent protective devices adjacent to utilization equipment that they supply, access shall be permitted to be by portable means.

**Exception:** The use of a tool shall be permitted to access overcurrent protective devices located within listed industrial control panels, within enclosures designed for hazardous (classified) locations or enclosures to protect against environmental conditions. An enclosure within the scope of this exception, and all overcurrent protective device(s) within such enclosures as judged with the enclosure open, shall comply with the accessibility provisions of 240.24(A).

## Exam Questions

**108. What section would apply if service equipment is replaced?**

- A. 220.15
- B. 230.85
- C. 215.20
- D. 240

**109. How many sections of the code list examples of other energy source system isolation means?**

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

## Exam Questions

**110. How is an emergency service disconnect required to be marked?**

- A. EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT
- B. EMERGENCY DISCONNECT, METER DISCONNECT, NOT SERVICE EQUIPMENT
- C. EMERGENCY DISCONNECT, SERVICE DISCONNECT
- D. All listed answers

**111. What minimum size height are the letters required to be when labeling an emergency disconnect?**

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

**112. What part(s) of article 240 provide the general requirements for overcurrent protection and overcurrent protective devices not more than 1000 volts, nominal?**

- A. VIII
- B. I through VII
- C. X
- D. VIII through IX

**113. Article 240 lists where reconditioned equipment is not permitted. How many equipment items are listed?**

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

**114. How many items does Article 240 list where reconditioned equipment is permitted?**

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

**115. In general, if all conditions are met, how many amperes is 14 AWG copper-clad aluminum rated for?**

- A. 8 amperes
- B. 10 amperes
- C. 12 amperes
- D. 6 amperes

**116. What section has the ampacity values where dwelling unit service and feeder conductors are permitted to be protected against overcurrent?**

- A. 240.4(B)
- B. 240.21(C)(1)
- C. 310.12
- D. 450.3

**117. What does UL 2900 cover?**

- A. NIST Framework for Improving critical infrastructure cybersecurity
- B. The ISA security compliance institute (ISCI) conformity assessment program
- C. Cybersecurity standard series
- D. Critical infrastructure cybersecurity

**118. What does Article 240 require to be listed?**

- A. Branch-circuit overcurrent protective devices
- B. Ground-fault circuit interrupter devices
- C. Relays and circuit breakers providing ground-fault protection of equipment
- D. All listed answers

**119. What section in Article 240 covers selective coordination?**

- A. 240.11
- B. 240.16
- C. 240.89
- D. 240.24

**120. What is the minimum branch-circuit overcurrent protective devices interrupting rating required to be?**

- A. 3000 amperes
- B. 5000 amperes
- C. 10000 amperes
- D. 50000 amperes

**121. What section has the overcurrent protection requirements for transformers?**

- A. 450.3
- B. 450.8
- C. 450.23
- D. 450.31

**122. At what maximum height is the operating handle of a circuit breaker required to be when at its highest position above grade?**

- A. 6 ft
- B. 5 ft 7 inches
- C. 5 ft
- D. 6 ft 7 inches

**(NEW) 240.89 Replacement Trip Units.** Replacement trip units shall be listed for use with the circuit breaker type in which it is installed.

**Informational Note:** The replacement trip unit can be a listed unit identical to the original or a different trip unit listed for use with the specific circuit breaker.

**(NEW) 242.2 Reconditioned Equipment.** SPDs and surge arresters shall not be reconditioned.

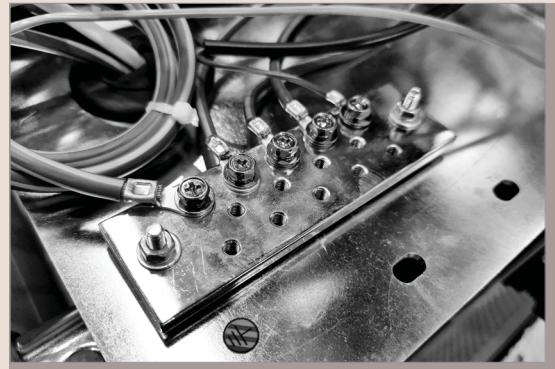
**(NEW) 242.9 Indicating.** An SPD shall provide indication that it is functioning properly.

**(CHANGE) 242.28 Conductor Size.** SPD line conductors and conductors to ground shall not be smaller than 14 AWG copper or 12 AWG aluminum.

**(CHANGE) 242.42 Surge Arrester Rating.** The duty cycle rating of a surge arrester shall be not less than 125 percent of the maximum continuous operating voltage available at the point of application.

For solidly grounded systems, the maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

For impedance or ungrounded systems, the maximum continuous operating voltage shall be the phase-to-phase voltage of the system.



**Informational Note No. 1:** See IEEE C62.11-2020, Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV), and IEEE C62.22-2009, Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems, for further information on surge arresters.

**Informational Note No. 2:** The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

**(NEW) 245.1 Scope.** This article covers overcurrent protection requirements for systems over 1000 volts ac, 1500 volts dc, nominal.

**(NEW) 245.2(A) Reconditioned Equipment Permitted.** The following reconditioned equipment shall be permitted:

- (1) Medium- and high-voltage circuit breakers
- (2) Electromechanical protective relays and current transformers

**(NEW) 245.2 (B) Reconditioned Equipment Not Permitted.** Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted.

**(NEW) 250.24(B) Load-Side Grounding Connections.** A grounded conductor shall not be connected to normally non-current-carrying metal parts of equipment, to equipment grounding conductor(s), or be reconnected to ground on the load side of the service disconnecting means except as otherwise permitted in this article.

**Informational Note:** See 250.30 for separately derived systems, 250.32 for connections at separate buildings or

structures, and 250.142 for use of the grounded circuit conductor for grounding equipment.

**(NEW) 250.64 (G) Enclosures with Ventilation Openings.** Grounding electrode conductors shall not be installed through a ventilation opening of an enclosure.

**(NEW) 250.70 (A) General.** The grounding or bonding conductor shall be connected to the grounding electrode by exothermic welding, listed lugs, listed pressure connectors, listed clamps, or other listed means. Connections depending on solder shall not be used. Ground clamps shall be listed for the materials of the grounding electrode and the grounding electrode conductor and, if used on pipe, rod, or other buried electrodes, shall also be listed for direct soil burial or concrete encasement. Not more than one conductor shall be connected to the grounding electrode by a single clamp or fitting unless the clamp or fitting is listed for multiple conductors.

**(NEW) 250.70 (B) Indoor Communications Systems.** For indoor communications purposes only, a listed sheet metal strap-type ground clamp having a rigid metal base that seats on the electrode and having a strap of such material and dimensions that it is not likely to stretch during or after installation shall be permitted.

