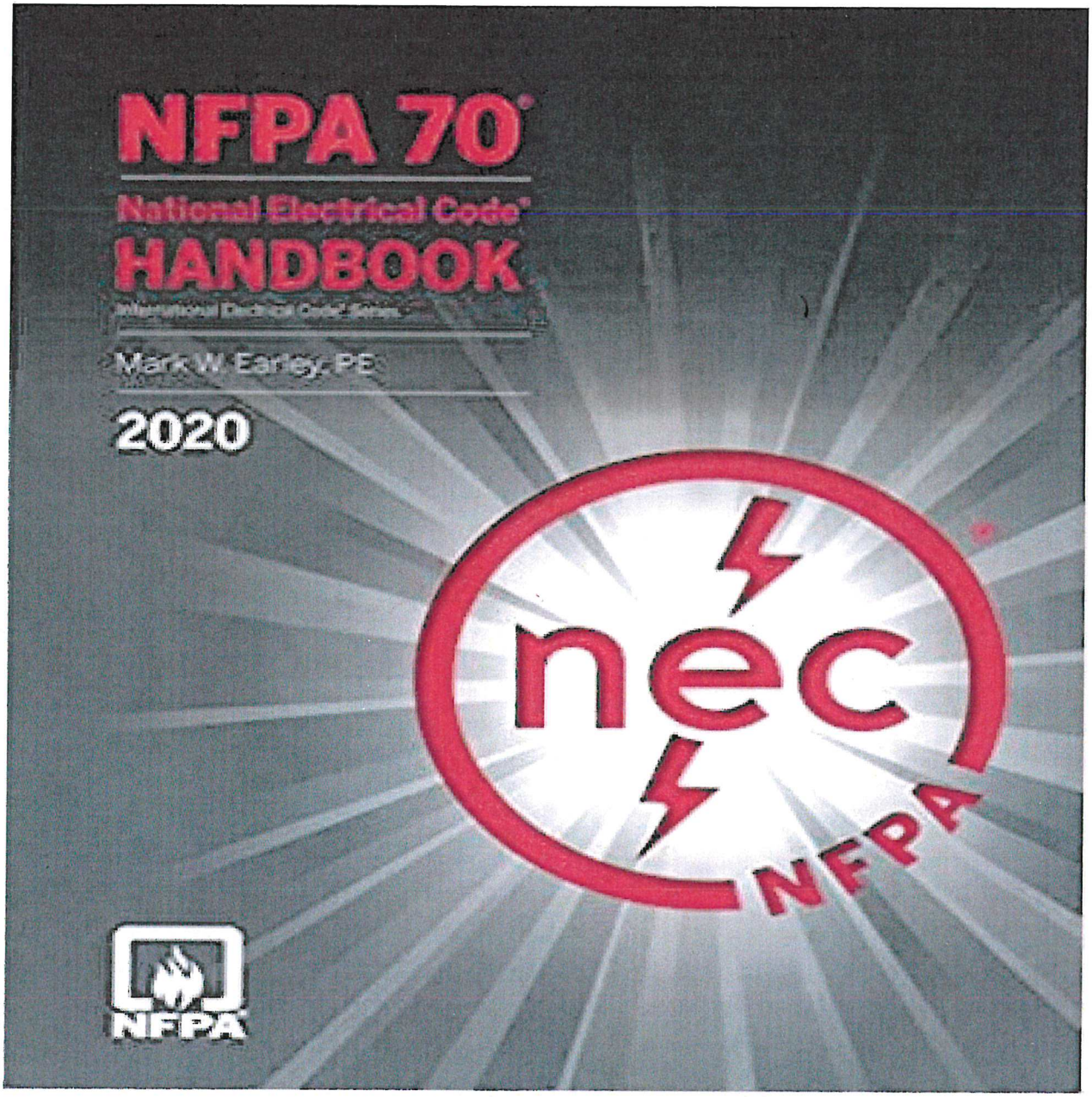



# 2020 NEC Significant Code Changes Part 1

Four (4) Continuing Education Hours

# Course description:

The 2020 NEC significant code changes part 1 course satisfies

Four (4) hours of professional training.

The course is designed as a distance learning course that

overviews the significant changes to the updated

National Electric Code (NEC)

# Objective:

The primary objective of this course is to enable the

student to understand some of the significant changes

Including additions, deletions and modifications

to articles 100, 200 and 300 of the 2020 edition of NFPA 70

National Electric Code (NEC)

from the 2014, 2017 to the 2020 edition.

This course is in no way a complete instructional of the 2020 NEC,

all students are encouraged to study the

2020 NEC completely and further develop the skills

needed to interpret and enforce the 2020 NEC

# Table of Contents

2020 NEC Significant Code Changes Part 1

# Introduction

Every three years, the National Electrical Code® (NEC®) is revised and expanded. Initially the NFPA® received **3,730** public suggestions for changes, which resulted in **1,400** first revisions. There were **1,930** public comments submitted in response to these **1,400** first revisions, resulting in **635** second revisions. Changes included editorial clarification, expanded requirements, new requirements, deleted requirements, and the relocation of other requirements. Nine new articles were proposed, and four new articles were added to the 2020 NEC. With the fast pace of technology, it's more important than ever for anyone participating in the electrical industry to get up to speed with all the changes.

2020 National Electric Code (NEC)

- 5,660 Public Suggestions to 2014 NEC
- 2.035 Revisions Made
- Changes Included
  - Editorial Clarification,
  - Expanded Requirements,
  - New Requirements,
  - Deleted Requirements,
  - Relocation of Requirements
- Four New Articles Added

# What to Expect

In this course the student will be presented an overview of the most significant changes found in the 2020 NEC. This is part 1 of a series of courses covering the changes and will progress through each chapter and its articles presenting the many important changes. The changes will be underlined for easy recognition and a short synopsis of the reason for the change is presented as well.



## AUTHORIZATION

By taking this course on line you are agreeing to allow ILLOWA to record this training presentation and your participation, if you do not agree to these terms you are to discontinue with the presentation and sign off as an active participant in this training.

## 2020 NEC Major Additions

**Article 242 Overvoltage Protection** provides the general, installation, and connection requirements for overvoltage protection and overvoltage protective devices.

**Article 311 Medium Voltage Conductors and Cable** covers the use, installation, construction specifications and ampacities for medium voltage conductors and cable (Type MV).

**Article 337 Type P Cable** covers the use, installation, and construction specifications for up through 2000-volt Type P cable (armored and unarmored).

**Article 800 General Requirements for Communications Systems** combines common requirements previously found in Articles 800 (now Article 805) for communications circuits, 820 for community antenna television and radio distribution systems, 830 for network-powered broadband communications systems and 840 for premises-powered broadband communications systems into a new "general" article that applies to all of these articles unless modified by the forenamed articles.

# Introduction: Article 90

## 90.2(A)(5) Scope

**Reason for Change:**

Revision clarifies that the *NEC* covers installations supplying shore power to ships and watercraft, including monitoring of leakage current.

**90.2(A) Scope**

**(A) Covered.** This *Code* covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables for the following:

**(1)** Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
**(2)** Yards, lots, parking lots, carnivals, and industrial substations
**(3)** Installations of conductors and equipment that connect to the supply of electricity
**(4)** Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
**(5)** Installations supplying shore power to ships and watercraft in marinas and boatyards, including monitoring of leakage current
**(6)** Installations used to export electric power from vehicles to premises wiring or for bidirectional current flow

# Chapter 1. General: Articles 100-110

## 100 – Definitions

### Article 100 — Definitions
Scope and Part III, Hazardous (Classified) Locations

**Reason for Change:**

The phrase, "Definitions are also found in XXX.2 sections of other articles" was added and the Scope of Article 100 is modified to include **new Part III for "Hazardous (Classified) Locations."**

**Article 100: Definitions**

**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. In general, only those terms that are used in two or more articles are defined in Article 100. Other definitions are included in the article in which they are used but may be referenced in Article 100. Definitions are also found in XXX.2 sections of other articles.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal. Part III contains definitions applicable to Hazardous (Classified) Locations.

## Article 100 — Definitions
### Accessible (as applied to equipment)

**Reason for Change:**

The definition of Accessible (as applied to equipment) was revised for clarity and usability.

**Accessible (as applied to equipment).**

Admitting close approach; not guarded by locked doors, elevation, or other effective means. Capable of being reached for operation, renewal, and inspection. (CMP-1)

## Article 100 — Definitions
### Supply-Side Bonding Jumper

**Reason for Change:**

The definition of a **Supply-Side Bonding Jumpe**r was relocated from 250.2 to Article 100.

**Bonding Jumper, Supply-Side.** A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

## Article 100 — Definitions
### Dormitory Unit

**Reason for Change:**

A new definition for a "Dormitory Unit" was introduced at Article 100.

**Dormitory Unit.** A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities. (CMP 2)

## Article 100 — Definitions
### Equipotential Plane

**Reason for Change:**

The definition for "Equipotential Plane was relocated from 682.2 to Article 100.

**Equipotential Plane**. An area where wire mesh or other conductive elements are on, embedded in, or placed under the walk surface within 75 mm (3 in.), bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to prevent a difference in voltage from developing within the plane. Accessible conductive parts bonded together to reduce voltage gradients in a designated area. (CMP-17)

## Article 100 — Definitions
### Fault Current and Fault Current, Available (Available Fault Current)

Two new definitions for "Fault Current" and "Fault Current, Available (Available Fault Current)" were added to Article 100. A new Informational- Note Figure 100.1 was also added.

**Fault Current.** The current delivered at a point on the system during a short-circuit condition. (CMP-10)

**Fault Current, Available (Available Fault Current).** The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

**Informational Note:** A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note Figure 100.1.

Figure Informational Note Figure 100.1 Available Fault Current.

(see illustration above and NEC Code text for figure)

## Article 100 — Definitions
### Free Air (as applied to conductors)

**Reason for Change:**

A new definition for "Free Air (as applied to conductors)" was added to Article 100.

**Free Air (as applied to conductors).** Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor. (CMP-6)

## Article 100 — Definitions
### Grounded Conductor

**Reason for Change:**

A new Informational note was added to the definition of a "Grounded Conductor." The new informational note is intended to clarify that an equipment grounding conductor is not subject to the identification and connection rules of a grounded conductor.

**Grounded Conductor.** A system or circuit conductor that is intentionally grounded. (CMP-5)

**Informational Note:** Although an equipment grounding conductor is grounded, it is not considered a grounded conductor.

## Article 100 — Definitions
Habitable Room

**Reason for Change:**

A new definition for "Habitable Room" was added to Article 100.

**Habitable Room.** A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilet rooms, closets, hallways, storage or utility spaces, and similar areas. (CMP-2)

## Article 100 — Definitions
Island Mode

**Reason for Change:**

A new definition for "Island Mode" primarily related to microgrid systems and stand-alone systems was added to Article 100.

**Island Mode.** The operational mode for standalone power production equipment or an isolated microgrid, or for a multimode inverter or an interconnected microgrid that is disconnected from an electric power production and distribution network or other primary power source. (CMP-4)

**Informational Note:** Isolated microgrids are distinguished from interconnected microgrids, which are addressed in Article 705.

## Article 100 — Definitions
Labeled

**Reason for Change:**

New Informational Note added explaining that even though a section of the *NEC* may require a product to be labeled, it is

common practice to have the label, symbol, or other identifying mark applied to the smallest unit container in which the product is packaged.

**Labeled.** Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (CMP-1)

**Informational Note:** If a listed product is of such a size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the complete label may appear on the smallest unit container in which the product is packaged.

## Article 100 — Definitions
Reconditioned

**Reason for Change:**

A new definition for "Reconditioned" was added to Article 100 and an informational note added to indicate that the term reconditioned is frequently referred to as rebuilt, refurbished, or remanufactured.

**Reconditioned.** Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis. (CMP-10)

**Informational Note:** The term reconditioned is frequently referred to as rebuilt, refurbished, or remanufactured.

# 110 – Requirements for Electrical Installations

## 110.3(B)
## Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment

**Reason for Change:**

Listing requirements were **modified** for clarity and usability to address equipment that is listed, labeled, or **both**.

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

**(B) Installation and Use.** ~~Listed or labeled equipment~~ Equipment that is listed, labeled, or both shall be installed and used in accordance with any instructions included in the listing or labeling.

## 110.12(C)
## Mechanical Execution of Work

**Reason for Change:**

Redundant requirements for "**Mechanical Execution of Work**" for communication cables and conductors in Chapter 7 and 8 were relocated to Article 110.

**110.12 Mechanical Execution of Work.**

Electrical equipment shall be installed in a neat and workmanlike manner.

**(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:** Accepted industry practices are described in ANSI/ NECA/FOA 301-2009, Standard for Installing and Testing Fiber Optic Cables, and other ANSI-approved installation standards.

**Informational Note No. 2:** See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

**Informational Note No. 3:** Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

# 110.14(D)
## Electrical Connections, Terminal Connection Torque

### Reason for Change:

Revisions occurred to the terminal connection torque rules and three new Informational Notes were added.

**110.14 Electrical Connections.**

**(D) Installation Terminal Connection Torque.** Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve the indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required 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:** The equipment manufacturer can be contacted if numeric torque values are not indicated on the equipment or if the installation instructions are not available. Informative Annex I of UL Standard 486A-486B, Standard for Safety-Wire Connectors, provides torque values in the absence of manufacturer's recommendations.

**Informational Note No. 3:** Additional information for torqueing threaded connections and terminations can be found in Section 8.11 of NFPA 70B-2019, Recommended Practice for Electrical Equipment Maintenance.

