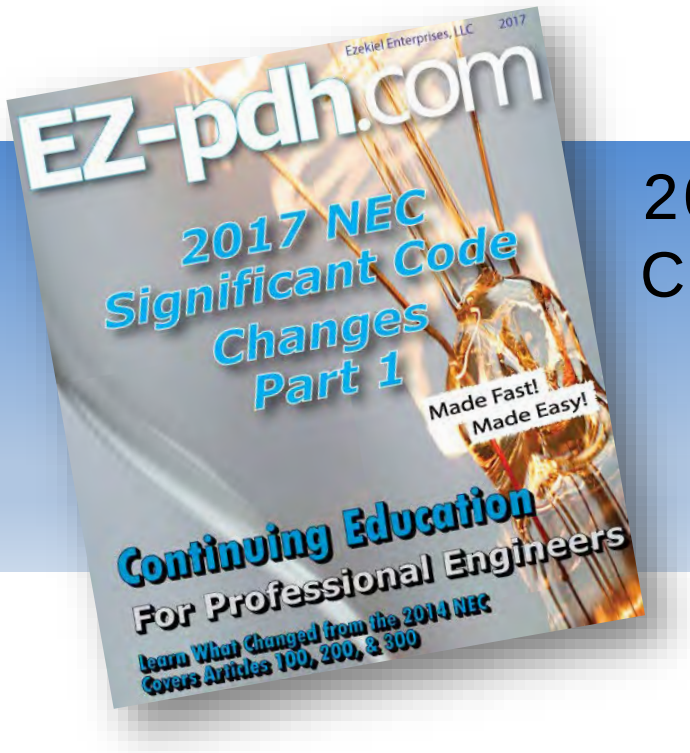

2017 NEC Significant Code Changes Part 1

Four (4) Continuing Education Hours
Course #EE1001

Approved Continuing Education for Professional Engineers

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2017 NEC Significant Code Changes Part 1

LEARNING OBJECTIVES

Upon completion of this course the student will be able to:

1. Become familiar with some of the significant changes including additions, deletions, and modification to the 2017 Edition of NFPA 70: National Electrical Code (NEC) from the 2014 Edition
2. Comprehend, after reviewing the significant changes and additions to the 2017 Edition of NFPA 70: National Electrical Code (NEC) the large scope of the changes to the code, thereby seeking additional and more thorough reviews of the entire code, following completion of this course.

INTRODUCTION

Every three years, the National Electrical Code® (NEC®) is revised and expanded. Initially the NFPA® received 4,012 public suggestions for changes, which resulted in 1,235 first revisions. There were 1,513 public comments submitted in response to these 1,235 first revisions, resulting in 559 second revisions. Changes included editorial clarification, expanded requirements, new requirements, deleted requirements, and the relocation of other requirements. Nine new articles were proposed, and five new articles were added to the 2017 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.

2017 National Electric Code (NEC)

- 5,525 Public Suggestions to 2014 NEC
- 1,794 Revisions Made
- Changes Included
  - Editorial Clarification,
  - Expanded Requirements,
  - New Requirements,
  - Deleted Requirements,
  - Relocation of Requirements
- Five New Articles Added

What to Expect

In this course the student will be presented an overview of the most significant changes found in the 2017 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 highlighted for easy recognition and a short synopsis of the reason for the change is presented as well.

2017 NEC Major Additions

- Large-Scale Photovoltaic (PV) Electric Power Production Facility (New Article 691) covers systems that produce at least 5 megawatts (MW) of power, or enough to power 800+ U.S. homes.
- Energy Storage Systems (New Article 706) governs ESS installation, disconnection, shutdown, and safety labeling.
- Stand-Alone Systems (New Article 710) covers power production sources that are not connected to the grid, including PV and wind-powered systems.
- Direct Current Microgrids (New Article 712) concerns independent energy distribution networks that allow the utilization of power from dc sources to direct-current loads. Microgrids are on the rise worldwide

ARTICLE 90
Introduction

90.3 Code Arrangement.

This Code is divided into the introduction and nine chapters, as shown in Figure 90.3. Chapters 1, 2, 3, and 4 apply generally; Chapters 5, 6, and 7 apply to special occupancies, special equipment, or other special conditions~~. These latter chapters~~ and may supplement or modify the ~~general rules.~~ requirements in Chapters 1 through 7.~~4 apply except as amended by Chapters 5, 6, and 7 for the particular conditions.~~

Chapter 8 covers communications systems and is not subject to the requirements of Chapters 1 through 7 except where the requirements are specifically referenced in Chapter 8.