**Informational Note:** Listed ground clamps that are identified for direct burial are also suitable for concrete encasement.

**(NEW) 250.119 (A) General.** Unless required elsewhere in this Code, equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors of the wire type shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors.

**Exception No. 1:** Power-limited Class 2 or Class 3 cables, power-limited fire alarm cables, or communications cables containing only circuits operating at less than 50 volts ac or 60 volts dc if connected to equipment not required to be grounded shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

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

**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.

**(CHANGE) 300.9 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).

**(CHANGE) 300.15 (L) Manholes and Handhole Enclosures.** A box or conduit body shall not be required for conductors in manholes or handhole enclosures, except where connecting to electrical equipment. The installation shall comply with Part V of Article 110 for manholes, and 314.30 for handhole enclosures.

**(CHANGE) 300.22 Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums).** The requirements of this section shall apply to the installation and uses of



electrical wiring and equipment in ducts used for dust, loose stock, or vapor removal; ducts specifically fabricated for environmental air; and other spaces used for environmental air (plenums).

**Informational Note:** See Part VI of Article 424 for requirements on duct heaters.

**(NEW) 300.26 Remote-Control and Signaling Circuits Classification.** Remote-control and signaling circuits shall be classified as either power-limited or non-power-limited and comply with the following:

- (1) Class 1 power-limited remote-control and signaling circuits shall comply with 724.3.
- (2) Class 2 and Class 3 power-limited remote-control and signaling circuits shall comply with 725.3.
- (3) Non-power-limited remote-control and signaling circuits shall be installed in accordance with 300.2 through 300.25.

**(CHANGE) 305.5 Conductor Bending Radius.** The conductor shall not be bent to a radius less than 8 times the overall diameter for nonshielded conductors or 12 times the overall diameter for shielded or lead-covered conductors during or after installation. For multiconductor or multiplexed single-conductor cables having individually shielded conductors, the minimum bending radius shall be 12 times the diameter of the individually shielded conductors or 7 times the overall diameter, whichever is greater.

**(NEW) 305.1 Scope.** This article covers wiring methods and materials for systems rated over 1000 volts ac, 1500 volts dc, nominal.

**(CHANGE) 305.15 (F) Raceway Seal.** Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound to prevent the entrance of moisture.

**Informational Note:** Presence of hazardous gases or vapors might also necessitate sealing of underground conduits or raceways entering buildings.

## Exam Questions

**123. What section in Article 240 covers replacement trip units?**

- A. 240.24
- B. 240.16
- C. 240.21
- D. 240.89

**124. What does Article 240 require a surge arresters SPD's NOT to be?**

- A. Installed
- B. Reconditioned
- C. Isolated
- D. Protected

**125. A SPD is required to provide \_\_\_\_\_ that it is functioning properly.**

- A. Updates
- B. Indication
- C. Analysis
- D. All listed answers

**126. What is the minimum size copper SPD line conductors and conductors to ground permitted for usage?**

- A. 10 AWG
- B. 12 AWG
- C. 14 AWG
- D. 16 AWG

**127. What does Article 245 cover?**

- A. Article 245 covers overcurrent protection requirements for systems over 600 volts ac, 575 volts dc, nominal
- B. Article 245 covers overcurrent protection requirements for systems over 1500 volts ac, 1000 volts dc, nominal
- C. Article 245 covers overcurrent protection requirements for systems over 800 volts ac, 600 volts dc, nominal
- D. Article 245 covers overcurrent protection requirements for systems over 1000 volts ac, 1500 volts dc, nominal

128. How many items are listed where Article 245 allows reconditioned equipment?

- A. 2
- B. 3
- C. 5
- D. 4

129. How many items are listed where Article 245 does not permit reconditioned equipment?

- A. 2
- B. 3
- C. 5
- D. 4

130. What article should be referenced for grounding separately derived systems?

- A. 250.30
- B. 250.32
- C. 250.142
- D. 245.2

131. How is the grounding or bonding conductor required to be connected to the grounding electrode?

- A. Using listed clamps
- B. By exothermic welding
- C. Using listed lugs
- D. All listed answers

132. What is an example of a flexible cord with integral-type insulation?

- A. Type PT-2, 2 conductor
- B. Type ST-2, 3 conductor
- C. Type SRT-3, 2 conductor
- D. Type SPT-2, 2 conductor

133. What is the interior of a raceway considered when installed in a wet location above grade?

- A. Damp
- B. Dry
- C. Wet
- D. Encapsulated

134. Section 300.15(L) does not require a box or conduit body for conductors in manholes if the installation complies with what part of Article 110 for manholes?

- A. V
- B. IV
- C. X
- D. VI

135. What part of Article 424 has listed requirements for duct heaters?

- A. VI
- B. IV
- C. X
- D. V

136. Remote-control and signaling circuits are required to be classified as \_\_\_\_\_.

- A. Low voltage
- B. Power storage
- C. Automated
- D. Either power-limited or non-power-limited

137. What does Article 305 cover?

- A. Article 305 covers wiring methods and materials for systems rated over 1000 volts ac, 1000 volts dc, nominal
- B. Article 305 covers wiring methods and materials for systems rated over 1500 volts ac, 1500 volts dc, nominal
- C. Article 305 covers wiring methods and materials for systems rated over 1000 volts ac, 1500 volts dc, nominal
- D. Article 305 covers wiring methods and materials for systems rated over 600 volts ac, 575 volts dc, nominal

138. A conductor shall not be bent to a radius less than \_\_\_\_\_ the overall diameter for nonshielded conductors.

- A. 4 times
- B. 6 times
- C. 8 times
- D. 12 times

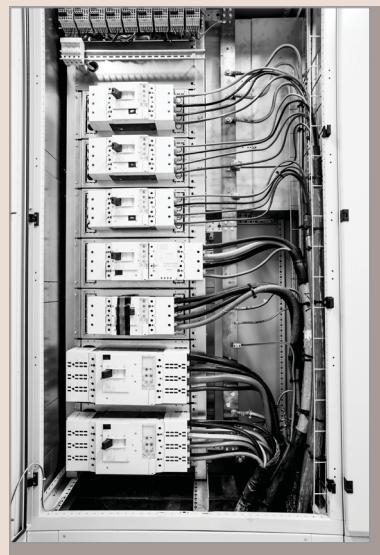
**(CHANGE) 310.3 (B) Conductor Material.** Conductors in this article shall be of copper, aluminum, or copper-clad aluminum, unless otherwise specified. Aluminum and copper-clad aluminum shall comply with the following:

(1) Solid aluminum conductors 8, 10, and 12 AWG shall be made of an AA-8000 series electrical grade aluminum alloy conductor material.