## 110.22(A)
### Identification of Disconnecting Means

**Reason for Change:**

Disconnects are now required to **identify of the source** of the branch circuit or feeder for the disconnect at the disconnecting means enclosure (other than one- or two-family dwellings).

**110.22 Identification of Disconnecting Means.**

**(A) General.** Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. In other than one- or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means. The marking shall be of sufficient durability to withstand the environment involved.

## 110.26(C)(2)
### Spaces About Electrical Equipment

**Reason for Change:**

Revisions to "Large Equipment" working space to addresses the hazards presented by two or more service disconnects with combined ratings of 1200 amps or more. Requirements also added to prevent open equipment doors from impeding the entry to or egress from the working space of large equipment.

**110.26 Spaces About Electrical Equipment.**

(C) Entrance to and Egress from Working Space.

**(2) Large Equipment.** For large equipment ~~rated 1200 amperes or more and over 1.8 m (6 ft) wide~~ that contains overcurrent devices, switching devices, or control devices,

there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6 ½ ft) high at each end of the working space. This requirement shall apply to either of the following conditions:

**(1)** For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide
**(2)** For service disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 1.8 m (6 ft) wide

Open equipment doors shall not impede the entry to or egress from the working space.

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

**(a) Unobstructed Egress.** Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.
**(b) Extra Working Space.** Where the depth of the working space is twice that required by 110.26(A) (1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.

## 110.26(C)(3)
### Spaces About Electrical Equipment

**Reason for Change:**

Revision added to clarity appropriate hardware (*equipped with listed panic hardware or listed fire exit hardware*) for personnel doors within 7.6 m (25 ft) from the working space around electrical equipment rated 800 amperes or more.

**110.26 Spaces About Electrical Equipment.**

**(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 in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.

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

# Chapter 2. Wiring and Protection: Articles 200-250

## 200 – Use and Identification of Grounded Conductors

### 200.3
### Connection to Grounded System

**Reason for Change:**

The grounded conductors of premises wiring systems are required to be electrically connected to the supply system grounded conductor. This applied to all premises wiring, not just interior wiring.

**200.3 Connection to Grounded System.**

~~Premises~~ Grounded conductors of premises wiring systems shall be electrically connected to ~~a~~ the supply system ~~unless the latter contains, for any~~ grounded conductor ~~of the interior system, a corresponding conductor that is grounded~~ to ensure a common, continuous grounded system. For the purpose of this section, electrically connected shall mean ~~connected so as to be~~ making a direct electrical connection capable of carrying current, as distinguished from ~~connection through electromagnetic induction~~ induced currents.

**Exception:** Listed ~~utility~~-interactive inverters identified for use in distributed resource generation systems such as photovoltaic and fuel cell power systems shall be

permitted to be connected to premises wiring without a grounded conductor ~~where~~ if the connected premises wiring or utility system includes a grounded conductor.

## 200.10(B)
### Identification of Terminals

**Reason for Change:**

The means of identification of the grounded conductor terminals or screws for such things as receptacles can now be achieved by a metal or metal coating that is not only substantially white in color, but "substantially silver" in color as well.

**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 substantially 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.

# 210 – Branch Circuits

## 210.8
### Ground-Fault Circuit-Interrupter Protection for Personnel

**Reason for Change:**

Revision removes "door" and "doorway" as items the supply cord of an appliance connected to the receptacle should not pass

through in order to satisfy measurement requirements for GFCI protection.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through ~~(E)~~(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

**Informational Note No. 1:** See 215.9 for groundfault circuit-interrupter protection for personnel on feeders.

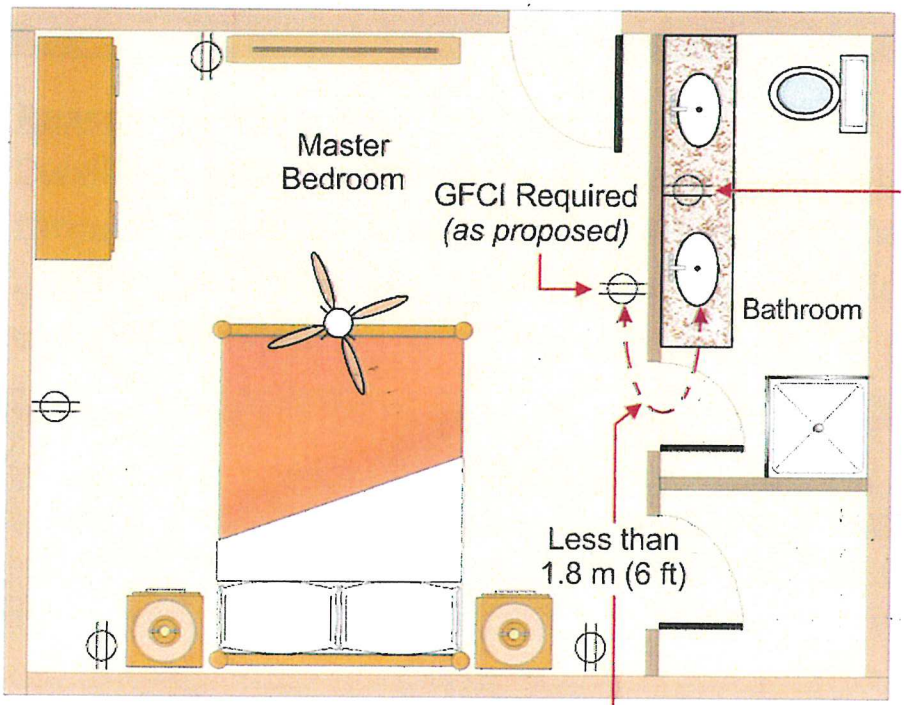
**Informational Note No. 2:** See 422.5(A) for GFCI requirements for appliances.

**Informational Note No. 3:** See 555.9 for GFCI requirements for boat hoists.

**Informational Note No. 4:** Additional GFCI requirements for specific circuits and equipment are contained in Chapters 4, 5, and 6.

For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a ~~door, doorway, or~~ window.

## 210.8 Measurements for GFCI Protection




All 125-volt through 250-volt receptacles installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink requires GFCI protection. *[210.8(A)(7)]*

For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a ~~door, doorway, or~~ window. *[210.8]*

# 210.8(A)
## Dwelling Unit GFCI Protection

**Reason for Change:**

Dwelling unit GFCI protection has been expanded to all 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground installed in the specified areas of 210.8(A).

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

**(A) Dwelling Units.** All 125-volt through 250-volt, ~~single-phase, 15- and 20-ampere~~ receptacles installed in the locations specified in 210.8(A)(1) through ~~(10)~~(11) and supplied by single-phase branch circuits rated 150 volts or less to ground shall have groundfault 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

**Exception to (3):** 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.

**(4)** Crawl spaces — at or below grade level
**(5)** Basements Unfinished portions or areas of the basement not intended as habitable rooms

**Exception to (5):** A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

**Informational Note:** See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems. Receptacles installed under the exception to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G).

**(6)** Kitchens — where the receptacles are installed to serve the countertop surfaces
**(7)** Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink
**(8)** Boathouses
**(9)** Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall
**(10)** Laundry areas

**Exception to (1) through (3), (5) through (8), and (10):** Listed locking support and mounting receptacles utilized in combination with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not be required to be ground-fault circuit-interrupter protected. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

**(11)** Indoor damp and wet locations

# 210.8(A)(5)
## GFCI Protection in Dwelling Unit Basements

**Reason for Change:**

GFCI protection now required for ***ALL*** dwelling unit basements(*not just unfinished portions of basements*).

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

**(A) Dwelling Units.** All 125-volt through 250- volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through ~~(10)~~(11) and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel.

**(5)** Basements Unfinished portions or areas of the basement not intended as habitable rooms

# 210.8(A)(11)
## GFCI Protection at Indoor Damp and Wet Locations of Dwelling Units

**Reason for Change:**

GFCI protection is now required at indoor damp and wet locations of dwelling units.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

**(A) Dwelling Units.** All 125-volt through 250- volt~~, single-phase, 15- and 20-ampere~~ receptacles installed in the locations specified in 210.8(A)(1) through ~~(10)~~(11) and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel.

**(11)** Indoor damp and wet locations

# 210.8(B)
## GFCI Requirements at Non-Dwelling Unit Locations

**Reason for Change:**

New GFCI requirements at non-dwelling unit locations were added for damp locations, accessory buildings, laundry areas, and areas around bathtubs and shower stalls.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through ~~(E)~~(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

(See NEC for remainder of Code text)

**(B) Other Than Dwelling Units.** All ~~single-phase~~ 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground or less, 50 amperes or less and all receptacles supplied by three-phase ~~receptacles~~ branch circuits rated 150 volts or less to ground ~~or less~~, 100 amperes or less installed in the ~~following~~ locations specified in 210.8(B)(1) through (B)(12) shall have ground-fault circuit-interrupter protection for personnel.

**(1)** Bathrooms
**(2)** Kitchens or areas with a sink and permanent provisions for either food preparation or cooking
**(3)** Rooftops *Exception: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.*
**(4)** Outdoors

**Exception No. 1 to (3) and (4):** 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 to (4):** In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 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 having a design that is not compatible with GFCI protection.

**(5)** Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

**Exception No. 1 to (5):** In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

**Exception No. 2 to (5):** ~~For~~ Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities ~~other than those covered under 210.8(B) (1), GFCI protection shall not be required~~ shall be permitted to comply with 517.21.

**(6)** Indoor damp and wet locations
**(7)** Locker rooms with associated showering facilities
**(8)** Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms
**(9)** Crawl spaces — at or below grade level
**(10)** Unfinished ~~portions or~~ areas of the basements ~~not intended as habitable rooms~~

**Exception to (1) through (5), (8), and (10):** Listed locking support and mounting receptacles utilized in combination with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not be required to be ground-fault circuit-interrupter protected. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

**(11)** Laundry areas
**(12)** Bathtubs and shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

## 210.8(B)(2)
## GFCI Protection for Personnel in Other Than Dwelling Kitchens

**Reason for Change:**

Additional language was added to clarify that areas *not defined as a kitchen such as ice cream parlors, coffee shops, smoothie stores, etc.*, with a sink and permanent provisions for either food preparation or cooking have the same potential for shock hazards as a kitchen.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through ~~(E)~~(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

(See NEC for remainder of Code text)

**(B) Other Than Dwelling Units.** All ~~single-phase~~ 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground ~~or less~~, 50 amperes or less and all receptacles supplied by three-phase ~~receptacles~~ branch circuits rated 150 volts or less to ground ~~or less~~, 100 amperes or less installed in the ~~following~~ locations specified in 210.8(B)(1) through (B)(12) shall have ground-fault circuit-interrupter protection for personnel.

**(2)** Kitchens or areas with a sink and permanent provisions for either food preparation or cooking

## 210.8(D)
## GFCI Protection in Specific Appliances

**Reason for Change:**

New List Item (D) correlates the requirements found in 422.5(B) (*Type of GFCI protection for appliances*) and refers to the list of GFCI requirements for appliances in 422.5(A) for continued consistency as the list is modified in future *Code* editions.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (E)(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

(See NEC for remainder of Code text)

**(D) Specific Appliances.** Unless GFCI protection is provided in accordance with 422.5(B)(3) through (B)(5), the outlets supplying the appliances specified in 422.5(A) shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2). Where the appliance is a vending machine as specified in 422.5(A)(5) and GFCI protection is not provided in accordance with 422.5(B)(3) or (B) (4), branch circuits supplying vending machines shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2).

# NOTE

The state of Iowa has proposed pursuant to section 5 of the NFPA Regulations Governing the Development of NFPA 70, 2020 addition of the National Electric Code

*Tentative Interim Amendment* (TIA)

This TIA is for section 210.8 (F) until January 1st, 2022, by delaying the adoption of some of the 250 volts to ground for GFCI protection until January 1st, 2022, the EEB hopes that this will provide time for the NEC, product standards and product certifications to synchronize, along with the product availability concerns

# 210.8(E)
## GFCI Protection for Equipment Requiring Servicing

**Reason for Change:**

GFCI protection is now required for the receptacles required by210.63 for HVAC equipment, indoor service equipment, and indoor equipment requiring dedicated equipment space.

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through ~~(E)~~(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

(See NEC for remainder of Code text)

**(E) Equipment Requiring Servicing.** GFCI protection shall be provided for the receptacles required by 210.63.

# 210.8(F)
## GFCI Protection in Outdoor Outlets

**Reason for Change:**

GFCI protection is now required on dwelling unit outdoor outlets supplied by single-phase branch circuit rated 150 volts or less to ground, and 50 amperes or less (including 240-volt AC units).

**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through ~~(E)~~(F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

(See NEC for remainder of Code text)

**(F) Outdoor Outlets.** All outdoor outlets for dwellings, other than those covered in 210.8(A) (3), Exception to (3), that are supplied by single- phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit-interrupter protection for personnel.

**Exception:** Ground-fault circuit-interrupter protection shall not be required on lighting outlets other than those covered in 210.8(C).

## 210.11(C)(3)
### Bathroom Branch Circuits

**Reason for Change:**

Additional text added to clarify that the only bathroom receptacles required to be supplied by the 20-ampere rated bathroom receptacle outlet branch circuits are the receptacle outlet(s) required by 210.52(D) and any other receptacles installed in the bathroom that serve a countertop or work surface.

**210.11 Branch Circuits Required**

**(C)** Dwelling Units.

**(3) Bathroom Branch Circuits.** In addition to the number of branch circuits required by other parts of this section, ~~at least~~ one or more 120-volt, 20-ampere branch circuit shall be provided to supply the bathroom(s) receptacle outlet(s) required by 210.52(D) and any countertop and similar work surface receptacle outlets. Such circuits shall have no other outlets.