Chapter 9 consists of tables that are applicable as referenced. Informative annexes are not part of the requirements of this Code but are included for informational purposes only.

CHAPTER 1 GENERAL

ARTICLE 100
Definitions

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth.

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the NEC.

■Reason for the Change

This revision will continue to allow a panelboard cover to be locked with a key while recognizing that the overcurrent devices located behind the panelboard's operable lid or door are still "readily accessible."

Associated Apparatus [as applied to Hazardous (Classified) Locations]. Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

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

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

■Reason for the Change

The definition of "Associated Apparatus" was relocated to Article 100 for application across the hazardous location *NEC* articles. The

addition of the words "[as applied to Hazardous (Classified) Locations]" will make it clear that the definition pertains to Articles 500 through 516 as applicable.

Building. A structure that stands alone or that is ~~cut off~~ separated from adjoining structures by fire walls ~~with all openings therein protected by approved fire doors~~.

Structure. That which is built or constructed, other than equipment.

■Reason for the Change

These terms were revised to eliminate Building Code provisions and to clarify that a structure is something other than equipment.

Coaxial Cable. A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket.

■Reason for the Change

The definition of *Coaxial Cable* was relocated to Article 100 to have an application to other articles across the *NEC*.

Field Evaluation Body (FEB). An organization or part of an organization that performs field evaluations of electrical or other equipment. [NFPA 790, 2012]

Field Labeled (as applied to evaluated products). Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report.

■Reason for the Change

These two new definitions are necessary to recognize a process of field evaluation of equipment as these terms are used in two or more *NEC* articles, specifically in the photovoltaic articles in Chapter 6. These definitions are extracted material from NFPA 790 (Standard for Competency of Third-Party Field Evaluation Bodies).

Receptacle. A ~~receptacle is a~~ contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of listed and labeled electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

■Reason for the Change

The definition was modified to accommodate electrical utilization equipment employing a means, other than a traditional attachment plug cap, to connect directly to the corresponding contact device.

ARTICLE 110:
Requirements for Electrical Installations

110.3 Examination, Identification, Installation, and Use of Equipment

(A)Examination. In judging equipment, considerations such as the following shall be evaluated: (1) Suitability for installation and use in conformity with the provisions of this *Code*

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

■Reason for the Change

A new informational note has been added at 110.3(A)(1) indicating that electrical equipment could be either new, reconditioned, refurbished or remanufactured when installed and inspected and examined.

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

(C) Listing. Product testing, evaluation, and listing (product certification) shall be performed by recognized qualified electrical testing laboratories and shall be in accordance with applicable product standards recognized as achieving equivalent and effective safety for equipment installed to comply with this *Code*.

Informational Note: The Occupational Safety and Health Administration (OSHA) recognizes qualified electrical testing laboratories that perform evaluations, testing, and certification of certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards. If the listing (product certification) is done under a qualified electrical testing laboratory program, this listing mark signifies that the tested and certified product complies with the requirements of one or more appropriate product safety test standards.

■Reason for the Change

A new List Item (C) was added at 110.3 requiring the listing process be executed by a qualified third-party electrical testing laboratory and that the product testing and certification process be in accordance with appropriate product standards.110.14 Electrical Connections

(D) Installation. 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.

■Reason for the Change

The Informational Note that was located after the parent text of 110.14 has been deleted and replaced with enforceable *Code* text at new 110.14(D). This new requirement calls for the implementation of tightening torque tools where torqueing is specified on the equipment or in installation instructions provided by the manufacturer.