(2) Stranded aluminum conductors 8 AWG through 1000 kcmil marked as Type RHH, RHW, XHHW, XHHN, XHWN, THW, THHW, THWN, THHN, service-entrance Type SE Style U, and SE Style R shall be made of an AA-8000 series electrical grade aluminum alloy conductor material.

(3) For copper-clad aluminum conductors, the copper shall form a minimum 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor. The aluminum core of a copper-clad aluminum conductor shall be made of an AA-8000 series electrical grade aluminum alloy conductor material.

(4) Copper-clad aluminum conductor material shall be listed.



**(CHANGE) 310.8 (B) (2) Marker Tape.** Metal-covered multiconductor cables shall employ a marker tape located within the cable and running for its complete length.

**Exception No. 1:** Type MI cable shall not require a marker tape.

**Exception No. 2:** Type AC cable shall not require a marker tape.

**Exception No. 3:** The information required in 310.8(A) shall be permitted to be durably marked on the outer nonmetallic covering of Type MC, Type ITC, or Type PLTC cables at intervals not exceeding 1.0 m (40 in.).

**Exception No. 4:** The information required in 310.8(A) shall be permitted to be durably marked on a nonmetallic covering under the metallic sheath of Type ITC or Type PLTC cable at intervals not exceeding 1.0 m (40 in.).

**Informational Note:** Included in the group of metal-covered cables are Type AC cable, Type MC cable, and lead-sheathed cable.

**(CHANGE) 312.2 Damp or Wet Locations.** In damp or wet locations, surface-type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 6-mm (1/4-in.) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables entering above the level of uninsulated live parts shall use fittings listed for wet locations.

**Exception:** Nonmetallic enclosures shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

**Informational Note:** See 300.6 for protection against corrosion.

**(NEW) 312.10 Screws or Other Fasteners.** Screws or other fasteners installed in the field that enter wiring spaces shall be as provided by or specified by the manufacturer or shall comply with the following as applicable:

(1) Screws shall be machine type with blunt ends.

(2) Other fasteners shall have blunt ends.

(3) Screws or other fasteners shall extend into the enclosure no more than 6 mm (1/4 in.) unless the end is protected with an approved means.

**Exception to (3):** Screws or other fasteners shall be permitted to extend into the enclosure not more than 11 mm (7/16 in.) if located within 10 mm (3/8 in.) of an enclosure wall.

**(NEW) 312.102 Doors or Covers.** Cabinets, cutout boxes, and meter socket enclosures shall be equipped with doors or covers.

**(NEW) 314.16 (B) (6) Terminal Block Fill.** Where a terminal block is present in a box, a single volume allowance in accordance with Table 314.16(B)(1) shall be made for each terminal block assembly based on the largest conductor(s) terminated to the assembly.

**(NEW) 314.24(C) Clearances for Side-Wiring Entrances.** Where devices or equipment are mounted in boxes having side-wiring entries, the conductors entering from the side shall be protected as covered in (1) or (2), as follows. The term side applies to any wall of a box other than the one opposite to the opening.

(1) The rearward projection of the device or equipment shall not extend beyond the centerline of the wiring knockout or other entry.

(2) The clearance from the box wall to the installed device or equipment shall be not less than 13 mm (1/2 in.).



**(CHANGE) 315.1 Scope.** This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors, cable, cable joints, and cable terminations. This article includes voltages from 2001 volts to 35,000 volts ac, nominal and 2001 volts to 2500 volts dc, nominal.

**(CHANGE) 315.6 Listing Requirements.** Type MV cables, type MV cable joints, type MV cable terminations, connectors, and associated fittings shall be listed. The listing requirement for Type MV cable joints, cable terminations, and connectors shall be effective January 1, 2026.

**(NEW) 315.17 Marking for Type MV Cable Joints and Terminations. (A) Required Information for Type MV Cable Joints, Terminations, and Connectors.** All Type MV cable joints, cable terminations, and connectors shall be marked to indicate the following information, using one or more of the methods described in 315.17(B)(1) or (B)(2), and shall be permitted to be optionally marked as described in 315.17(C):

(1) The maximum rated voltage.

(2) The proper type letter or letters for the type of wire or cable as specified elsewhere in this Code that the cable joint or cable terminations is listed for use with.

(3) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.

(4) The conductor AWG size or circular mil area size, or range of sizes, that the cable joint or cable terminations is listed for use with.

(5) The cable outer diameter size, or size range, that the cable joint or cable termination is listed for use with.

(6) Connectors shall be marked with the following information; the marking shall also be on the unit container (the smallest container in which the connector is packaged):

a. The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified

b. The manufacturer's catalog number

c. The conductor AWG size or circular mil area range, and die number if applicable

d. The type of conductor material(s) the connector is for use with

**(NEW) 315.17 (B) Method of Marking for Type MV Cable Joints, Terminations, and Connectors.** One or both of the methods in 315.17(B)(1) or (B)(2) shall be used for the marking of cable joints, terminations, or connectors.

(1) Surface Marking. Type MV cable joints, terminations, or connectors shall be durably marked on the surface.

(2) Tag Marking. Type MV cable joints, terminations, or connectors shall be marked by means of a durably printed tag or label attached to joint or termination.

**(CHANGE) 320.23 In Accessible Attics.** Type AC cables in accessible attics or roof spaces shall be installed as specified in 320.23(A) and (B). (A) Cables Run Across the Top of Framing Members. Where run across the top of

framing members, or across the face of rafters or studding within 2.1 m (7 ft) of the floor or horizontal surface, the cable shall be protected by guard strips that are at least as high as the cable. Where this space is not accessible by permanently installed 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.

**(CHANGE) 322.56(B) Taps.** Taps shall be made between any phase conductor and the grounded conductor or any other phase conductor by means of devices and fittings identified for the use. Tap devices shall be rated at not less than 15 amperes, or more than 300 volts to ground, and shall be marked in accordance with 322.120(C).



**(CHANGE) 330.30 (B) Securing.** Unless otherwise permitted in this Code, 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).

**(CHANGE) 330.30 (C) Supporting.** Unless otherwise permitted in this Code, cables shall be supported at intervals not exceeding 1.8 m (6 ft).

Horizontal runs of Type MC cable installed in wooden or metal framing members or similar supporting means shall be considered supported and secured where such support does not exceed 1.8m (6ft) intervals.