**Exception:** Where the 20-ampere circuit supplies a single bathroom, outlets for other equipment within the same bathroom shall be permitted to be supplied in accordance with 210.23(A)(1) and (A)(2).

## 210.11(C)(4)
### Garage Branch Circuits

**Reason for Change:**

Garage receptacle outlet 120-volt, 20-ampere branch circuits are only required for the receptacles required by 210.52(G)(1) for attached garages and in detached garages with electric power.

**210.11 Branch Circuits Required**

**(C)** Dwelling Units.

**(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 in required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

**Exception:** This circuit shall be permitted to supply readily accessible outdoor receptacle outlets.

## 210.12(C)
## AFCI Protection in Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities

**Reason for Change:**

AFCI protection has been expanded to patient sleeping rooms in nursing homes and limited-care facilities.

**210.12 Arc-Fault Circuit-Interrupter Protection.**

Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A), (B), (C), and (D). The arc-fault circuit interrupter shall be installed in a readily accessible location.

**(C) Guest Rooms and, Guest Suites**, and Patient Sleeping Rooms in Nursing Homes and Limited- Care Facilities. All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels and patient sleeping rooms in nursing homes and limited-care facilities shall be protected by any of the means described in 210.12(A)(1) through (6).

## 210.12(D)
## AFCI Protection in Guest Rooms and Guest Suites

**Reason for Change:**

Guest rooms and guest suites of hotels and motels have been

added to the areas requiring AFCI protection for extensions and modifications of existing occupancies.

**210.12 Arc-Fault Circuit-Interrupter Protection.**

**(D)** Branch Circuit Extensions or Modifications - Dwelling Units and, Dormitory Units, ~~and~~ Guest Rooms and Guest Suites.

~~In~~ Where branch circuit wiring for any of the areas specified in 210.12(A) ~~or~~, (B), ~~where branch-circuit wiring~~ or (C) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

**(1)** ~~A listed combination-type AFCI located at the origin of the branch circuit~~ By any of the means described in 210.12(A)(1) through (A)(6)
**(2)** 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.

## 210.15
## Devices Not Allowed to be Reconditioned

**Reason for Change:**

New section added prohibiting GFCI devices, AFCI devices, and ground-fault protection equipment from being reconditioned.

**210.15 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
**(3)** Equipment that provides ground-fault protection of equipment

## 210.52(C)
### Receptacle Outlets for Countertop or Work Surfaces

**Reason for Change:**

Revision clarifies that the receptacle outlets installed for countertop or work surfaces [210.52(C)] are not permitted to satisfy the requirement for receptacle outlet placement (wall spacing) as provided in 210.52(A).

**210.52 Dwelling Unit Receptacle Outlets.**

**(C)** Countertops and Work Surfaces.

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through ~~(C)(5)~~ (C) (3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

## 210.52(C)(1), (C)(2), and (C)(3)
### Receptacles in Wall Spaces, Island and Peninsular Countertops and Work Spaces

**Reason for Change:**

Revision creates two separate List Items for wall space, and island and peninsular countertops and work surfaces. For island and peninsular countertop and work surfaces, the horizontal measurement was changed to a square foot calculation to determine the number of receptacles required. One receptacle outlet is required for the first 9 sq. ft of countertop and an additional receptacle outlet is required for each additional 18 sq. ft. or fraction thereof.

**210.52 Dwelling Unit Receptacle Outlets.**

**(C) Countertops and Work Surfaces.** In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through ~~(C)(5)~~ (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).

For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

**(1) Wall Spaces Countertop and Work Surface.** A receptacle outlet shall be installed at each wall countertop and work surface that is 300 mm (12 in.) or wider. Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space.

**Exception:** Receptacle outlets shall not be required on a wall directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

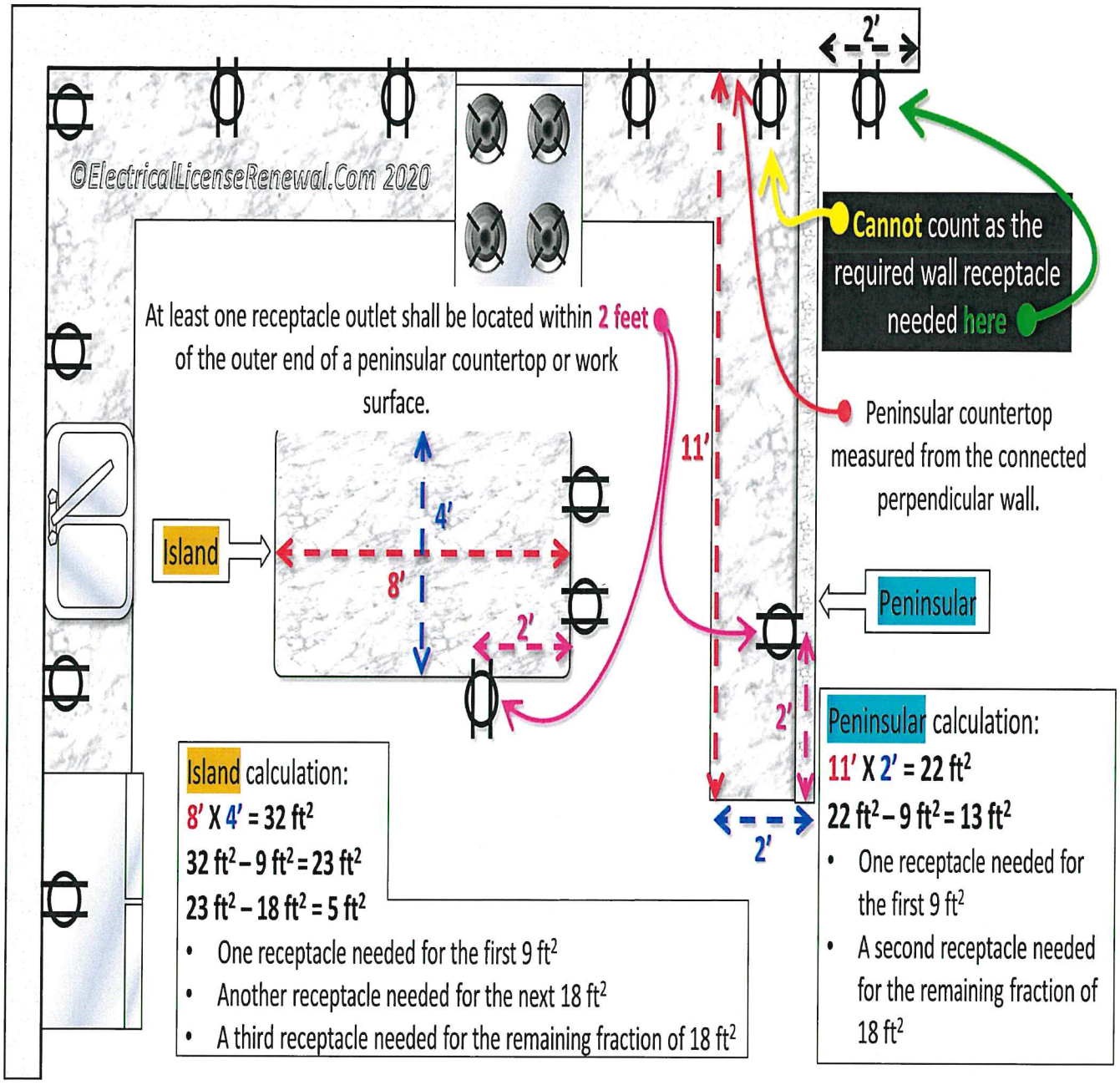
**(2) Island and Peninsular Countertops and Work Surfaces ~~Spaces~~.** Receptacle outlets shall be installed in accordance with 210.52(C)(2)(a) and (C)(2)(b).

**(a)** At least one receptacle shall be provided for the first 0.84 m2 (9 ft2), or fraction thereof, of the countertop or work surface. A receptacle outlet shall be provided for every additional 1.7 m2 (18 ft2), or fraction thereof, of the countertop or work surface ~~installed at each island countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater.~~

**(b)** At least one receptacle outlet shall be located within 600 mm (2 ft) of the outer end of a peninsular countertop or work surface. Additional required receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner. The location of the receptacle outlets shall be in accordance with 210.52(C)(3). A peninsular countertop shall be measured from the connected perpendicular wall.

**(3)** Peninsular Countertop Spaces. At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connected perpendicular wall.

**~~(5)~~ (3) Receptacle Outlet Location.** Receptacle outlets shall be located in one or more of the following:


©ElectricalLicenseRenewal.Com 2020
2'
Cannot count as the required wall receptacle needed here
At least one receptacle outlet shall be located within 2 feet of the outer end of a peninsular countertop or work surface.
Peninsular countertop measured from the connected perpendicular wall.
11'
Island
4'
8'
2'
Peninsular
2'
2'
Island calculation:
8' X 4' = 32 ft²
32 ft² – 9 ft² = 23 ft²
23 ft² – 18 ft² = 5 ft²
• One receptacle needed for the first 9 ft²
• Another receptacle needed for the next 18 ft²
• A third receptacle needed for the remaining fraction of 18 ft²
Peninsular calculation:
11' X 2' = 22 ft²
22 ft² – 9 ft² = 13 ft²
• One receptacle needed for the first 9 ft²
• A second receptacle needed for the remaining fraction of 18 ft²

**(1) On or Above Countertop or Work Surfaces:** On or above, but not more than 500 mm (20 in.) above, the countertop or work surface.
**(2) In Countertop or Work Surfaces:** Receptacle outlet assemblies listed for use in countertops or work surfaces shall be permitted to be installed in countertops or work surfaces.
**(3) Below Countertop or Works Surfaces:** ~~To comply with the following conditions (1) and (2), receptacle outlets shall be permitted to be mounted~~ Not more than 300 mm (12 in.) below the countertop or work surface. Receptacles installed below a countertop or work surface shall not be located where the countertop or work surface extends more than 150 mm (6 in.) beyond its support base.

**(1)** Construction for the physically impaired
**(2)** On island and peninsular countertops or work surface where the surface is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop or work surface, such as an overhead cabinet

Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception, or appliances occupying assigned spaces shall not be considered as these required outlets.

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

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

# 210.52(E)(3)
## Receptacle Outlet for Balconies, Decks, and Porches

**Reason for Change:**

The required receptacle outlet for balconies, decks, and porches is also required at decks that are installed in a freestanding manner where connection to the actual dwelling is not made at any point.

**210.52 Dwelling Unit Receptacle Outlets**

**(3) Balconies, Decks, and Porches.** Balconies, decks, and porches that are ~~attached to~~ within 102 mm (4 in.) horizontally of the dwelling unit and ~~are accessible from inside the dwelling unit~~ shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6 . ft) above the balcony, deck, or porch walking surface.

## 210.65
## Receptacle Outlets in Meeting Rooms

**Reason for Change:**

Revisions recognize non-rectangular meeting rooms (such as round-shaped meeting rooms). Revision also provides flexibility to provide a floor receptacle outlet or an outlet to supply receptacles for hardwired furniture with receptacles.

**~~210.71~~ 210.65 Meeting Rooms.**

**(A) General.** Each meeting room of not more than 93 m2 (1000 ft2) in other than dwelling units shall have outlets for nonlocking-type, 125-volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.~~71~~65(B). Where a room or space is provided with movable partition( s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

**Informational Note No. 1:** For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

**Informational Note No. 2:** Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

**(B) Receptacle Outlets Required.** The total number of receptacle outlets, including floor outlets and receptacle outlets in fixed furniture, shall not be less than as determined in (1) and (2). ~~These receptacle outlets shall be permitted to be located as determined by the designer or building owner.~~

**(1) Receptacle Outlets in Fixed Walls.** The required number of receptacle outlets shall be ~~installed~~ determined in accordance with 210.52(A) (1) through (A)(4). These

receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

**(2) Floor ~~Receptacle~~ Outlets.** A meeting room with any floor dimension that is ~~at least~~ 3.7 m (12 ft) ~~wide~~ or greater in any direction and that has a floor area of at least 20 m2 (215 ft2) shall have at least one floor receptacle outlet ~~located in the floor~~, or at least one floor outlet to serve receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m2 (215 ft2) or major portion of floor space.

**Informational Note No. 1:** See Section 314.27(B) for floor boxes used for receptacles located in the floor.

**Informational Note No. 2:** See Article 518 for assembly occupancies designed for 100 or more persons.

# 215 - Feeders

## 215.9
## Feeders in GFCI in Readily Accessible Location

**Reason for Change:**

Revision provides correlation with GFCI protection requirements in 210.8 by removing the existing limitations of a feeder to provide GFCI protection to only 15 and 20-ampere receptacle branch circuits.

**215.9 Ground-Fault Circuit-Interrupter Protection for Personnel.**

Feeders ~~supplying 15- and 20-ampere receptacle branch circuits~~ shall be permitted to be protected by a ground-fault circuit interrupter installed in a readily accessible location in lieu of the provisions for such interrupters as specified in 210.8 and 590.6(A).

## 215.10, Ex. No. 3
Exception to Permit Temporary Feeders

**Reason for Change:**

New exception added to permit temporary feeders to be used during repair, maintenance or emergencies without GFP of equipment. The time period permitted is not to exceed 90 days.

**215.10 Ground-Fault Protection of Equipment.**

Each feeder disconnect rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with the provisions of 230.95.