110.16 Arc-Flash Hazard Warning

(B)Service Equipment. In other than dwelling units, in addition to the requirements in (A), a permanent label shall be field or factory applied to service equipment rated 1200 amps or more. The label shall meet the requirements of 110.21(B) and contain the following information:

(1) Nominal system voltage

(2) Available fault current at the service overcurrent protective devices

(3) The clearing time of service overcurrent protective devices based on the available fault current at the service equipment

(4) The date the label was applied

Exception: Service equipment labeling shall not be required if an arc flash label is applied in accordance with acceptable industry practice.

Informational Note No. 1: NFPA 70E-~~2012~~ 2015, *Standard for Electrical Safety in the Workplace*, provides guidance, such as determining the severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-~~1998~~ 2011, *Product Safety Signs and Labels*, provides guidelines for the design of safety signs and labels for application to products.

Informational Note No. 3: Acceptable industry practices for equipment labeling are described in NFPA 70E-2015 *Standard for Electrical Safety in the Workplace.* This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, minimum required levels of personal protective equipment, and so forth.

■Reason for the Change

A new List Item (B) was added requiring non-dwelling unit service equipment rated 1200 amperes or more to be labeled with the normal system voltage, available fault current, clearing times, and date the label was applied.

110.21 Marking.

(A) ~~Manufacturer's~~ Equipment Markings.

(2) Reconditioned Equipment. Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the

reconditioning. Reconditioned equipment shall be identified as "reconditioned" and approval of the reconditioned equipment shall not be based solely on the equipment's original listing.

Exception: *In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required.*

Informational Note: Industry standards are available for application of reconditioned and refurbished equipment. Normal servicing of equipment that remains within a facility should not be considered reconditioning or refurbishing.

■**Reason for the Change** New requirements were added at 110.21(A)(2) to require refurbished, reconditioned, or remanufactured equipment to be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified. The date of the reconditioning must also be established on the nameplate or marking

110.26 Spaces About Electrical Equipment

(A) Working Space. Working space for equipment operating at ~~600~~ 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A) (1), (A)(2), ~~and~~ (A)(3), and (A)(4) or as required or permitted elsewhere in this *Code*.

Informational Note: NFPA 70E-2015, *Standard for Electrical Safety in the Workplace*, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

(4) Limited Access. Where equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is required by installation instructions or function to be located in a space with limited access, all of the following shall apply:

(a)Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 559 mm × 559 mm (22 in. × 22 in.), or in a crawl space, there shall be an accessible opening not smaller than 559 mm × 762 mm (22 in. × 30 in.).

(b)The width of the working space shall be the width of the equipment enclosure or a minimum of 762 mm (30 in.), whichever is greater.

(c)All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.

(d)The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1). The maximum height of the working space shall be the height necessary to install the equipment in the limited space. A horizontal ceiling structural member or access panel shall be permitted in this space.

■**Reason for the Change**
The same basic limited access working space requirements at 424.66(B) were relocated to 110.26(A)(4) to broaden this requirement to more than just duct heaters. Provisions for limited access to crawl spaces were added to this requirement as well.

110.41 Inspections and Tests

(A) Pre-energization and Operating Tests. Where required elsewhere in this *Code*, the complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be tested when first installed on-site.

(B) Test Report. A test report covering the results of the tests required in 110.41(A) shall be available to the authority having jurisdiction prior to energization and made available to those authorized to install, operate, test, and maintain the system.

■**Reason for the Change**
New requirements were added at 110.41 for pre-energization testing and reporting of

electrical equipment (over 1000 volts) upon request by the AHJ. Since it is located in Article 110, this will apply to all equipment rated over 1000 volts regardless of its location.

CHAPTER 2

ARTICLE 210
Branch Circuits

210.5(C)(1), Exception Identification for Branch Circuits

(C)Identification of Ungrounded Conductors. Ungrounded conductors shall be identified in accordance with 210.5(C)(1) or (2), as applicable.

(1)Branch Circuits Supplied from More Than One Nominal Voltage System. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b).

(a)Means of Identification. The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.