**(CHANGE) 334.15 (B) Protection from Physical Damage.** Cable shall be protected from physical damage where necessary by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC conduit, RTRC marked with the suffix -XW, or other approved means. Where passing through a floor, the cable shall be enclosed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, Schedule 80 PVC conduit, RTRC marked with the suffix -XW, or other approved means extending at least 150 mm (6 in.) above the floor. Conduit or tubing shall be provided with a bushing or adapter that provides protection from abrasion at the point the cable enters and exits the raceway.

Type NMC cable installed in shallow chases or grooves in masonry, concrete, or adobe shall be protected in accordance with the requirements in 300.4(F) and covered with plaster, adobe, or similar finish.

## Exam Questions

**139. What is the aluminum core of a copper-clad aluminum conductor required to be made of?**

- A. Copper
- B. An aluminum conductor material
- C. An AA-8000 series electrical grade aluminum alloy conductor material
- D. Cadmium

**140. How many exceptions are there to requiring metal-covered multiconductor cables to have a marker tape installed within the cable and running its entire length?**

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

141. What are enclosures installed in wet locations required to be?

- A. Identified
- B. Elongated
- C. Explosion-proof
- D. Weatherproof

142. What section details the type of screw to be used in the field that enter wiring spaces?

- A. 312.10
- B. 312.102
- C. 310.10
- D. 315.10

143. What listed items are required to be equipped with doors or covers?

- A. Cabinets
- B. Cutout boxes
- C. Meter socket enclosures
- D. All listed answers

144. What table is required to be used to determine terminal block fill?

- A. 220.20
- B. 310.15
- C. 315.10
- D. 314.16(B)(1)

145. What type of cable does Article 315 cover?

- A. AC
- B. IGS
- C. MV
- D. MC

146. When will the listing requirement for Type MV cable joints, cable terminations, and connectors become effective?

- A. January 1, 2026
- B. July 1, 2026
- C. August 1, 2026
- D. January 1, 2023

147. How many items are MV connectors required to be marked with?

- A. 2
- B. 6
- C. 7
- D. 4

148. Where is an MV cable marking tag required to be attached?

- A. The cable before entering the termination enclosure
- B. The termination enclosure door
- C. The joint or termination
- D. All listed answers

149. What section describes how tall guard strips are required to be for the protection of AC cables installed in attics?

- A. 320.10
- B. 322.56
- C. 322.56(B)
- D. 320.23

150. Tap devices are required to be rated at not less than \_\_\_\_\_ or more than 300 volts to ground.

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

151. How often is MC cable required to be supported in horizontal runs?

- A. 15 ft
- B. 10 ft
- C. 4 ft
- D. 6 ft

152. What section has the protection requirements for type NMC cable installed in shallow chases or grooves in masonry, concrete, or adobe?

- A. 300.4(F)
- B. 322.56
- C. 322.56(B)
- D. 320.10

**(CHANGE) 334.15 (C) In Unfinished Basements and Crawl Spaces.** Where cable is run at angles with joists in unfinished basements and crawl spaces, it shall be permissible to secure cables not smaller than two 6 AWG or three 8 AWG conductors directly to the lower edges of the joists. Smaller cables shall be run either through bored holes in joists or on running boards. Nonmetallic-sheathed cable installed on the wall of an unfinished basement shall be permitted to be installed in a listed conduit or tubing or shall be protected in accordance with 300.4. Conduit or tubing shall be provided with a bushing or adapter that provides protection from abrasion at the point the cable enters and exits the raceway. The sheath of the nonmetallic-sheathed cable shall extend through the conduit or tubing and into the outlet, device, or junction box not less than 6 mm (1/4 in.). The cable shall be secured within 300 mm (12 in.) of the point where the cable enters the conduit or tubing. Metal conduit, tubing, and metal outlet boxes shall be connected to an equipment grounding conductor complying with 250.86 and 250.148.

**(NEW) 334.19 Cable Entries.** The sheath on nonmetallic-sheathed cable shall extend not less than 6 mm (1/4 in.) beyond any cable clamp or cable entry.

**(NEW) 335.1 Scope.** This article covers the use, installation, and construction specifications of instrumentation tray cable (Type ITC) for application to instrumentation and control circuits operating at 150 volts or less and 5 amperes or less.

**(NEW) 335.4 Uses Permitted.** Type ITC cable shall be permitted to be used as follows in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation:



- (1) In cable trays.
- (2) In raceways.
- (3) In hazardous locations as permitted in 501.10, 502.10, 503.10, 504.20, 504.30, 504.80, and 505.15.
- (4) Enclosed in a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor applied over the nonmetallic sheath in accordance with 335.6. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).
- (5) Cable, without a metallic sheath or armor, that complies with the crush and impact requirements of Type MC cable and is identified for such use with the marking ITC-ER shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft). **Exception to (5):** Where not subject to physical damage, Type ITC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.
- (6) As aerial cable on a messenger.
- (7) Direct buried where identified for the use.
- (8) Under raised floors in rooms containing industrial process control equipment and rack rooms where arranged to prevent damage to the cable.
- (9) Under raised floors in information technology equipment rooms in accordance with 645.5(E)(2).

**(NEW) 335.5 Uses Not Permitted.** Type ITC cable shall not be installed on circuits operating at more than 150 volts or more than 5 amperes.

Installation of Type ITC cable with other cables shall be subject to the stated requirements of the specific articles for the other cables. Where the governing articles do not contain stated requirements for installation with Type ITC cable, the installation of Type ITC cable with the other cables shall not be permitted.

Type ITC cable shall not be installed with power, lighting, Class 1 circuits that are not power limited, or non-power-limited circuits.

**Exception No. 1:** Where terminated within equipment or junction boxes and separations are maintained by insulating barriers or other means.

**Exception No. 2:** Where a metallic sheath or armor is applied over the nonmetallic sheath of the Type ITC cable.

**(NEW) 335.8 Ampacity.** The ampacity of the conductors shall be 5 amperes, except for 22 AWG conductors, which shall have an ampacity of 3 amperes.

**(NEW) 335.9 Overcurrent Protection.** Overcurrent protection shall not exceed 5 amperes for 20 AWG and larger conductors, and 3 amperes for 22 AWG conductors.

**(NEW) 342.24 Bends. (A) How Made.** Bends of IMC shall be so made that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. The radius of the curve of any field bend to the centerline of the conduit shall not be less than indicated in Table 2, Chapter 9.

**(NEW) 342.24 (B) Number in One Run.** The total degrees of bends in a conduit run shall not exceed 360 degrees between pull points.