**Informational Note:** For buildings that contain health care occupancies, see ~~the requirements of~~ 517.17.

**Exception No. 1:** ~~The provisions of~~ This section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

**Exception No. 2:** ~~The provisions of~~ This section shall not apply if ground-fault protection of equipment is provided on the supply side of the feeder and on the load side of any transformer supplying the feeder.

**Exception No. 3:** If temporary feeder conductors are used to connect a generator to a facility for repair, maintenance, or emergencies, ground-fault protection of equipment shall not be required. Temporary feeders without ground-fault protection shall be permitted for the time period necessary but shall not exceed 90 days.

# 220 – Branch-Circuit, Feeder, and Service Load Calculations

# 220.12 and Table 220.12
## Lighting Load for Non-Dwelling Occupancies

**Reason for Change:**

Section 220.12 and Table 220.12 has been extensively revised. Reduced lighting loads in most occupancies was achieved. Dwelling and multi-family dwelling units were moved out of Table 220.12 and referenced in revised 220.14(J).

**220.12 Lighting Load for Specified Non-Dwelling Occupancies.**

**(A) General.** A unit load of not less than that specified in Table 220.12 for ~~occupancies specified shall constitute~~ non-dwelling occupancies and the floor area determined in 220.11shall be used to calculate the minimum lighting load. ~~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, garages, or unused or unfinished spaces not adaptable for future use.~~ Motors rated less than 1⁄8 HP and connected to a lighting circuit shall be considered general lighting load.

**Informational Note:** The unit values of Table 220.12 are based on minimum load conditions and 100 percent power factor and may not provide sufficient capacity for the installation contemplated.

**(B) Energy Code.** ~~Exception No. 1:~~ Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated ~~at~~ using the unit values specified in the energy code where the following conditions are met:

**(1)** A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.
**(2)** The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted.
**(3)** The demand factors specified in 220.42 are not applied to the general lighting load.
**(4)** The continuous load multiplier of 125 percent shall be applied.

**Exception No. 2** Where a building is designed and constructed to comply with an energy code adopted by the local authority and specifying an overall lighting density of less than 13.5 volt-amperes/m2 (1.2 volt-amperes/ft2), the unit lighting loads in

Table 220.12 for office and bank areas within the building shall be permitted to be reduced by 11 volt-amperes/ m2 (1 volt-amperes/ft2).

Table 220.12 General Lighting Loads by Non-Dwelling Occupancy

(See NEC and Table 220.12 provided in this text)

## 220.14(J)
### Unit Loads for Dwelling Units

**Reason for Change:**

The *NEC* calculation of 3.0 watts per square foot for dwelling units was moved from Table 220.12 to 220.14(J) and reference to Table 220.12 was removed from 220.14(J).

**220.14 Other Loads – All Occupancies**

**(J) Dwelling ~~Occupancies~~ Units.** In one-family, two-family, and multifamily dwellings ~~and in guest rooms or guest suites of hotels and motels~~, the minimum unit load shall be not less than 33 VA volt-amperes/m2 (3 VA volt-amperes/ft2). The lighting and receptacle outlets specified in 220.14(J)(1), (J)(2), and (J)(3) are included in the minimum ~~general lighting load calculations of 20.12~~ unit load. No additional load calculations shall be required for such outlets. The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.11 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.

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

## 220.42
### Lighting Load Demand Factors

**Reason for Change:**

Hospitals were deleted from Table 220.42 and is now required to include 100 percent of the total VA of the calculated lighting load.

**220.42 General Lighting.**

The demand factors specified in Table 220.42 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

Table 220.42 Lighting Load Demand Factors

(See NEC and supplied table for complete NEC text of table)

## 220.53
## Appliance Load — Dwelling Unit

**Reason for Change:**

All household electric cooking equipment that is fastened in place (*not just an electric range*) has been added to the list of appliances that cannot be included in the four or more appliances eligible for a 75% derating demand factor.

**220.53 Appliance Load — Dwelling Unit(s).** It shall be permissible to apply a demand factor of 75 percent to the nameplate rating load of four or more appliances rated 1/4 hp or greater, or 500 watts or greater, that are fastened in place, ~~other than electric ranges, clothes dryers, space-heating equipment, or air-conditioning equipment~~, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling. This demand factor shall not apply to:

**(1)** Household electric cooking equipment that is fastened in place
**(2)** Clothes dryers
**(3)** Space heating equipment
**(4)** Air-conditioning equipment

# 225 – Outside Branch Circuits and Feeders

## 225.30(B)
### Special Conditions for More than One Outside Feeder

**Reason for Change:**

New text added that will permit more than one feeder (up to six feeders) under very limited circumstances (same panelboard, grouped, etc.).

**225.30 Number of Supplies.**

**(A) Special Conditions.**

**(B) Common Supply Equipment.** Where feeder conductors originate in the same panelboard, switchboard, or other distribution equipment, and each feeder terminates in a single disconnecting means, not more than six feeders shall be permitted. Where more than one feeder is installed in accordance with this section, all feeder disconnects supplying the building or structure shall be grouped in the same location, and the requirements of 225.33 shall not apply. Each disconnect shall be marked to indicate the load served.

(C) Special Occupancies.

(D) Capacity Requirements. (

E) Different Characteristics.

(F) Documented Switching Procedures.

(See NEC for complete Code text)

# 230 - Services

## 230.46
### Spliced and Tapped Conductors

**Reason for Change:**

Requirement for power distribution blocks installed on service conductors required to be marked "suitable for use on the line side of the service equipment" or equivalent was moved to

230.46. All devices used to splice service conductors must be listed and marked as "suitable for use on the line side of the service equipment" or equivalent by January 1, 2023.

**230.46 Spliced and Tapped Conductors.**

Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

Effective January 1, 2023, pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

## 230.62(C)
## Barriers at Service Panels, Switchboards, and Switchgear

**Reason for Change:**

Previous provision for barriers at service panelboards, switchboards, and switchgear has been moved to Article 230 to apply to all service equipment.

**230.62 Service Equipment - Enclosed or Guarded.**

Energized parts of service equipment shall be enclosed as specified in 230.62(A) or guarded as specified in 230.62(B).

**(C) Barriers.** Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

# What is the difference between Type 1 and type 2 SPSs?

A type 1 SPD is a hardwired, permanently connected SPD which may be installed on the utility side of the main service overcurrent protection devise (i.e. before the main breaker), or may be installed after the main breaker.

Type 1 SPDs installed before the main breaker protect about 20% of surges/spikes from the utility company, however will not protect against surge spikes from the surges/spikes from internally from the house.

Type 1 SPDs install before the main range in cost of $200 to $300 per unit and $175 to install and may require utility company disconnect

Type 2 SPDs is also hard wired permanently connected and must be installed after the main service overcurrent protective device.

Type 2 SPDs are normally installed in the breaker panel and require a specific type of breaker called out by the SPD manufacture

Type 2 SPDs installed after the main breaker protect about 80% of surges/spikes in the house generated from switches, receptacles, motors etc. being turned off and on

Type 2 SPDs installed after the main breaker range in cost of $88 to $250 per unit and $150 to install

Type 3 SPDs are not cover by article 230.67 of the NEC as required and cannot be used to satisfy the requirements. Type 3 SPDs are point of use devices and are still recommend for the protection of computers, TVs and other electronic devices. Type 3 SPDS are usually incorporated in power strips

## 230.67
## Surge Protection Devices in Dwelling Units

**Reason for Change:**

New requirement added to require surge protection on all services at dwelling units.

**230.67 Surge Protection.**

**(A) Surge-Protective Device.** All services supplying dwelling units shall be provided with a surge-protective device (SPD).

**(B) Location.** The SPD shall be an integral part of the service equipment or shall be located immediately adjacent thereto.

**Exception:** The SPD shall not be required to be located in the service equipment as required in (B) if located at each next level distribution equipment downstream toward the load.

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

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

## 230.71
## Maximum Number of Disconnects in Single Enclosure

**Reason for Change:**

Revision eliminates more than one service disconnecting means in the same panelboard or other enclosure. Continues to retain the six service disconnect rule for services; however, the permission for up to six service disconnects is modified to require installation in separate enclosures only.

**230.71 Maximum Number of Disconnects.**

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

**(A) General.** The service disconnecting means 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, shall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard or in switchgear. There shall be not more than six sets of disconnects per service grouped in any one location.

For the purpose of this section, disconnecting means installed as part of listed equipment and used solely for the following shall not be considered a service disconnecting means:

**(1)** Power monitoring equipment
**(2)** Surge-protective device(s)
**(3)** Control circuit of the ground-fault protection system
**(4)** Power-operable service disconnecting means

**(B) Single-Pole Units Two to Six Service Disconnecting Means.** Two or three single-pole switches or breakers, capable of individual operation, shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with identified handle ties or a master handle to disconnect all conductors of the service with no more than six operations of the hand. 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 where there are barriers separating each vertical section
**(4)** Service disconnects in switchgear or metering centers where each disconnect is located in a separate compartment

**Informational Note No. 1:** See 408.36, Exception No. 1 and Exception No. 3, for service equipment in certain panelboards, and see 430.95 for service equipment in motor control centers Metering centers are addressed in UL 67, Standard for Panelboards.

**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, circuit breaker enclosures, and transfer switches that are suitable for use as service equipment.

# 230.85
## Emergency Disconnect at a Readily Accessible Location

**Reason for Change:**

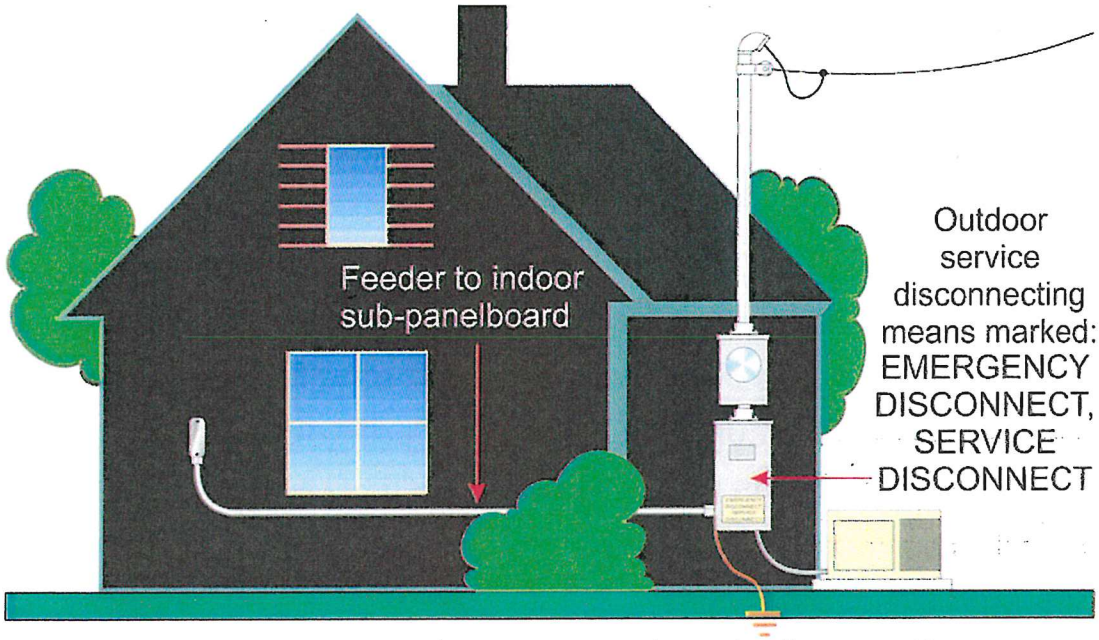
New requirement added to require an emergency disconnect at a readily accessible outdoor location for dwelling units.

**230.85 Emergency Disconnects.**

For one- and two-family dwelling units, all service conductors shall terminate in disconnecting means having a short-circuit current rating equal to or greater than the available fault current, installed in a readily accessible outdoor location. If more than one disconnect is provided, they shall be grouped. Each disconnect shall be one of the following:

**(1)** Service disconnects marked as follows: EMERGENCY DISCONNECT, SERVICE DISCONNECT
**(2)** Meter disconnects installed per 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 suitable for use as service equipment and marked as follows: EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT Markings shall comply with 110.21(B).

## 230.85 Exterior Emergency Disconnect(s)




For dwellings, all service conductors to terminate in disconnecting means having a short-circuit current rating equal to or greater than the available fault current, installed in a readily accessible outdoor location

If more than one disconnect is provided, must be grouped

# 240 - Overcurrent Protection

## 240.6(C)
## Restricted Access Adjustable-Trip Circuit Breakers

**Reason for Change:**

New provision added to recognize modern electronic trip units to provide the ability to set a password to keep unauthorized users from changing the settings on an adjustable-trip circuit breaker(s) that has restricted access to the adjusting means.

**240.6 Standard Ampere Ratings.**

**(C) Restricted Access Adjustable-Trip Circuit Breakers.** A circuit breaker(s) that has restricted access to the adjusting means shall be permitted to have an ampere rating(s) that is equal to the adjusted current setting (long-time pickup setting). Restricted access shall be ~~defined as located behind~~ achieved by one of the following methods:

**(1)** Located behind removable and sealable covers over the adjusting means
**(2)** Located behind bolted equipment enclosure doors
**(3)** Located behind locked doors accessible only to qualified personnel
**(4)** Password protected, with password accessible only to qualified personnel

## 240.87
## Arc Energy Reduction Method to Reduce Clearing Time

### Reason for Change:

Revision to 240.87(B)(5) clarifies that temporary adjustment of the instantaneous trip setting to achieve arc energy reduction shall not be permitted.