(b)Posting of Identification Means. The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: *In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in compliance with* 210.5(C)(1)(a) *and* (b). *Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."*

■**Reason for the Change** The previous identification requirements for branch circuits supplied from more than one nominal voltage system moved forward for the 2017 NEC with a new exception added for relief from identifying each ungrounded conductor for existing installations where a voltage system(s) already exists and a different voltage system is being added. A new requirement was also added concerning the durability and makeup of the labels.

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 ~~(D)~~ (E). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel

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

For the purposes of this section, when determining 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.

■**Reason for the Change**
A new provision was added to the parent text of 210.8 to indicate that measurements from receptacles to objects (such as a sink) that would qualify for GFCI protection should be measured as the "shortest path" a cord of an appliance connected to a receptacle would take without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

210.8(A)(7) Ground-Fault Circuit-Interrupter Protection for Personnel

(A)Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

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

■**Reason for the Change** All 125-volt, single-phase, 15- and 20-ampere receptacles installed within 1.8 m (6 ft) of the "top inside edge of the bowl" of any dwelling unit sink (including the kitchen sink) requires GFCI protection without the measurement piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

210.8(B) Ground-Fault Circuit-Interrupter Protection for Personnel

(B) Other Than Dwelling Units. All ~~125-volt,~~ single-phase, ~~15- and 20-ampere~~ receptacles rated 150 volts to ground or less, 50 amperes or less; and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, installed in the locations specified in 210.8(B)(1) through ~~(8)~~ (10) shall have ground-fault circuit-interrupter protection for personnel.

■**Reason for the Change** The GFCI requirements at "Other Than Dwelling Units" still include coverage of 125-volt, single-phase, 15- and 20-ampere receptacles. These requirements have been expanded to include all single-phase receptacles rated 150 volts to ground or less, 50 amperes or less; and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less.

210.8(B)(9) Ground-Fault Circuit-Interrupter Protection for Personnel.

(9) Crawl spaces — at or below grade level

■**Reason for the Change**
GFCI protection is now required for all single-phase receptacles rated 150 volts to ground or less, 50 amperes or less; and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less installed in non-dwelling unit crawl spaces.

210.8(B)(10) Ground-Fault Circuit-Interrupter Protection for Personnel.

(10) Unfinished portions or areas of the basement not intended as habitable rooms

■**Reason for the Change**
GFCI protection for receptacles installed in unfinished basements has been expanded to include commercial applications as well as dwelling units. Revisions to the parent text at 210.8(B) has expanded the receptacles involved to those that are rated 150 volts to ground or less, 50 amperes or less; and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less.

210.8(E) Ground-Fault Circuit-Interrupter Protection for Personnel

(E) Crawl Space Lighting Outlets. GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

■**Reason for the Change**
In addition to the GFCI requirements for lighting outlets of the previous *Code*, GFCI protection is now required for lighting outlets not exceeding 120 volts in crawl spaces where space is at or below grade level.

210.11(C)(4) Garage Branch Circuits

(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 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.*

■**Reason for the Change**

The branch circuit supplying receptacle outlets in dwelling unit garages is now required to be a 120-volt, 20-ampere rated branch circuit. The garage receptacle outlet branch circuit is still prohibited from serving other outlets with the exception of readily accessible receptacles located outdoors.

210.12(C) Arc-Fault Circuit-Interrupter Protection

(C) Guest Rooms and Guest Suites. 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 shall be protected by any of the means described in 210.12(A)(1) through (6).

■**Reason for the Change**

New provisions were added at 210.12(C) requiring AFCI protection for 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, regardless of the existence of "permanent provisions for cooking" or not.

210.17 Electric Vehicle Branch Circuit

~~**Code Language: 210.17 Electric Vehicle Branch Circuit.**~~

~~An outlet(s) installed for the purpose of charging electric vehicles shall be supplied by a separate branch circuit. This circuit shall have no other outlets.~~

~~**Informational Note:** See 625.2 for the definition of Electric Vehicle.~~

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

■**Reason for the Change**

The requirement for a separate branch circuit for electric vehicle outlets was relocated to 625.40, the article for electric vehicle charging systems. During this relocation, the requirement for a "separate" branch circuit was changed to an "individual" branch circuit. There is still no requirement for an outlet to be installed specifically for the purpose of charging of an electric vehicle.