**(NEW) 348.2 Reconditioned Equipment.** FMC shall not be reconditioned.

**(NEW) 348.60 Grounding and Bonding(A) Fixed Installation.** FMC shall be permitted to be used as an equipment grounding conductor when installed in accordance with 250.118(A)(5) where flexibility is not required after installation.

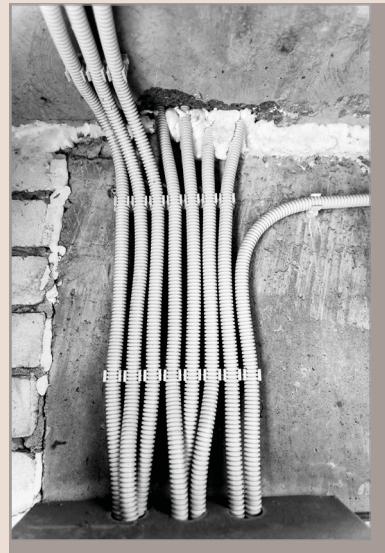
**(NEW) 348.60 (B) Flexible Installation.** An equipment grounding conductor shall be installed where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation.

**(NEW) 348.60(C) Equipment Grounding Conductors.** Where required or installed, equipment grounding conductors shall be installed in accordance with 250.134.

**(NEW) 348.60(D) Equipment Bonding Jumpers.** Where required or installed, equipment bonding jumpers shall be installed in accordance with 250.102.

**(NEW) 350.2 Reconditioned Equipment.** LFMC shall not be reconditioned.

**(NEW) 350.60 Grounding and Bonding. (A) Fixed Installation.** LFMC shall be permitted to be used as an equipment grounding conductor when installed in accordance with 250.118(A)(6) where flexibility is not required after installation.



**(NEW) 350.60 (B) Flexible Installation.** An equipment grounding conductor shall be installed where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation.

**(NEW) 350.60 (C) Equipment Grounding Conductor.** Where required or installed, equipment grounding conductors shall be installed in accordance with 250.134.

**(NEW) 350.60 (D) Equipment Bonding Jumpers.** Where required or installed, equipment bonding jumpers shall be installed in accordance with 250.102.

**Informational Note:** See 501.30(B)(2), 502.30(B)(2), 503.30(B)(2), 505.30(B)(2), and 506.30(B)(2) for types of equipment grounding conductors.

**(NEW) 352.10(B) Encased in Concrete.** PVC conduit shall be permitted to be encased in concrete.

**(NEW) 352.10(K) Physical Damage.** Where subject to physical damage, Schedule 80 PVC conduit, Schedule 80 PVC elbows, and listed fittings for PVC conduit shall be used.

**Informational Note:** All listed PVC conduit fittings are suitable for connection to both Schedule 40 and Schedule 80 PVC conduit.

**(NEW) 352.44(B) Earth Movement.** Expansion fittings for underground runs of direct buried PVC conduit emerging from the ground shall be provided above grade when required to compensate for earth settling or movement, including frost heave.

**Informational Note:** See 300.5(J).

**(NEW) 354.24(B) Number in One Run.**

The total degrees of bends in a conduit run shall not exceed 360 degrees between pull points.

**(NEW) 362.2 Reconditioned Equipment.** ENT shall not be reconditioned.

## Exam Questions

**153. What does Article 335 cover?**

- A. Article 335 covers the use and installation for application to instrumentation and control circuits operating at 150 volts or less and 50 amperes or less
- B. Article 335 covers the use, installation, and construction specifications of instrumentation tray cable (Type ITC) for application to instrumentation and control circuits operating at 1500 volts or less and 5000 amperes or less
- C. Article 335 covers the use, installation, and construction specifications of instrumentation tray cable
- D. Article 335 covers the use, installation, and construction specifications of instrumentation tray cable (Type ITC) for application to instrumentation and control circuits operating at 150 volts or less and 5 amperes or less

**154. In general, how often should you support ITC cable?**

- A. 3 ft
- B. 4 ft
- C. 6 ft
- D. 8 ft

**155. What is the maximum permitted operating current for ITC cable?**

- A. 3 amperes
- B. 10 amperes
- C. 15 amperes
- D. 5 amperes

**156. What is the maximum permitted operating current for 22 AWG ITC cable?**

- A. 3 amperes
- B. 10 amperes
- C. 15 amperes
- D. 5 amperes

**157. What is the maximum overcurrent protection permitted for 20 AWG ITC cable?**

- A. 3 amperes
- B. 10 amperes
- C. 15 amperes
- D. 5 amperes

**158. What table in Chapter 9 is the radius of the curve of any IMC field bend to the centerline of the conduit required to comply with?**

- A. Table 5
- B. Table 3
- C. Table 2
- D. Table 10

**159. What are the total degrees of bends permitted in an IMC conduit run between pull points?**

- A. 270 degrees
- B. 360 degrees
- C. 300 degrees
- D. 1800 degrees

**160. What section allows FMC to be used as an equipment grounding conductor when flexibility is not required after installation?**

- A. 250.118(A)(5)
- B. 250.134
- C. 250.102
- D. 250.122

161. What section requires an equipment grounding conductor to be installed where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation when using FMC?

- 348.38
- 348.50
- 348.60(B)
- 348.48

162. What section is required to be followed when equipment grounding conductors are installed in FMC?

- 250.122
- 250.118(A)(5)
- 250.102
- 250.134

163. What section is required to be followed when equipment bonding jumpers are installed in FMC?

- 250.122
- 250.118(A)(5)
- 250.134
- 250.102

164. What section allows LFMC to be used as an equipment grounding conductor when flexibility is not required after installation?

- 250.134
- 250.118(A)(6)
- 250.102
- 250.122

165. Where required or installed in LFMC, equipment grounding conductors are required be installed in accordance with \_\_\_\_\_.

- 250.118(A)(6)
- 250.134
- 250.102
- 250.122

166. Where required or installed in LFMC, equipment bonding jumpers are required be installed in accordance with \_\_\_\_\_.

- 250.102
- 250.118(A)(6)
- 250.134
- 250.122

167. What code section permits PVC conduit to be encased in concrete?

- 352.10(B)
- 352.44
- 352.10(K)
- 352.44(B)

168. What schedule of PVC is required to be used when subject to physical damage?

- 20
- 40
- 80
- Thin wall

169. Where are PVC expansion joints required to be installed when needed in underground runs of direct buried PVC conduit?

- In a vault
- Underground
- Above grade
- Inside the electrical room

**(NEW) 366.10 (C) Extended Distance of Auxiliary Gutters.** Auxiliary gutters shall be permitted to extend a distance not greater than 9 m (30 ft) beyond the equipment that it supplements.