**240.87 Arc Energy Reduction.**

**(A) Documentation.** Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s). Documentation shall also be provided to demonstrate that the method chosen to reduce clearing time is set to operate at a value below the available arcing current.

**(B) Method to Reduce Clearing Time.** One of the following means shall be provided and shall be set to operate at less than the available arcing current:

**(1)** Zone-selective interlocking
**(2)** Differential relaying
**(3)** Energy-reducing maintenance switching with local status indicator
**(4)** Energy-reducing active arc flash mitigation system
**(5)** An instantaneous trip setting ~~that is less than the available arcing current.~~ Temporary adjustment of the instantaneous trip setting to achieve arc energy reduction shall not be permitted.
**(6)** An instantaneous override ~~that is less than the available arcing current~~
**(7)** An approved equivalent means

(See NEC text for Informational Notes)

## 240.88
Reconditioned Equipment

**Reason for Change:**

New section added dealing with reconditioned equipment. Molded- case circuit breakers shall not be permitted to be reconditioned.

**240.88 Reconditioned Equipment.**

Reconditioned equipment shall be listed as "reconditioned" and the original listing mark removed.

**(A) Circuit Breakers.** The use of reconditioned circuit breakers shall comply with (1) through (3):

**(1)** Molded-case circuit breakers shall not be permitted to be reconditioned.
**(2)** Low- and medium-voltage power circuit breakers shall be permitted to be reconditioned.
**(3)** High-voltage circuit breakers shall be permitted to be reconditioned.

**(B) Components.** The use of reconditioned trip units, protective relays, and current transformers shall comply with (1) and (2):

**(1)** Low-voltage power circuit breaker electronic trip units shall not be permitted to be reconditioned.
**(2)** Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

# 242 – Overvoltage Protection

## Article 242
Overvoltage Protection

**Reason for Change:**

New article added to provide the general, installation, and connection requirements for overvoltage protection and

overvoltage protective devices. Relocates Articles 280 and 285 into a new Article 242.

**Article 242 Overvoltage Protection**

**Part I. General**

**242.1 Scope.** This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

**Informational Note:** Article 242 combines and replaces Articles 280 and 285 in NFPA 70-2017.

**242.3 Other Articles.**

**Table 242.3 Other Articles**

**Part II. Surge-Protective Devices (SPDs), 1000 Volts or Less**

**242.6 Uses Not Permitted.**
**242.8 Listing.**
**242.10 Short-Circuit Current Rating.**
**242.12 Type 1 SPDs.**

**(A) Installation.**
**(B) At the Service.**

**242.14 Type 2 SPDs.**

**(A) Service-Supplied Building or Structure.**
**(B) Feeder-Supplied Building or Structure.**
**(C) Separately Derived System.**

**242.16 Type 3 SPDs.**
**242.18 Type 4 and Other Component Type SPDs.**
**242.20 Number Required.**
**242.22 Location.**
**242.24 Routing of Connections.**
**242.26 Connection.**
**242.28 Conductor Size.**
**242.30 Connection Between Conductors.**
**242.32 Grounding Electrode Conductor Connections and Enclosures.**

**Part III. Surge Arresters, Over 1000 Volts**

**242.40 Uses Not Permitted.**
**242.42 Surge Arrester Selection.**

**(A) Rating.**

**(1) Solidly Grounded Systems.**
**(2) Impedance or Ungrounded System.**

**(B) Silicon Carbide Types.**

**242.44 Number Required.**
**242.46 Location.**
**242.48 Routing of Surge Arrester Equipment Grounding Conductors.**
**242.50 Connection.**
**242.52 Surge-Arrester Conductors.**
**242.54 Interconnections.**

**(A) Metal Interconnections.**

**(1) Additional Grounding Connection.**
**(2) Multigrounded Neutral System Connection.**

**(B) Through Spark Gap or Device.**

**(1) Ungrounded or Unigrounded Primary System.**
**(2) Multigrounded Neutral Primary System.**

**(C) By Special Permission.**

**242.56 Grounding Electrode Conductor Connections and Enclosures.**

(See NEC for complete text)

# 250 – Grounding and Bonding

## 250.25
## Grounding Systems Permitted to Be Connected on the Supply Side of the Disconnect.

**Reason for Change:**

New section created to cover the requirements for grounding of

supply-side disconnects permitted to be connected on the supply-side of a service. Points user of the *Code* to 250.24.

**250.25 Grounding Systems Permitted to Be Connected on the Supply Side of the Disconnect.**

The grounding of systems connected on the supply side of the service disconnect, as permitted in 230.82, that are in enclosures separate from the service equipment enclosure shall comply with 250.25(A) or (B).

**(A) Grounded System.** If the utility supply system is grounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(A) through (D).

**(B) Ungrounded Systems.** If the utility supply system is ungrounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(E).

## 250.64(A)
## Grounding Electrode Conductor Installation in Aluminum or Copper-Clad Aluminum Conductors

**Reason for Change:**

*Code* language was formatted into a list format for improved clarity and usability and to clarify that terminations for aluminum or copper-clad aluminum conductors located in the interior of equipment "listed and identified for the environment" are separated from the earth and can be terminated within 450 mm (18 in.) of the earth.

**250.64 Grounding Electrode Conductor Installation.**

Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (F).

**(A)** Aluminum or Copper-Clad Aluminum Conductors. And identified for the enviroment

**(1)** Bare or covered conductors without an extruded polymeric covering shall not be installed where subject to corrosive conditions or be installed in direct contact with concrete.
**(2)** Terminations made within outdoor enclosures that are listed and identified for the environment shall be permitted within 450 mm (18 in.) of bottom of the enclosure.
**(3)** ~~Bare~~ Aluminum or copper-clad aluminum ~~grounding electrode~~ conductors external to buildings or equipment enclosures shall not ~~be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be~~ terminated within 450 mm (18 in.) of the earth.

# 250.64(B)(2) and (B)(3)
## Grounding Electrode Conductor Protection from Physical Damage

**Reason for Change:**

Revision clarifies that Schedule 80 is required when PVC conduit is used for protection from physical damage for a grounding electrode conductor.

**250.64 Grounding Electrode Conductor Installation**

**(B) Securing and Protection Against Physical Damage.** Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members.

**(1) Not Exposed to Physical Damage.** A 6 AWG or larger copper or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection.
**(2) Exposed to Physical Damage.** A 6 AWG or larger copper or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), Schedule 80 rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor.

**(3) Smaller Than 6 AWG.** Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, Schedule 80 PVC, RTRC-XW, EMT, or cable armor.

# 250.68(C)(3)
## Grounding Electrode Conductor Connections in Rebar System

**Reason for Change:**

New provisions added to clarify that the rebar system in a footing or foundation is not suitable as the conductor to interconnect other grounding electrodes.

**250.68(C)(3) Grounding Electrode Conductor and Bonding Jumper Connection to Grounding Electrodes.**

The connection of a grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system and associated bonding jumper(s) shall be made as specified 250.68(A) through (C).

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

**(1)** Interior metal water piping...(*see NEC for complete Code text*)
**(2)** The metal structure frame of a building...(*see NEC for complete Code text*)
**(3)** A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete foundation or footing to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers. ~~The rebar extension shall not be exposed to contact with the earth without corrosion protection~~. in accordance with the following:

**(a)** The additional rebar section shall be continuous with the grounding electrode rebar or shall be connected to the grounding electrode rebar and connected together by the usual steel tie wires, exothermic welding, welding, or other effective means.
**(b)** The rebar extension shall not be exposed to contact with the earth without corrosion protection.
**(c)** Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.

# 250.104(A)(1)
## Bonding Jumpers used to Bond Metal Water Piping Systems Requirements

**Reason for Change:**

Bonding jumper(s) used to bond metal water piping system(s) together are not required to be larger than 3/0 copper or 250 kcmil aluminum or copper- clad aluminum.

**250.104 Bonding of Piping Systems and Exposed Structural Metal.**

**(A) Metal Water Piping.** The metal water piping system shall be bonded as required in 250.104(A) (1), (A)(2), or (A)(3) ~~of this section~~. (1) General. Metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

**(1)** Service equipment enclosure
**(2)** Grounded conductor at the service
**(3)** Grounding electrode conductor, if of sufficient size
**(4)** One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1) except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum and except as permitted in 250.104(A) (2) and 250.104(A)(3).

# 250.104(A)(3)
## Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s)

**Reason for Change:**

Revision clarifies the sizing requirements for bonding jumper(s) used for bonding metal water piping systems when a building or structure is supplied by a feeder or branch circuit. Reference changed from Table 250.102(C)(1) to 250.102(D) (and Table 250.122).

**250.104 Bonding of Piping Systems and Exposed Structural Metal.**

**(A) Metal Water Piping.** The metal water piping system shall be bonded as required in 250.104(A) (1), (A)(2), or (A)(3) of this section.

**(3) ~~Multiple~~ Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).** The metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

**(1)** Building or structure disconnecting means enclosure where located at the building or structure
**(2)** Equipment grounding conductor run with the supply conductors
**(3)** One or more grounding electrodes used The bonding jumper(s) shall be sized in accordance with ~~Table 250.102(C)(1)~~, 250.102(D) ~~based on the size of the feeder or branch-circuit conductors that supply the building or structure~~. The bonding jumper shall not be required to be larger than the largest ungrounded feeder or branch-circuit conductor supplying the building or structure.

# 250.109
## Metal Enclosures to Connect Bonding Jumpers or Equipment Grounding Conductors

**Reason for Change:**

New section indicating metal enclosures can be used to connect bonding jumpers or equipment grounding conductors, or both, together to become a part of an effective ground-fault current path.

**250.109 Metal Enclosures**

Metal enclosures shall be permitted to be used to connect bonding jumpers or equipment grounding conductors, or both, together to become a part of an effective ground-fault current path. Metal covers and metal fittings attached to these metal enclosures shall be considered as being connected to bonding jumpers or equipment grounding conductors, or both.

## 250.121(B)
### Restricted Use of Metal Frames as Equipment Grounding Conductors

**Reason for Change:**

New sub-section prohibits the structural metal frame of a building or structure from being used as an equipment grounding conductor.

**250.121 Restricted Use of Equipment Grounding Conductors.**

**(B) Metal Frame of Building or Structure.** The structural metal frame of a building or structure shall not be used as an equipment grounding conductor.

## 250.122(B), Exception
### Resizing ECG to Provide Effective Ground Fault Current Path

**Reason for Change:**

Revisions clarify that adjustment and/or correction factors do not require an increase in the size of the EGC. New exception was added to allow the EGC to be sized by a qualified person, provided an effective ground fault current path can be established.

**250.122 Size of Equipment Grounding Conductors.**

**(B) Increased in Size.** If ~~Where~~ ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C) ~~from the minimum size that has sufficient ampacity for the intended installation~~, wire-type equipment grounding conductors, if ~~where~~ installed, shall be increased in size proportionately, ~~according to the~~ to the increase in circular mil area of the ungrounded conductors.

**Exception:** Equipment grounding conductors shall be permitted to be sized by a qualified person to provide an effective ground fault current path in accordance with 250.4(A)(5) or (B)(4).

# 250.148
## Continuity of Equipment Grounding Conductors in Boxes

**Reason for Change:**

Revision clarifies that all wire-type equipment grounding conductors associated with any of those spliced circuit conductors must be connected within the box or to the box.

**250.148 Continuity of Equipment Grounding Conductors and Attachment ~~of Equipment Grounding Conductors to~~ in Boxes.**

If circuit conductors are spliced within a box or terminated on equipment within or supported by a box, all wire-type equipment grounding conductor( s) associated with any of those circuit conductors shall be connected within the box or to the box ~~with devices suitable for the use~~ in accordance with 250.8 and 250.148(A) through ~~(E)~~(D).

**Exception:** The equipment grounding conductor permitted in 250.146(D) shall not be required to be connected to the other equipment grounding conductors or to the box.

**(A) Connections and Splices.** Connections and splices shall be made in accordance with 110.14(B) except that insulation shall not be required.

**(B) Equipment Grounding Conductor Continuity.** The arrangement of grounding connections shall be such that the disconnection or the removal of a luminaire, receptacle, ~~luminaire~~, or other device fed from the box does not ~~interfere with~~ or interrupt the ~~grounding~~ electrical continuity of the equipment grounding conductor(s) providing an effective ground-fault current path.

**(C) Metal Boxes.** A connection used for no other purpose shall be made between the one or more equipment grounding conductors and a metal box by means of a grounding screw that shall be used for no other purpose, equipment listed for grounding, or a listed grounding device metal box and the equipment grounding conductor(s) in accordance with 250.8.

**(D) Nonmetallic Boxes.** One or more equipment grounding conductors brought into a nonmetallic outlet box shall be arranged such that a connection can be made to any fitting or device in that box requiring connection to an equipment grounding conductor.

**(E) Solder.** Connections depending solely on solder shall not be used.

# 250.184(C), Exception
## Exception for Multi-grounded Neutral Systems

**Reason for Change:**

New exception added to relieve bonding the neutral conductor to a grounding electrode in an uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode in a multigrounded neutral system.

**250.184 Solidly Grounded Neutral Systems**

**(C) Multigrounded Neutral Systems.** Where a multigrounded neutral system is used, the following shall apply:

**(1)** The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations:

**(a)** Transformers supplying conductors to a building or other structure
**(b)** Underground circuits where the neutral conductor is exposed
**(c)** Overhead circuits installed outdoors

**(2)** The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode.
**(3)** At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft).
**(4)** The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft).
**(5)** In a multigrounded shielded cable system, the shielding shall be grounded at each cable joint that is exposed to personnel contact.

**Exception:** In a multipoint grounded system, a grounding electrode shall not be required to bond the neutral conductor in an uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode.