210.52(A)(2)(1) Dwelling Unit Receptacle Outlets

(2)Wall Space. As used in this section, a wall space shall include the following:

(1)Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, and fixed cabinets that do not have countertops or similar work surfaces

■**Reason for the Change**

Only "fixed cabinets that do not have countertops or similar work surfaces" are now considered as an item (along with doorways and fireplaces) that would not be counted as "wall space" concerning receptacle spacing and location requirements.

210.52 Dwelling Unit Receptacle Outlets

(B) Small Appliances

(1) Receptacle Outlets Served. In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Exception No. 1: *In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose branch circuit as defined in 210.70(A)(1), Exception No. 1, shall be permitted.*

Exception No. 2: ~~*The receptacle outlet for refrigeration equipment*~~ *In addition to the required receptacles specified by 210.52, a receptacle outlet to serve a specific appliance shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.*

■**Reason for the Change** Any specific dwelling unit kitchen appliance is permitted by exception to be supplied from an individual branch circuit rated 15 amperes or greater rather than from one of the 20-ampere rated small-appliance branch circuits.

210.52(C)(3) 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 surface spaces shall be installed in accordance with 210.52(C)(1) through (C)(5).

(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 connecting edge connected perpendicular wall.

■**Reason for the Change**
At least one receptacle outlet is still required at each peninsular countertop with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater, but the measurement is now measured from the "connected perpendicular wall."

210.52(G) Dwelling Unit Receptacle Outlets

(G) Basements, Garages, and Accessory Buildings. For a one- and two-family dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G)(1) through (3). These receptacles shall be in addition to receptacles required for specific equipment.

■**Reason for the Change** The same one receptacle outlet requirement still applies to qualifying basements, garages, and accessory buildings, but this requirement has been extended to two-family dwellings as well as one-family dwellings.

210.52(G)(1) Dwelling Unit Receptacle Outlets

(G) Basements, Garages, and Accessory Buildings. For a one- and two-family dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G)(1) through (3). These receptacles shall be in addition to receptacles required for specific equipment.

(1) Garages. In each attached garage and in each detached garage with electric power, ~~. The branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. At at~~ least one receptacle outlet shall be installed ~~for~~ in each ~~car space~~ vehicle bay and not more than 1.7 m (51/2 ft) above the floor.

■**Reason for the Change**
In each attached garage and in each detached garage with electric power, at least one receptacle outlet is required to be installed "in each vehicle bay and not more than 1.7 m (51/2 ft) above the floor." The branch circuit supplying these receptacle(s) cannot serve outlets outside of the garage with the exception of readily accessible receptacles located outdoors. This latter requirement concerning the branch circuit supplying the garage is now located at 210.11(C)(4).

210.64 Electrical Service Areas

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed in an accessible location within ~~15 m (50 ft)~~ 7.5 m (25 ft) of the indoor electrical service equipment. The required receptacle outlet shall be located within the same room or area as the service equipment.

Exception No. 1: *The receptacle outlet shall not be required to be installed in one-and-two-family dwellings.*

Exception No. 2: *Where the service voltage is greater than 120 volts to ground, a receptacle outlet shall not be required for services dedicated to equipment covered in Articles 675 and 682.*

■Reason for the Change

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet is still required to be installed at the electrical service equipment. The maximum distance this receptacle outlet can be located from the electrical service has been shortened to 7.5 m (25 ft) and limited to indoor service equipment only. This required receptacle outlet is now required to be installed in an accessible location and must be located within the same room or area as the service equipment. This requirement is still not applicable to one- and two-family dwellings. A new exception was also added allowing services dedicated to equipment covered in Articles 675 and 682 to be exempt from this requirement when the service voltage is greater than 120 volts to ground.