**Exception:** Where used in accordance with 620.35 for elevators, an auxiliary gutter shall be permitted to extend a distance greater than 9 m (30 ft) beyond the equipment it supplements.

**(NEW) 370.120 Marking. (A) Nameplates.** Each cablebus system shall include a nameplate at each terminating end of the system with the manufacturer's name or trade designation and the maximum diameter, number, voltage rating, and ampacity of the conductors to be installed. Nameplates shall be visible after installation.

**(NEW) 370.120 (B) Identification.** Each section and fitting of a cablebus system shall be identified with a marking that corresponds to the manufacturer's installation instructions.

**(NEW) 371.1 Scope.** This article covers the use and installation requirements of flexible bus systems and associated fittings.

**(NEW) 371.10 Uses Permitted.** Flexible bus systems shall be permitted for the following:

- (1) Services, feeders, and branch circuits
- (2) Indoors
- (3) Outdoors where identified for outdoor use
- (4) Installed in corrosive, wet, or damp locations where identified for use
- (5) Exposed
- (6) Behind access panels where the space behind the access panel is not used for air-handling purposes
- (7) To penetrate through walls and floors in accordance with 371.18



**(NEW) 371.12 Uses Not Permitted.** Flexible bus systems shall not be permitted to be installed in the following:

- (1) Hoistways
- (2) Where exposed to severe physical damage
- (3) Hazardous (classified) locations, unless specifically permitted in Chapter 5
- (4) Air-handling spaces

**(NEW) 371.17 (C) Rating of Overcurrent Protection — Branch Circuits.** Flexible bus systems installed as branch circuits shall be protected against overcurrent in accordance with 210.20.

**Exception:** The applicable requirements of 240.4 shall be permitted.

**(NEW) 371.17 (F) Flexible Bus Systems from Battery Terminals.** Flexible bus systems installed for battery systems shall be protected from overcurrent in accordance with 240.21(H).

**(NEW) 371.30 Securing and Supporting.** Flexible insulated bus conductors shall be supported on identified mounting means at intervals not greater than 900 mm (3 ft) for horizontal runs and 450 mm (1 1/2 ft) for vertical runs unless otherwise permitted by the product listing. Flexible bus systems shall be secured and supported by listed associated fittings in accordance with 371.30(A) through (C).

**(NEW) 400.45 Shielding.** All shields shall be grounded at least at one end.

**(NEW) 400.46 Equipment Grounding Conductors.** Equipment grounding conductors shall be connected in accordance with Parts VI and VII of Article 250.

**(NEW) 400.47 Minimum Bending Radii.** The minimum bending radii for portable power feeder cables from 2000 volts to 5000 volts shall not exceed six times the overall cable outer diameter. The minimum bending radii for portable cables from 5001 volts to 25,000 volts shall not exceed eight times the overall cable outer diameter.

**(NEW) 400.50 Types.** Portable power feeder cables rated greater than 2000 volts shall conform to the description in Table 400.50. Types G, SHD-PCG, and SHD-CGC shall be used only from 2000 volts to 5000 volts. Types SH, SHD, and SHD-GC shall be used from 2000 volts to 25,000 volts. Where a Type designation for portable power feeder cables over 2000 volts conflicts with a designation description in Table 400.4, the description in Table 400.50 shall apply. The use of portable power feeder cables other than those in Table 400.50 shall require permission by the authority having jurisdiction.

**(NEW) 404.14 (D) Snap Switch Terminations.** Snap switch terminations shall be in accordance with the following:

- (1) Terminals of 15-ampere and 20-ampere snap switches not marked CO/ALR shall be used with copper and copper-clad aluminum conductors only.

(2) Terminals marked CO/ALR shall be permitted to be used with copper, aluminum, and copper-clad aluminum conductors.

(3) Snap switches connected using screwless terminals of the conductor push-in type construction (also known as conductor push-in terminals) shall be installed on not greater than 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only unless listed and marked for other types of conductors.

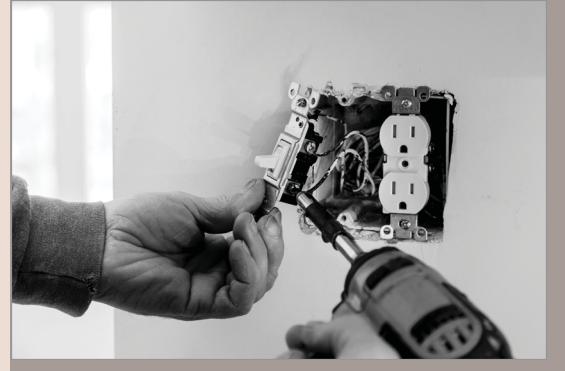
**(NEW) 406.2 Reconditioned Equipment.** Reconditioned receptacles, attachment plugs, cord connectors, and flanged surface devices shall not be permitted.

**(NEW) 406.3 (D) Receptacle Terminations.** Receptacle terminations shall be in accordance with the following:

(1) Terminals of 15-ampere and 20-ampere receptacles not marked CO/ALR shall be used with copper and copper-clad aluminum conductors only.

(2) Terminals marked CO/ALR shall be permitted to be used with aluminum, copper, and copper-clad aluminum conductors.

(3) Receptacles installed using screwless terminals of the conductor push-in type construction (also known as push-in-terminals) shall be installed on not greater than 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only unless listed and marked for other types of conductors.



**Informational Note:** See UL 498, Attachment Plugs and Receptacles, for information regarding screwless terminals of various type constructions employed on receptacles. Screwless terminals of the separable-terminal assembly, spring-action clamp, and insulation-displacement type constructions are not classified in UL 498 as screwless terminals of the conductor push-in type construction (also known as push-in terminals).

**(NEW) 406.4 (G) Protection of Floor Receptacles.** Protection for floor receptacles shall be in accordance with the following:

(1) Physical protection of floor receptacles shall allow floor-cleaning equipment to be operated without damage to receptacles.

(2) All 125-volt, single-phase, 15- and 20-ampere floor receptacles installed in food courts and waiting spaces of passenger transportation facilities where food or drinks are allowed shall be GFCI protected.

**(NEW) 409.60 Bonding.** Industrial control panels shall be grounded and bonded in accordance with 409.60(A) and (B).

(A) **Grounding.** An equipment grounding conductor sized in accordance with 250.122 shall be connected to an equipment grounding bus or to an equipment grounding termination point provided in a single-section industrial control panel.

(B) **Bonding.** Multisection industrial control panels shall be bonded together using an equipment bonding jumper sized in accordance with 250.102(D).