# 250.187
## Impedance Grounded Systems

**Reason for Change:**

Impedance Grounded Neutral Systems. Revisions clarify that the conductor from the neutral point of a transformer to the grounding impedance device does not meet the definition of neutral conductor in Article 100 since it is not intended to carry current during normal operation.

**250.187 Impedance Grounded Neutral Systems.**

Impedance grounded ~~neutral~~ systems in which a grounding impedance, usually a resistor, limits the ground-fault current shall be permitted where all of the following conditions are met:

**(1)** The conditions of maintenance and supervision ensure that only qualified persons service the installation.
**(2)** Ground detectors are installed on the system.
**(3)** Line-to-neutral loads are not served. Impedance grounded neutral systems shall comply with ~~the provisions of~~ 250.187(A) through (D).

**(A) Location.** The grounding impedance shall be inserted in the grounding electrode conductor between the grounding electrode of the supply system and the neutral point of the supply transformer or generator.

**(B) Identified and Insulated.** The neutral conductor shall comply with both of the following: grounded conductor shall be insulated for the maximum neutral voltage. The neutral conductor shall be identified. The neutral conductor shall be insulated for the maximum neutral voltage.

**Informational Note:** The maximum neutral voltage in a three 3-phase wye system is 57.7 percent of the phase-to-phase voltage.

**(C) Grounded System Neutral Conductor Connection.** The system ~~neutral~~ grounded conductor shall not be connected to ground, except through the neutral grounding impedance.

**(D) Equipment Grounding Conductors.** Equipment grounding conductors shall be permitted to be bare and shall be electrically connected to the ground bus and grounding electrode conductor.

# Chapter 3. Wiring Methods: Articles 300-392

## 300 – General Requirements for Wiring Methods and Materials

### 300.4(G)
Alternative Metal Fittings: Protection Against Physical Damage

**Reason for Change:**

Title was revised to remove the word "Insulated" to cover alternative metal fittings. Text added to cover listed metal fittings that have smoothly rounded edges that will not damage the 4 AWG and larger conductors.

**300.4 Protection Against Physical Damage.**

Where subject to physical damage, conductors, raceways, and cables shall be protected.

**(G)** ~~Insulated~~ Fittings. Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected ~~by an identified fitting providing a smoothly rounded insulating surface, unless the conductors are separated from the fitting or raceway by identified insulating material that is securely fastened in place.~~ in accordance with any of the following:

**(1)** ~~by~~ An identified fitting providing a smoothly rounded insulating surface
**(2)** A listed metal fitting that has smoothly rounded edges
**(3)** Separation from the fitting or raceway by using an identified insulating material that is securely fastened in place
**(4)** Threaded hubs or bosses that are an integral part of cabinet, box, enclosure, or raceway provide a smoothly rounded or flared entry for conductors.

**Exception:** Where threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway provide a smoothly rounded or flared entry for conductors.

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

## 300.7(A)
## Sealings in Raceways Exposed to Different Temperatures

**Reason for Change:**

Where raceways or sleeves are known to be subjected to different temperatures, and where condensation is known to be a problem, it is required to be sealed with a sealant identified for use with cable insulation, conductor insulation (*rather than filled with an approved material*).

**300.7 Raceways Exposed to Different Temperatures.**

**(A) Sealing.** Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway or sleeve shall be ~~filled with an approved material~~ sealed to prevent the circulation of warm air to a colder section of the raceway or sleeve. Sealants shall be identified for use with cable insulation, conductor insulation, a bare conductor, a shield, or other components. An explosionproof seal shall not be required for this purpose.

## 300.15(F)
## Boxes, Conduit Bodies, or Fittings- Where Required

**Reason for Change:**

Revisions occurred to make it clear that listed transition fittings and listed interconnector devices are permitted to be installed in concealed locations behind drywall and similar locations.

**300.15 Boxes, Conduit Bodies, or Fittings- Where Required.**

A box shall be installed at each outlet and switch point for concealed knob-and-tube wiring. Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed.

Where the wiring method is conduit, tubing, Type AC cable, Type MC cable, Type MI cable, nonmetallic- sheathed cable, or other cables, a box or conduit body shall be installed at each conductor splice point, outlet point, switch point, junction point, termination point, or pull point, unless otherwise permitted in 300.15(A) through (L).

**(F) Fitting.** A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, unless listed for concealed installation.

# 300.22(D)
## Air-handling Areas Beneath Raised Floors for IT Rooms

**Reason for Change:**

Revision to reference 645.5(E) rather than the entire Article 645 for electrical wiring in air-handling areas beneath raised floors for information technology equipment.

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

The provisions 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).

**(D) Information Technology Equipment.** Where the installation complies with the special requirements in 645.4, electrical wiring in air-handling areas beneath raised floors for information technology equipment shall be permitted in accordance with ~~Article 645~~ 645.5(E).

## 300.25
## Exit Enclosures (Stair Towers).

**Reason for Change:**

New section added pertaining to the allowable electrical wiring methods serving electrical equipment in exit enclosures (*stairways*).

**300.25 Exit Enclosures (Stair Towers).**

Where an exit enclosure is required to be separated from the building, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

**Informational Note:** For more information, refer to NFPA 101-2018, Life Safety Code, 7.1.3.2.1(10)(b).

## 300.45
## Replacing the word "Warning" with "Danger" Signs

**Reason for Change:**

Editorial revisions for signs required to be posted at points of access to conductors for raceway and cable systems of over 1000 volts replacing the word "Warning" with the word "Danger."

**300.45 ~~Warning~~ Danger Signs.**

~~Warning~~ Danger signs shall be conspicuously posted at points of access to conductors in all conduit raceway systems and cable systems. The warning sign(s) shall ~~be legible and permanent and shall carry the following wording~~ meet the requirements in 110.21(B), shall be readily visible, and shall state the following:

DANGER—HIGH VOLTAGE—KEEP OUT

# 310 – Conductors for General Wiring

# Article 310
## Conductors for General Wiring

**Reason for Change:**

Article 310 was extensively reorganized to increase the usability of the article.

**Part I. General**

310.1 Scope
~~310.2 Definitions~~
310.3 Conductors

**Part II. Construction Specifications**

310.4 Conductor Constructions and Applications
310.6 Conductor Identification
310.8 Marking

**Part III. Installation**

310.10 Uses Permitted
310.12 Single-Phase Dwelling Services and Feeders
310.14 Ampacities for Conductors Rated 0-2000 Volts 310.15 Ampacity Tables
310.16 Allowable Ampacities of Insulated Conductors in Raceway, Cable, or Earth (Directly Buried)
310.17 Allowable Ampacities of Single-Insulated Conductors in Free Air.
310.18 Allowable Ampacities of Insulated Conductors in Raceway or Cable
310.19 Allowable Ampacities of Single-Insulated Conductors in Free Air
310.20 Ampacities of Conductors Supported on a Messenger
310.21 Ampacities of Bare or Covered Conductors in Free Air
~~310.60 Conductors Rated 2001 to 35,000 Volts~~

(See NEC for complete text)

# Article 310 Ampacity Tables
## Ampacity Tables

**Reason for Change:**

The ampacity tables will simply be titled as Table 310.16 through Table 310.21 (Example: Table 310.15(B)(16) will now be simply Table 310.16).

**Article 310 Ampacity Tables.**

Table 310.16 ~~310.15(B)(16) (formerly Table 310.16) Allowable~~ Ampacities of Insulated Conductors ~~Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F),~~ with- Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), ~~Based on Ambient Temperature of 30°C (86°F)*~~
*[was Table 310.16(B)(16)]*

Table 310.17 310.15(B)(17) (formerly Table 310.17) Allowable Ampacities of Single-Insulated Conductors Rated Up to and Including 2000 Volts in Free Air, Based on Ambient Temperature of 30°C (86°F)*
*[was Table 310.16(B)(17)]*

Table 310.18 310.15(B)(18) (formerly Table 310.18) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 150°C Through 250°C (302°F Through 482°F). with Not More Than Three Current-Carrying Conductors in Raceway or Cable, Based on Ambient Air Temperature of 40°C (104°F)* *[was Table 310.16(B)(18)]*

Table 310.19 310.15(B)(19) (formerly Table 310.19) Allowable Ampacities of Single-Insulated Conductors, Rated Up to and Including 2000 Volts, 150°C Through 250°C (302°F Through 482°F), in Free Air, Based on Ambient Air Temperature of 40°C (104°F)*
*[was Table 310.16(B) (19)]*

Table 310.20 310.15(B)(20) (formerly Table 310.20) Ampacities of Not More Than Three Single Insulated Conductors, Rated Up to and Including 2000 Volts, Supported on a Messenger, Based on Ambient Air Temperature of 40°C (104°F)*
*[was Table 310.16(B)(20)]*

Table 310.21 310.15(B)(21) (formerly Table 310.21) Ampacities of Bare or Covered Conductors in Free Air, Based on 40°C (104°F) Ambient, 80°C (176°F) Total Conductor Temperature, 610 mm/sec (2 ft/sec) Wind Velocity
[*was Table 310.16(B)(21)*]

# Article 310
## Ampacity for Conductors

**Reason for Change:**

Revision throughout Article 310 occurred by removing the term "allowable" from allowable ampacities for conductors.

**Example: 310.15 Ampacity Tables.**

**(A) General.** Ampacities for conductors rated 0 to 2000 volts shall be as specified in the ~~Allowable~~ Ampacity ~~Table 310.15(B) (16) through Table 310.15(B)(19), and Ampacity Table 310.15(B)(20) and Table 310.15(B)(21)~~ Table 310.16 through Table 310.21, as modified by ~~310.15(B)(1) through (B)(7)~~ 310.15(A) through (F) and 310.12. Under engineering supervision, ampacities of sizes not shown in ampacity tables for conductors meeting the general wiring requirements shall be permitted to be determined by interpolation of the adjacent conductors based on the conductor's area. ~~(B) Tables.~~

# 310.10
## Uses Permitted of XHHN, XHWN, and XHWN-2

**Reason for Change:**

Type XHHN, XHWN, and XHWN-2 were added to the "Uses Permitted" locations and the ampacity tables based on appropriate temperature ratings.

**310.10 Uses Permitted**

The conductors described in ~~310.104~~ 310.4 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as specified in their respective tables or as permitted elsewhere in this *Code*.

**(A) Dry Locations.** Insulated conductors and cables used in dry locations shall be any of the types identified in this *Code*.

**(B) Dry and Damp Locations.** Insulated conductors and cables used in dry and damp locations shall be Types FEP, FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW- 2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, XHHN, XHWN, XHWN- 2, Z, or ZW.

**(C) Wet Locations.** Insulated conductors and cables used in wet locations shall comply with one of the following:

**(1)** Be moisture-impervious metal-sheathed
**(2)** Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, XHWN, XHWN-2, or ZW
**(3)** Be of a type listed for use in wet locations

[These conductor types were also added to the ampacity tables (Table 310.16 through Table 310.21). See NEC for complete Code text.]

## 310.12 and Table 310.12
### Dwelling Unit Service and Main Power Feeder Conductors

**Reason for Change:**

New dwelling unit service ampacity table from Informative Annex D, Example D7 added at 310.12 and text added indicating table permitted to be used if there are no temperature correction or adjustment factors needed.

**310.12 Single-Phase Dwelling Services and Feeders.**

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single- phase, 120/240-volt system shall be permitted to be sized in accordance with ~~310.15(B)(7)(1) through (4)~~ 310.12(A) through (D).

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, single-phase feeder conductors consisting of 2 two ungrounded conductors and the neutral conductor from a 208Y/120-volt system shall be permitted to be sized in accordance with ~~310.15(B)(7)(1) through (3)~~ 310.12(A) through (C).

**(A) Services.** For a service rated 100 amperes through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating. If no adjustment or correction factors are required, Table 310.12 shall be permitted to be applied.

**(B) Feeders.** For a feeder rated 100 amperes through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling, or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the feeder rating. If no adjustment or correction factors are required, Table 310.12 shall be permitted to be applied.

**(C) Feeder Ampacities.** In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that specified in ~~310.15(B)(7)(1) or (2)~~ 310.12(A) or (B).

**(D) Grounded Conductors.** Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, if the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

Where correction or adjustment factors are required by 310.15(B)(2) or (3) 310.15(B) or (C), they shall be permitted to be applied to the ampacity associated with the temperature rating of the conductor.

**Informational Note No. 1:** The service or feeder ratings addressed by this section are based on the standard ampere ratings for fuses and inverse time circuit breakers from 240.6(A).

**Informational Note No. 2:** See Example D7 in Annex D.

Table 310.12 Single-Phase Dwelling Services and Feeders

(See NEC and illustration provided for complete text)

# 311 – Medium Voltage Conductors and Cable

## Article 311
Medium Voltage Cable

**Reason for Change:**

In order to consolidate the medium voltage requirements found in Articles 310 and Article 328, and to improve the usability of the *Code*, the requirements are combined into a new Article 311.