210.70(C) Lighting Outlets Required

(C) ~~Other Than Dwelling Units~~ All Occupancies. For attics and underfloor spaces, ~~containing equipment requiring servicing, such as heating, air-conditioning, and refrigeration equipment~~ utility rooms, and basements, at least one lighting outlet containing a switch or controlled by a wall switch shall be installed ~~in such~~ where these spaces are used for storage or contain equipment requiring servicing. At least one point of control shall be at the usual point of entry to these spaces. The lighting outlet shall be provided at or near the equipment requiring servicing.

■Reason for the Change

The title of 210.70(C) was changed from "Other Than Dwelling Units" to "All Occupancies" and the text at this provision was revised to mirror the *Code* text at 210.70(A)(3) for dwelling units. This lighting outlet requirement for storage or equipment spaces now applies to dwelling units as well as non-dwelling unit attics, underfloor spaces, utility rooms, and basements.

210.71 Meeting Rooms

210.71 Meeting Rooms.

(A) General. Each meeting room of not more than 93 m^2 (1000 ft^2) 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(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. Receptacle outlets shall be installed in accordance with 210.52(A)(1) through (A)(4).

(2) Floor Receptacle Outlets. A meeting room that is at least 3.7 m (12 ft) wide and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one receptacle outlet located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m2 (215 ft^2) 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.

■Reason for the Change

New provisions were added at 210.71 with minimum provisions for receptacle outlets

placement and wall spacing requirements in non-dwelling unit meeting rooms such as those found at hotels and convention centers. See *NEC* text for complete requirements and specifics.

ARTICLE 215
Feeders

215.2 Minimum Rating and Size

Code Language: 215.2 Minimum Rating and Size.

(A) Feeders Not More Than 600 Volts.

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

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

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

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

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

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

[(3) Informational Notes unchanged]

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

~~***Exception No. 2:*** *Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.*~~

■Reason for the Change

The previous exceptions to 215.2(A)(1)(b) have been relocated after 215.2(A)(1)(a). This relocation clarifies that these exceptions apply to the main rule that the feeder conductors must have an allowable ampacity of not less than the noncontinuous load plus 125 percent of the continuous load. A new exception was also added that allows a portion of a feeder that is connected at both its supply and load ends to separately installed pressure connections to have an allowable ampacity not less than the sum of the continuous load plus the noncontinuous load (rather than the noncontinuous load plus 125 percent of the continuous load).

ARTICLE 220
Article 220 and 220.1 Branch-Circuit, Feeder, and Service Load Calculations

Article 220 Branch-Circuit, Feeder, and Service Load Calculations

220.1 Scope. This article provides requirements for calculating branch-circuit, feeder, and service loads. Part I provides for general requirements for calculation methods. Part II provides calculation methods for branch-circuit loads. Parts III and IV provide calculation methods for ~~feeders~~ feeder and ~~services~~ service

loads. Part V provides calculation methods for ~~farms~~ farm loads.

■Reason for the Change

The title of Article 220 was changed to "Branch Circuit, Feeder, and Service 'Load' Calculations." Parts of the scope of the article were changed to clarify that Parts III and IV provide calculation methods for "feeder and service loads." Text concerning Part V was revised to clarify that this part of the article covers calculation methods for "farm loads."

ARTICLE 225
Outside Branch Feeders and Circuits

225.30(F) Number of Supplies. (Outside Branch Circuits and Feeders)

Code Language: 225.30 Number of Supplies. (Outside Branch Circuits and Feeders)

A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 225.30(A) through ~~(E)~~ (F). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit.

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 225.30(A) through ~~(E)~~(F).

(F) One- or Two-Family Dwelling Unit(s). For a one- or two- family dwelling unit(s) with multiple feeders, it shall be permissible to install not more than six disconnects grouped at one location where the feeders enter the building, provided the feeder conductors originate at the same switchboard, panelboard, or overcurrent

Reason for the Change

A new first level subdivision (F) was added to 225.30 that will allow multiple feeders at one- or two-family dwelling unit(s) with not more than six grouped disconnecting means. These feeder conductor(s) are to originate at the same switchboard, panelboard, or overcurrent protective device location.