**(NEW) 409.70 Surge Protection.** Safety circuits for personnel protection that are subject to damage from surge events shall have surge protection installed within or immediately adjacent to the control panel.

**(NEW) 410.71 Disconnecting Means for Fluorescent or LED Luminaires that Utilize Double-Ended Lamps(1)**  
**General.** In indoor locations other than dwellings and associated accessory structures, fluorescent or LED luminaires that utilize double-ended lamps and contain ballast(s) or LED driver(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire. For existing installed luminaires without disconnecting means, at the time a ballast or LED driver is added or replaced a disconnecting means shall be installed. The line side terminals of the disconnecting means shall be guarded.

**Exception No. 1:** A disconnecting means shall not be required for luminaires installed in hazardous (classified) location(s).

**Exception No. 2:** A disconnecting means shall not be required for luminaires that provide emergency illumination required in 700.16.

**Exception No. 3:** For cord-and-plug-connected luminaires, an accessible separable connector or an accessible plug and receptacle shall be permitted to serve as the disconnecting means.

**Exception No. 4:** Disconnecting means shall not be required for every luminaire in a building area if all of the following conditions apply:

- (1) More than one luminaire is installed in the building area
- (2) The luminaires are not connected to a multiwire branch circuit
- (3) The design of the installation includes disconnecting means
- (4) The building area will not be left in total darkness should only one disconnect be opened

## Exam Questions

**170. How far past the equipment it supplements is an auxiliary gutter permitted to extend?**

- A. 5 ft
- B. 10 ft
- C. 30 ft
- D. 20 ft

**171. What does Article 371 cover?**

- A. This article covers the use and installation requirements of flexible metal conduit and associated fittings
- B. This article covers the use and installation requirements of ridged bus systems and associated fittings
- C. This article covers the use and installation requirements of continuous bus systems and associated fittings
- D. This article covers the use and installation requirements of flexible bus systems and associated fittings

**172. How many areas does the code list where Flexible bus systems are permitted to be installed?**

- A. 4
- B. 5
- C. 7
- D. 8

**173. How many areas does the code list where Flexible bus systems are not permitted to be installed?**

- A. 4
- B. 5
- C. 7
- D. 8

**174. What code section is required to be used for the overcurrent protection where flexible bus systems are installed with battery systems?**

- A. 371.30
- B. 210.20
- C. 240.21(H)
- D. 400.46

**175. Where are flexible cord and flexible cable shields required to be grounded?**

- A. Both ends
- B. At least at one end
- C. At each junction box
- D. At each terminal block location

**176. What type of conductors can terminals marked as CO/ALR be used with?**

- A. Copper-clad aluminum
- B. Copper
- C. Aluminum
- D. All listed answers

**177. What type of devices does Article 406 prohibit from being reconditioned?**

- A. Cord connectors
- B. Receptacles
- C. Attachment plugs
- D. All listed answers

**178. What does UL 498 cover?**

- A. Information regarding terminal marking on receptacles
- B. Information regarding cord connectors employed on receptacles
- C. Information regarding screwless terminals of various type constructions employed on receptacles
- D. Information regarding conductor marking for receptacles

**179. How many provisions does Article 406 require for the protection of floor receptacles?**

- A. 2
- B. 4
- C. 5
- D. 8

**180. What code section are industrial control panels required to be grounded and bonded in accordance with?**

- A. 490.60(A) and (B)
- B. 420.50(C) and (D)
- C. 409.24(A) and (B)
- D. 409.60(A) and (B)

**181. Where is surge protection required to be located regarding safety circuits for personnel protection that are subject to damage from surge events?**

- A. On any cord powered tool
- B. As close as possible to the hazard
- C. Immediately adjacent to the control panel or within
- D. Immediately adjacent to personnel

**182. What type of protection does the code require for the line side terminals of a disconnecting means used with fluorescent or LED luminaires that utilize double-ended lamps?**

- A. They shall be guarded
- B. They shall be encased
- C. They shall be in a locked enclosure
- D. All listed answers

**(NEW) 410.71(2) Multiwire Branch Circuits.** When connected to multiwire branch circuits, the disconnecting means shall simultaneously break all the supply conductors to the ballast, including the grounded conductor.

**(NEW) 410.71(3) Location.** The disconnecting means shall be located so as to be accessible to qualified persons before servicing or maintaining the ballast. Where the disconnecting means is external to the luminaire, it shall be a single device, and it shall be attached to the luminaire or the luminaire shall be located within sight of the disconnecting means.

**(NEW) 411.3 Voltage Limitations.** The operating voltage of low-voltage lighting systems and their associated components shall not exceed 30 volts ac or 60 volts dc. If wet contact is likely to occur, the operating voltage of low-voltage lighting systems and their associated components shall not exceed 15 volts ac or 30 volts dc.

**Informational Note:** See 680.1 for swimming pools, fountains, and similar installations.

**(NEW) 422.18 (B) Location.** No metal parts of ceiling-suspended (paddle) fans in bathrooms and shower spaces shall be located within a zone measured 900 mm (3 ft) horizontally and 2.5 m (8 ft) vertically from the top of the bathtub rim or shower stall threshold. This zone is all-encompassing and shall include the space directly over the tub or shower stall.

**(NEW) 424.4 (B) Branch-Circuit Conductor Sizing.** The branch-circuit conductor(s) ampacity shall not be less than 125 percent of the load of the fixed electric space-heating equipment and any associated motor(s).

**(NEW) 424.48 Installation of Cables in Walls.** Unless prohibited by 424.38(B), heating cables and cable sets



shall be permitted to be installed in, on, or behind walls provided all of the following are met:

- (1) Heating cables and cable sets shall be identified as suitable for installation in, on, or behind walls.
- (2) Heating cables and cable sets shall be GFCI protected.
- (3) Grounding means, such as copper braid, metal sheath, or other approved means, shall be provided.
- (4) Heating cables and cable sets shall be AFCI protected.
- (5) Heating cables and cable sets shall be permitted to be installed no more than 1.2 m (4 ft) above the floor.

This requirement shall become effective January 1, 2026.

**(NEW) 430.2 Reconditioned Motors.** Reconditioned motors shall be permitted if the reconditioning has been conducted in accordance with the manufacturer's instructions or, if no instructions are provided, nationally recognized standards. Reconditioned motors identified for use in hazardous (classified) locations shall be listed as reconditioned if installed in hazardous (classified) locations.

**Informational Note:** See ANSI/EASA AR100-2020, Recommended Practice for the Repair of Rotating Electrical Apparatus, for information on the rewinding and repair of motors.

**(NEW) 430.31 (A) Where Hazard Exists.** These provisions shall not require overload protection where a power loss would cause a hazard, such as in the case of fire pumps.