**Article 311 Medium Voltage Cable.**

**Part I. General**

**311.1 Scope.**
**311.2 Definitions.**
**311.6 Listing Requirements.**

**Part II Construction Specifications**

**311.10 Conductor Constructions and Applications.**
**Table 311.10(A) Conductor Application and Insulation Rated 2001 Volts and Higher**
**Table 311.10(B) Thickness of Insulation and Jacket for Nonshielded Solid Dielectric Insulated Conductors Rated 2001 to 5000 Volts**
**Table 311.10(C) Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 to 35,000 Volts**
**311.12 Conductors.**
**311.14 Conductor Identification.**
**311.16 Marking.**

**Part III. Installation**

**311.30 Installation 311.32 Uses Permitted.**
**311.36 Direct-Burial Conductors.**
**311.40 Support.**
**311.44 Shielding.**

**Part IV Ampacities**

**311.60 Conductors Rated 2001 to 35,000 Volts.**
**Table 311.60(D)(4) Ambient Temperature Correction Factors**
**Table 311.60(C)(67) Ampacities of Insulated Single Copper Conductor Cables Triplexed in Air**
**Table 311.60(C)(68) Ampacities of Insulated Single Aluminum Conductor Cables Triplexed in Air**
**Table 311.60(C)(69) Ampacities of Insulated Single Copper Conductor Isolated in Air**
**Table 311.60(C)(70) Ampacities of Insulated Single Aluminum Conductor Isolated in Air**
**Table 311.60(C)(71) Ampacities of an Insulated Three-Conductor Copper Cable Isolated in Air**
**Table 311.60(C)(72) Ampacities of an Insulated Three-Conductor Aluminum Cable Isolated in Air**
**Table 311.60(C)(73) Ampacities of an Insulated Triplexed or Three Single-Conductor Copper Cables in Isolated Conduit in Air**

**Table 311.60(C)(74) Ampacities of an Insulated Triplexed or Three Single-Conductor Aluminum Cables in Isolated Conduit in Air**
**Table 311.60(C)(75) Ampacities of an Insulated Three-Conductor Copper Cable in Isolated Conduit in Air**
**Table 311.60(C)(76) Ampacities of an Insulated Three-Conductor Aluminum Cable in Isolated Conduit in Air**
**Table 311.60(C)(77) Ampacities of Three Single- Insulated Copper Conductors in Underground Electrical Ducts (Three Conductors per Electrical Duct)**
**Table 311.60(C)(78) Ampacities of Three Single- Insulated Aluminum Conductors in Underground Electrical Ducts (Three Conductors per Electrical Duct)**
**Table 311.60(C)(79) Ampacities of Three Insulated Copper Conductors Cabled Within an Overall Covering (Three-Conductor Cable) in Underground Electrical Ducts (One Cable per Electrical Duct)**
**Table 311.60(C)(80) Ampacities of Three Insulated Aluminum Conductors Cabled Within an Overall Covering (Three-Conductor Cable) in Underground Electrical Ducts (One Cable per Electrical Duct)**
**Table 311.60(C) (81) Ampacities of Single Insulated Copper Conductors Directly Buried in Earth**
**Table 311.60(C)(82) Ampacities of Single Insulated Aluminum Conductors Directly Buried in Earth**
**Table 311.60(C)(83) Ampacities of Three Insulated Copper Conductors Cabled Within an Overall Covering (Three-Conductor Cable), Directly Buried in Earth**
**Table 311.60(C)(84) Ampacities of Three Insulated Aluminum Conductors Cabled Within an Overall Covering (Three-Conductor Cable), Directly Buried in Earth**
**Table 311.60(C)(85) Ampacities of Three Triplexed Single Insulated Copper Conductors Directly Buried in Earth**
**Table 311.60(C)(86) Ampacities of Three Triplexed Single Insulated Aluminum Conductors Directly Buried in Earth**
**FIGURE 311.60(F)(6) Cable Installation Dimensions for Use with Table 311.60(C)(77) Through Table 311.60(C)(86)**

(See NEC for complete text)

# 312 – Cabinets, Cutout Boxes, and Meter Socket Enclosure

# 312.8(B)
## Energy Management Equipment

**Reason for Change:**

The term "Energy Management Equipment" added to equipment permitted within the wiring space of enclosures for switches or overcurrent devices along with power monitoring equipment. A new list Item (3) was added for conductors used exclusively for control or instrumentation circuits.

**312.8 Switch and Overcurrent Device Enclosures.**

**(B) Power Monitoring or Energy Management Equipment.** The wiring space of enclosures for switches or overcurrent devices shall be permitted to contain power monitoring or energy management equipment ~~where all of the following conditions are met:~~ in accordance with 312.8(B)(1) through (B)(3).

**(1) Identification.** The power monitoring or energy management equipment ~~is~~ shall be identified as a a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in switch or overcurrent device enclosures.
**(2) Area.** The total area of all conductors, splices, taps, and equipment at any cross section of the wiring space does shall not exceed 75 percent of the cross-sectional area of that space.
**(3) Conductors.** Conductors used exclusively for control or instrumentation circuits shall comply with either 312.8(B)(3)(a) or (B)(3)(b). (a) Conductors shall comply with 725.49. (b) Conductors smaller than 18 AWG, but not smaller than 22 AWG for a single conductor and 26 AWG for a multiconductor cable, shall be permitted to be used where the conductors and cable assemblies meet all of the following conditions:

**(1)** Are enclosed within raceways or routed along one or more walls of the enclosure and secured at intervals that do not exceed 250 mm (10 in.)
**(2)** Are secured within 250 mm (10 in.) of terminations
**(3)** Are secured to prevent contact with current carrying components within the enclosure
**(4)** Are rated for the system voltage and not less than 600 volts
**(5)** Have a minimum insulation temperature rating of 90°C

# 314 – Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fitting; and Handhole Enclosures

## 314.16(B)(5)
### Volume Allowance for EGCs and Equipment Bonding Jumpers

**Reason for Change:**

Volume allowance for EGCs and equipment bonding jumpers was revised to add an additional ¼ volume allowance to the existing single volume allowance. New ¼ volume allowance to be counted in installations with more than four EGCs or equipment bonding conductors.

**314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.**

Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C).

The provisions of this section shall not apply to terminal housings supplied with motors or generators.

Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28. Outlet and device boxes shall also comply with 314.24.

**(B) Box Fill Calculations.** The volumes in paragraphs 314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings. Each space within a box installed with a barrier shall be calculated separately.

**(5) Equipment Grounding Conductor Fill.** Where ~~one or more~~ up to four equipment grounding conductors or equipment bonding jumpers enter a box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest equipment grounding conductor or equipment bonding jumper ~~present in~~ entering the box. ~~Where an additional set of equipment grounding conductors, as permitted by 250.146(D), is present in the box, an additional~~ A ¼ volume allowance shall be

made for each additional equipment grounding conductor or equipment bonding jumper that enters the box, based on the largest equipment grounding conductor ~~in the additional set~~ or equipment bonding conductor.

## 314.27(C)
## Outlet Boxes for Support of Ceiling-Suspended (Paddle) Fan

**Reason for Change:**

Revision will now generally require all outlet boxes mounted in a location acceptable for the installation of a ceiling-suspended (paddle) fan in the ceilings of habitable rooms of dwelling units to be listed for the sole support of ceiling-suspended (paddle) fan.

**314.27 Outlet Boxes**

**(C) Boxes at Ceiling-Suspended (Paddle) Fan Outlets.** Outlet boxes or outlet box systems used as the sole support of a ceiling-suspended (paddle) fan shall be listed, shall be marked by their manufacturer as suitable for this purpose, and shall not support ceiling-suspended (paddle) fans that weigh more than 32 kg (70 lb). For outlet boxes or outlet box systems designed to support ceiling-suspended (paddle) fans that weigh more than 16 kg (35 lb), the required marking shall include the maximum weight to be supported.

~~Where spare, separately switched, ungrounded conductors are provided to a ceiling-mounted outlet box,~~ Outlet boxes mounted in the ceilings of habitable rooms of dwelling occupancies in a location acceptable for the installation of a ceiling-suspended (paddle) fan ~~in one-family, two-family, or multifamily dwellings, the outlet box or outlet box system shall be listed for sole support of a ceiling-suspended (paddle) fan~~ comply with one of the following:

**(1)** Listed for the sole support of a ceiling-suspended (paddle) fans
**(2)** An outlet box complying with the applicable requirements of 314.27 and providing access to structural framing capable of supporting of a ceiling- suspended (paddle) fan bracket or equivalent.

# 320 – Armored Cable: Type AC

## 320.80(A)
### Adjustment Factors of Type AC Cable

**Reason for Change:**

Type AC cable is now required to comply with adjustment factors of **Table 310.15(C)(1)** [currently T. 310.15(B)(3)(a) (**More Than Three-Current-Carrying Conductors**)] when installed without maintaining spacing (similar to 334.80 for Type NM cable).

**320.80 Ampacity**

The ampacity shall be determined in accordance with 310.14.

**(A) Thermal Insulation.** Armored cable installed in thermal insulation shall have conductors rated at 90°C (194°F). The ampacity of cable installed in these applications shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations; however, the ampacity shall not exceed that of a 60°C (140°F) rated conductor.

Where more than two Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

# 330 – Metal-Clad Cable: Type MC

## 330.130
### Type MC Cable "TC-ER-HL" in Hazardous (Classified) Locations

**Reason for Change:**

New requirements added for Type MC cable with a designation of "TC-ER-HL" installed in a hazardous (classified) location.

**330.130 Hazardous (Classified) Locations.**

Where required to be marked MC-HL, the cable shall be listed and shall have a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.

# 334 – Nonmetallic-Sheathed Cable: Type MC and NMC

## 334.2
## Deletion of References to Type NMS Cable

**Reason for Change:**

All references to Type NMS cable has been deleted from Article 334 as this cable construction is no longer manufactured.

**334.2 Definitions.**

The definitions in this section shall apply within this article and throughout the *Code*. Nonmetallic-Sheathed Cable. A factory assembly of two or more insulated conductors enclosed within an overall nonmetallic jacket.

Type NM. Insulated conductors enclosed within an overall nonmetallic jacket. Type NMC.

Insulated conductors enclosed within an overall, corrosion resistant, nonmetallic jacket. Type NMS. Insulated power or control conductors with signaling, data, and communications conductors within an overall nonmetallic jacket.

## 334.30
## Measuring Type NM Cable from the Enclosure

**Reason for Change:**

Revision will clarify how Type NM cable should be measured from the enclosure to the securing method with the cable length between the cable entry and the closest cable support not exceeding 450 mm (18 in.).

**334.30 Securing and Supporting.**

Nonmetallic-sheathed cable shall be supported and secured by staples, cable ties listed and identified for securement and support or straps, hangers, or similar fittings

designed and installed so as not to damage the cable, at intervals not exceeding 1.4 m (4 ½ ft) and within 300 mm (12 in.) of every cable entry into enclosures such as outlet boxes, junction boxes, cabinets, or fittings. The cable length between the cable entry and the closest cable support shall not exceed 450 mm (18 in.). Flat cables shall not be stapled on edge. Sections of cable protected from physical damage by raceway shall not be required to be secured within the raceway.

# 337 – Type P Cable

## Article 337
### New Article Covering Type P Cable

**Reason for Change:**

A new article was added covering the use, installation, and construction specifications for Type P cable.

**Article 337 Type P Cable**

Part I. General

**337.1 Scope.** This article covers the use, installation, and construction specifications for up through 2000 volt Type P cable (armored and unarmored).

**337.2 Definition.**

**Type P Cable.** A factory assembly of one or more insulated flexible tinned copper conductors, with associated equipment grounding conductor(s), with or without a braided metallic armor and with an overall nonmetallic jacket.

**337.6 Listing Requirements.**

**Part II. Installation**

**337.10 Uses Permitted.**

**337.12 Uses Not Permitted.**

**337.24 Bending Radius.**

**337.30 Securing and Supporting.**

**337.31 Single Conductors.**

**337.80 Ampacity**

**Part III. Construction Specifications**

**337.104 Conductors.**

**337.108 Equipment Grounding Conductor.**

**337.112 Insulation.**
**337.114 Shield.**
**337.115 Jacket.**
**337.116 Armor.**
**337.120 Marking.**

# 338 – Service-Entrance Cable: Type SE and USE

## 338.2
## Service-Entrance Conductor Assembly

**Reason for Change:**

A new definition for "Service-Entrance Conductor Assembly" was added to differentiate between service-entrance cables and assemblies of single-insulated USE conductors.

**338.2 Definitions. (Service-Entrance Cables)**

**Service-Entrance Cable.** A single conductor or multiconductor assembly cable provided with or without an overall covering, primarily used for services, and of the following types:

**Type SE.** Service-entrance cable having a flame-retardant, moisture-resistant covering.

**Type USE.** Service-entrance cable, identified for underground use, having a moisture-resistant covering, but not required to have a flame-retardant covering.

**Service-Entrance Conductor Assembly.** Multiple single-insulated conductors twisted together without an overall covering, other than an optional binder intended only to keep the conductors together.

## 338.100
## Assemblies, Construction, and Uninsulated SE Conductors

**Reason for Change:**

All conductors of a cabled assemblies of multiple single-

conductors of a Type USE cable are now required to be insulated.

**338.100 Construction. (*Service-Entrance Cables*)**

**(A) Assemblies.** Cabled assemblies of multiple single- conductor Type USE constructions recognized for underground use conductors shall be permitted to have a bare copper conductor cabled with the assembly. Type USE single, parallel, or cabled conductor assemblies recognized for underground use shall be permitted to have a bare copper concentric conductor applied. These constructions shall not require an outer overall covering for direct burial. All conductors shall be insulated.

**Informational Note:** ~~See 230.41, Exception, item (2), for directly buried, uninsulated service-entrance conductor~~ The term "cabled" refers to a manufacturing process of twisting single conductors together and may also be referred to as "plexed."

**(B) Uninsulated Conductor.** Type SE or USE cable with an overall covering containing two or more conductors shall be permitted to have one conductor uninsulated.

# 342 – Intermediate Metal Conduit: Type IMC

## 342.10(E)
Intermediate Metal Conduit (Type IMC)

**Reason for Change:**

New sub-section (E) clarifies that intermediate metal conduit (Type IMC) is permitted to be installed where subject to severe physical damage.

**342.10 Uses Permitted. (Intermediate Metal Conduit: Type IMC)**

**(E) Severe Physical Damage.** IMC shall be permitted to be installed where subject to severe physical damage.

## 342.14
### Type IMC with Dissimilar Metals

**Reason for Change:**

Revision added to make it clear that stainless steel fittings and enclosures can be used with galvanized steel IMC, but galvanized fittings should not be used with stainless steel IMC.

**342.14 Dissimilar Metals.**

Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Stainless steel and aluminum fittings and enclosures shall be permitted to be used with galvanized steel IMC where not subject to severe corrosive influences. Stainless steel IMC shall only be used with the following:

**(1)** Stainless steel fittings
**(2)** Stainless steel outlet boxes and enclosures
**(3)** Steel (galvanized, painted, powder or PVC coated, and so forth) boxes and enclosures when not subject to severe corrosive influences
**(4)** Stainless steel, nonmetallic, or approved accessories

# 344 – Rigid Metal Conduit: Type RMC

## 344.10(A)
### Uses Permitted of Red Brass RMC

**Reason for Change:**

Revision to clarify that red brass RMC is not restricted to just underground or swimming pool applications.

**344.10 Uses Permitted.**

**(A)** Atmospheric Conditions and Occupancies.

**(1) Galvanized Steel and, Stainless Steel, and Red Brass RMC.** Galvanized steel and, stainless steel, and red brass RMC shall be permitted under all atmospheric conditions and occupancies.

**(2) Red Brass RMC.** Red brass RMC shall be permitted to be installed for direct burial and swimming pool applications.

**(2) ~~(3)~~ Aluminum RMC.** Aluminum RMC shall be permitted to be installed where approved for the environment. Rigid aluminum conduit encased in concrete or in direct contact with the earth shall be provided with approved supplementary corrosion protection.

**(3) ~~(4)~~ Ferrous Raceways and Fittings.** Ferrous raceways and fittings protected from corrosion solely by enamel shall be permitted only indoors and in occupancies not subject to severe corrosive influences

# 350 – Liquid tight Flexible Metal Conduit: Type LFMC

## 350.10(4)
Permitted Uses for LFMC

**Reason for Change:**

Conductors or cables with higher temperature ratings are permitted to be used in LFMC as long as the conductors or cables are not operated at a higher temperature than the LFMC temperature rating.

**350.10 Uses Permitted. (Liquidtight Flexible Metal Conduit: Type LFMC)**

LFMC shall be permitted to be used in exposed or concealed locations as follows:

**(1)** Where conditions of installation, operation, or maintenance require flexibility or protection from machine oils, liquids, vapors, or solids.
**(2)** In hazardous (classified) locations where specifically permitted by Chapter 5.
**(3)** For direct burial where listed and marked for the purpose.
**(4)** Conductors or cables rated at a temperature higher than the listed temperature rating of LFMC conduit shall be permitted to be installed in LFMC, provided the conductors or cables are not operated at a temperature higher than the listed temperature rating of the LFMC per 110.14(C).

# 370 - Cable bus

## 370.20
## Conductor Sizing and Terminations for Cablebus

**Reason for Change:**

Two new informational notes were added to 370.20 related to conductor sizing and terminations for cablebus.

**370.20 Conductor Size and Termination. (*Cablebus*)**

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

**(B) Termination.** Approved terminating means shall be used for connections to cablebus conductors.

**Informational Note No. 1:** See 110.14(C) for conductor temperature limitations due to termination provisions for installations up to and including 2000 volts.

**Informational Note No. 2:** See 110.40 for conductor temperature limitations due to termination provisions for installations 2001 volts to 35,000 volts.

# 374 - Cellular Metal Floor Raceways

## 374.6
## Listed Cellular Metal Floor Raceways

**Reason for Change:**

New provision added to require cellular metal floor raceways shall be listed.

**374.6 Listing Requirements. (Cellular Metal Floor Raceways)**

Cellular metal floor raceways shall be listed.

# 380 – Multioutlet Assembly

## 380.12(7)
### Uses Not Permitted for Multioutlet Assembly

**Reason for Change:**

Multioutlet assemblies are intended to be permanently connected with a branch circuits and prohibited from employing a cord and plug connection (*intended for permanent connection only*).

**380.12 Uses Not Permitted. (*Multioutlet Assemblies*)** A multioutlet assembly shall not be installed as follows:

**(1)** Where concealed, except that it shall be permissible to surround the back and sides of a metal multioutlet assembly by the building finish or recess a nonmetallic multioutlet assembly in a baseboard
**(2)** Where subject to severe physical damage
**(3)** Where the voltage is 300 volts or more between conductors unless the assembly is of metal having a thickness of not less than 1.02 mm (0.040 in.)
**(4)** Where subject to corrosive vapors
**(5)** In hoistways
**(6)** In any hazardous (classified) location, except as permitted by other articles in this *Code*
**(7)** Where cord and plug connected

# 382 – Nonmental Extensions

## 382.104(C)
### Equipment Grounding Conductor for Concealable Nonmetallic Extensions

**Reason for Change:**

Revision replaces "grounding conductor" with appropriate term "equipment grounding conductor" for concealable nonmetallic extensions.

**382.104 Flat Conductors. (*Nonmetallic Extensions*)**

**(C) Equipment Grounding Conductor (Outer Sectioned Layers).** The equipment grounding conductor shall consist of two overall sectioned conductors that enclose the grounded conductor and ungrounded conductor( s) and shall comply with 250.4(A)(5). The equipment grounding conductor layers shall be identified by any one of the following methods:

**(1)** As permitted in 250.119
**(2)** A clear covering
**(3)** One or more continuous green stripes or hash marks
**(4)** The term "Equipment ~~Ground~~" Grounding Conductor" printed at regular intervals throughout the cable

# 392 – Cable Trays

## 392.10
## Limitations of Single Conductor Applications in Cable Tray Systems

**Reason for Change:**

Revision provides clarity relative to the limitations of single conductor applications in cable tray systems.

**392.10 Uses Permitted. (*Cable Trays*)**

Cable tray shall be permitted to be used as a support system for wiring methods containing service conductors, feeders, branch circuits, communications circuits, control circuits, and signaling circuits. Single insulated conductors shall be permitted in cable tray only when installed in accordance with 392.10(B)(1). Cable tray installations shall not be limited to industrial establishments. Where exposed to direct rays of the sun, insulated conductors and jacketed cables shall be identified as being sunlight resistant. Cable trays and their associated fittings shall be identified for the intended use.

## 392.30(B)(4)
### Securing and Supporting (Cable Trays)

**Reason for Change:**

Cable ties used to secure and support conductors and cables in a cable tray are an acceptable means of securement when identified for securement and support in a cable tray.

**392.30 Securing and Supporting (*Cable Trays*)**

**(A) Cable Trays.** Cable trays shall be supported at intervals in accordance with the installation instructions.

**(B) Cables and Conductors.** Cables and conductors shall be secured to and supported by the cable tray system in accordance with (1), (2), ~~and~~ (3), and (4) as applicable:

**(1)** In other than horizontal runs, the cables shall be fastened securely to transverse members of the cable ~~runs~~ tray.
**(2)** Supports shall be provided to prevent stress on cables where they enter raceways from cable tray systems.
**(3)** The system shall provide for the support of cables and raceway wiring methods in accordance with their corresponding articles. Where cable trays support individual conductors or multiconductor cables and where the conductors or multiconductor cables pass from one cable tray to another, or from a cable tray to raceway(s) or from a cable tray to equipment where the conductors are terminated, the distance between the cable trays or between the cable tray and the raceway(s) or the equipment shall not exceed 1.8 m (6 ft). The conductors shall be secured to the cable tray(s) at the transition, and they shall be protected, by guarding or by location, from physical damage.
**(4)** Cable ties shall be listed and identified for the application and for securement and support.

## 392.44
### Expansion Splice Plates

**Reason for Change:**

New section added for expansion splice plates to address

thermal expansion and contraction due to temperature variations for cable trays.

**392.44 Expansion Splice Plates.**

Expansion splice plates for cable trays shall be provided where necessary to compensate for thermal expansion and contraction.

## 392.46
## Bushed Conduit and Tubing. (Cable Trays)

**Reason for Change:**

Individual conductors and multi-conductor cables transitioning from a cable tray to raceways or openings associated with flanges entering enclosures is a compliant application.

**392.46 Bushed Conduit and Tubing. (*Cable Trays*)**

A box shall not be required where cables or conductors are installed in bushed conduit and tubing used for support or for protection against physical damage or where conductors or cables transition to a raceway wiring method from the cable tray. Conductors shall be permitted to enter equipment in accordance with 392.46(A) or (B).

**(A)** Through Bushed Conduit or Tubing. Individual conductors or multiconductor cables with entirely nonmetallic sheaths shall be permitted to enter enclosures where they are terminated through nonflexible bushed conduit or tubing installed for their protection provided they are secured at the point of transition from the cable tray and the conduit or tubing is sealed at the outer end using an approved means so as to prevent debris from entering the equipment through the conduit or tubing.

**(B)** Flanged Connections. Individual conductors or multiconductor cables with entirely nonmetallic sheaths shall be permitted to enter enclosures through openings associated with flanges from cable trays where the cable tray is attached to the flange and the flange is mounted directly to the equipment. The openings shall be made such that the conductors are protected from abrasion and the opening shall be sealed or covered to prevent debris from entering the enclosure through the opening.

**Informational Note:** One method of preventing debris from entering the enclosure is to seal the outer end of the raceway or the opening with duct seal.

# Quiz Questions

1. **The National Electric Code (NEC) is updated _____?**

   - every year
   - ongoing basis
   - every 3 years
   - every 4 years

2. **What of the following was added to the scope of the 2020 NEC?**

   - Installations supplying service power to recreational vehicle campground sites
   - Installations supplying alternative power to airships and aerocrafts at airports
   - Installations supplying shore power to ships and watercraft in marinas and boatyards
   - All of the above

3. **What is the definition of Equipotential Plane?**

   - Accessible conductive parts bonded together to reduce voltage gradients in a designated area
   - The current delivered at a point on the system during a short-circuit condition
   - A system or circuit conductor that is intentionally grounded
   - The operational mode for standalone power production equipment or an isolated microgrid

4. **Why was code updated for Terminal Connection Torque updated?**

   - Revisions were made to place the proper emphasis on using a calibrated torque tool to achieve the required torque values
   - Revisions were made to distinguish when to use a manufacturer's suggested torque value
   - Revisions were made to ensure torque values are clearly labeled
   - Revisions were made to place the proper emphasis on achieving the required torqueing values rather than the tool used to achieve such values

5. **A new rule was added to prohibit an open equipment door from obstructing the entry/egress, what are they referring too?**

   - Mechanical Execution of Work
   - Island Mode
   - Identification of Disconnecting Means
   - Spaces About Electrical Equipment

6. **What is the mandatory color of a grounded conductor's terminal on a receptacle?**

   - White or Sliver
   - Brass
   - Green
   - None of the above

7. **What code changed affected 250 volt receptacles in a dwelling unit laundry room?**

   - Removed GFCI protection
   - Allowed for optional GFCI protection
   - Mandated GFCI protection
   - No change

8. **Which of the following outdoor outlets require GFCI protection?**

- 125 volt receptacle
- 240 volt receptacle ( i.e A/C unit)
- 250 volt receptacle
- All of the above

9. **Which of the following equipment cannot be reconditioned?**

- GFCI devices
- AFCI devices
- Ground-fault protection equipment
- All of the above

10. **Regarding lighting loads, which of the following is false?**

- Reduced lighting loads in most occupancies was achieved
- Increased lighting loads in most occupancies was achieved
- 3 watts per sq. ft. remained as the standard for dwelling units
- Hospitals require 100% of total watts of calculated lighting load

11. **A new requirement was added to require _____ on all services at dwelling units.**

- surge protection
- GFCI protection
- island mode
- emergency on/off switch

12. **A new requirement added to require a/an _____ at a readily accessible outdoor location for dwelling units.**

- stand-only mode selector
- GFCI protector
- high-voltage warning label
- emergency disconnect

13. **Article 242 was newly added and pertains to what?**

- Reconditioned equipment
- Emergency disconnects
- Overvoltage protection
- AFCI protection

14. **What is the largest sized bonding jumper used to bond metal water piping systems?**

- As required per table 250.102(c)
- 2/0 copper
- 3/0 copper
- 4/0 copper

15. **Metal enclosures can now be used to?**

- connect bonding jumpers
- connect equipment grounding conductors
- become a part of an effective ground-fault current path
- All of the above

16. **For systems over 1000 volts, which type of sign needs to conspicuously posted?**

- Caution sign
- Warning sign
- Danger sign
- Any of the above

17. **Nonmetallic-sheathed cable is required to not exceed this length from cable entry to first cable support?**

- 4.5 ft.
- 18 in.
- 12 in.
- 300 mm

18. **What type of rigid metal conduit can be used in all atmospheric conditions and occupancies.**

- Galvanized steel
- Stainless steel
- Red brass
- All of the above

19. **_____ shall be permitted in cable tray only when installed in accordance with 392.10(B)(1).**

- Single insulated conductors
- Single non-insulated conductors
- NMS
- None of the above

20. **What is the purpose of an expansion splice plate?**

- To address thermal expansion and contraction due to temperature variations for cable trays
- To prevent thermal expansion of cable trays
- To enable access to hardware in difficult or hard to reach locations
- To enable splicing of raceways