**Informational Note:** See 695.7 for protection of fire pump supply conductors.

**(NEW) 430.31 (B) Not Over 1000 Volts.** Part III shall not apply to motor circuits rated over 1000 volts, nominal.

**Informational Note:** See Part XI for over 1000 volts, nominal.

**(NEW) 430.53 (C) (5) Overcurrent Protection.** Loads other than motor loads shall be protected in accordance with Part I through Part VII of Article 240.

**Informational Note:** See 110.10 for circuit impedance and other characteristics.

**(NEW) 445.19 Emergency Shutdown of Prime Mover. (A) General.** Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

(1) Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting

(2) Initiate a shutdown mechanism that requires a mechanical reset

The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25.

**(NEW) 445.19 (B) Remote Emergency Shutdown.** For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of 445.19(A)(1) and (A)(2). The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B).



**(NEW) 460.1 Scope.** This article covers the installation of capacitors on electrical circuits. Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements.

**(CHANGE) 460.24 Switching. (A) Load Current.** Switches shall be rated for switching of capacitive loads. Capacitor

switch operation shall open all ungrounded conductors and the switch shall be capable of the following:

- (1) Carrying continuously not less than 135 percent of the rated current of the capacitor installation
- (2) Interrupting the maximum continuous load current of each capacitor, capacitor bank, or capacitor installation that will be switched as a unit
- (3) Withstanding the maximum inrush current, including contributions from adjacent capacitor installations
- (4) Carrying currents due to faults on capacitor side of switch

**(NEW) 470.2 Reconditioned Equipment.**

- (A) Resistors. Reconditioned resistors shall not be permitted.
- (B) Reactors. Reconditioned reactors shall be permitted.

**(CHANGE) 480.1 Scope.** This article applies to all installations of stationary standby batteries having a capacity greater than 3.6 MJ (1 kWh).

**Informational Note No. 1:** See Article 706 for installations that do not meet the definition of stationary standby batteries.

**Informational Note No. 2:** The following standards are frequently referenced for the installation of stationary batteries:

- (1) IEEE 484, Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications
- (2) IEEE 485, Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications
- (3) IEEE 1145, Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems
- (4) IEEE 1187, IEEE Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications
- (5) IEEE 1375, IEEE Guide for the Protection of Stationary Battery Systems
- (6) IEEE 1578, Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management
- (7) IEEE 1635/ASHRAE 21, Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications
- (8) UL 1973, Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications
- (9) UL Subject 2436, Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems
- (10) UL 1989, Standard for Standby Batteries
- (11) UL Subject 1974, Standard for Evaluation of Repurposed Batteries
- (12) NFPA 855-2020, Standard for the Installation of Stationary Energy Storage Systems

**(CHANGE) 480.7 DC Disconnect Methods. (A) Disconnecting Means.** A disconnecting means shall be provided for all ungrounded conductors derived from a stationary standby battery with a voltage over 60 volts dc. A disconnecting means shall be readily accessible and located within sight of the stationary standby battery.

**Informational Note:** See 240.21(H) for information on the location of the overcurrent device for battery conductors.

**(CHANGE) 480.10 (C) Spaces About Stationary Standby Batteries.** Spaces about stationary standby batteries shall comply with 110.26 and 110.34. 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.

**Informational Note:** Additional space is often needed to accommodate battery hoisting equipment, tray removal, or spill containment.

## Exam Questions

**183. What article covers swimming pools, fountains, and similar installations?**

- A. 505
- B. 680
- C. 690
- D. 645

**184. How many conditions must be met when installing heating cables and cable sets in, on, or behind walls?**

- A. 3
- B. 8
- C. 5
- D. 10

**185. What part of Article 430 addresses motors that require over 1000 volts nominal?**

- A. VI
- B. X
- C. III
- D. XI

**186. What code section has information for circuit impedance and other characteristics?**

- A. 695.7
- B. 240.6
- C. 110.10
- D. 445.19

**187. How many required code provisions are listed for a generator to shut down the prime mover?**

- A. 2
- B. 3
- C. 4
- D. 5

**188. What are generators for other than one- and two-family dwelling units greater than 15 kW required to be provided with?**

- A. A series wired emergency stop switch that shuts down the fuel supply
- B. A local emergency stop switch that shuts down the generator
- C. A remote emergency stop switch that shuts down the prime mover
- D. All listed answers

**189. How is the remote emergency stop switch for a generator required to be labeled?**

- A. Emergency Shutdown
- B. Generator Shutdown
- C. Generator Emergency Shutdown
- D. Remote Emergency Shutdown

**190. What code section is the label for a remote emergency stop switch required to comply with?**

- A. 706
- B. 445.18(A)
- C. 110.25
- D. 110.21(B)

**191. What does Article 460 cover?**

- A. Article 460 covers the installation of inductors on electrical circuits
- B. Article 460 covers the installation of capacitors on electrical circuits
- C. Article 460 covers the installation of resistor banks on electrical circuits
- D. Article 460 covers the installation of sub panels used with farm equipment

**192. How many required code provisions must the switching of capacitive loads comply with?**

- A. 4
- B. 3
- C. 2
- D. 5

**193. What is permitted to be reconditioned according to Article 470?**

- A. Inductors
- B. Resistors
- C. Capacitors
- D. Reactors

**194. What is not permitted to be reconditioned according to Article 470?**

- A. Reactors
- B. Resistors
- C. Capacitors
- D. Inductors

**195. What does Article 480 apply to?**

- A. Article 480 applies to all installations of capacitors
- B. Article 480 applies to all installations of inductors
- C. Article 480 applies to all installations of stationary standby batteries having a capacity greater than 3.6 MJ (1 kWh)
- D. Article 480 applies to all installations of stationary standby batteries having a capacity lower than 3.6 MJ (1 kWh)

**196. What article is required to be used for the installations that do not meet the definition of stationary standby batteries**

- A. 725
- B. 480
- C. 706
- D. 440

**197. How many standards are frequently referenced for the installation of stationary batteries?**

- A. 12
- B. 10
- C. 8
- D. 13

**198. What code section has information on the location of the overcurrent device for battery conductors?**

- A. 695.10
- B. 240.21(H)
- C. 685.7
- D. 220.21(H)

**199. Why is additional space needed around stationary standby batteries?**

- A. Tray removal
- B. To accommodate battery hoisting equipment
- C. Spill containment
- D. All listed answers

**200. What code section has information on the location of the overcurrent device for battery conductors?**

- A. 240.21(H)
- B. 695.10
- C. 685.7
- D. 220.21(H)