ARTICLE 230
Services

230.24(B)(5) Clearances

(B) Vertical Clearance for Overhead Service Conductors. Overhead service conductors, where not in excess of 600 volts, nominal, shall have the following m

(5)7.5 m (24.5 ft) over tracks of railroads

■Reason for the Change

A new vertical clearance of 7.5 m (24.5 ft) was added at 230.24(B)(5) for overhead service conductors installed over the tracks of a railroad. This will coordinate with the same requirement for outside overhead branch circuits and feeders in Article 225.

230.29 Branch-Circuit Receptacle Requirements

230.29 Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. ~~The bonding jumper shall be of the same conductor size and material as the grounded overhead service conductor, and in no case smaller than mandated in 250.102(C)(1) based on the size of the ungrounded service conductors.~~ Where practicable, such supports shall be independent of the building.

■Reason for the Change

Metal support structures that support overhead service conductors installed over a roof are now required to be bonded to the grounded overhead service conductor.

ARTICLE 240
Overcurrent Protection

Table 240.6(A) Standard Ampere Ratings

240.6 Standard Ampere Ratings.

(A) Fuses and Fixed-Trip Circuit Breakers. The standard ampere ratings for fuses and inverse time circuit breakers shall be considered ~~15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000 amperes~~ as shown in Table 240.6(A). Additional standard ampere ratings for fuses shall be 1, 3, 6, 10, and 601. The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted.

■Reason for the Change

The standard ampere ratings for fuses and inverse time circuit breakers have been revised to be included in a list format located at new Table 240.6(A) shown below.

Table 240.6(A)

The standard ampere ratings for fuses and inverse time circuit breakers shall be considered as shown in Table 240.6(A)

15	20	25	30	35
40	45	50	60	70
80	90	100	110	125
150	175	200	225	250
300	350	400	450	500
600	700	800	1000	1200
1600	2000	2500	3000	4000
5000	6000			

Additional standard ampere ratings for fuses shall be 1, 3, 6, 10, and 601

The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted

240.67 Arc Energy Reduction

240.67 Arc Energy Reduction. Where fuses rated 1200 amperes or higher are installed, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

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

(B) Method to Reduce Clearing Time. A fuse shall have a clearing time of 0.07 seconds or less at the available arcing current, or one of the following shall be provided:

(1) Differential relaying

(2) Energy-reducing maintenance switching with local status indicator

(3) Energy-reducing active arc flash mitigation system

(4) An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, *Standard for Electrical Safety in the Workplace*, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, *Standard for Electrical Safety in the Workplace.*

Informational Note No. 3: IEEE 1584, *IEEE Guide for Performing Arc Flash Hazard Calculations*, is one of the available methods that provides guidance in determining arcing current.

■Reason for the Change

Comparable methods of incident energy reduction as that of 240.87 have been

introduced into the 2017 *NEC* at 240.67 for fuses rated at 1200 amperes and greater.

ARTICLE 250
Grounding and Bonding

250.22(6) Circuits Not to Be Grounded

250.22 Circuits Not to Be Grounded.

The following circuits shall not be grounded:

(6) Class 2 load-side circuits for suspended ceiling low-voltage power grid distribution systems as provided in 393.60(B).

■Reason for the Change

A new List Item (6) was added to 250.22 for circuits not to be grounded with the addition of Class 2 load-side circuits for suspended ceiling low-voltage power grid distribution systems as provided in 393.60(B).

250.30(A)(4) and (A)(5) Grounding Separately Derived Alternating-Current Systems

(4) Grounding Electrode. The building or structure grounding electrode system shall be used as the grounding electrode for the separately derived system. If located outdoors, the grounding electrode shall be in accordance with 250.30(C). ~~as near as practicable to, and preferably in the same area as, the grounding electrode conductor connection to the system. The grounding electrode shall be the nearest of one of the following:~~

~~(1) Metal water pipe grounding electrode as specified in 250.52(A)(1)~~

~~(2) Structural metal grounding electrode as specified in 250.52(A)(2)~~

~~***Exception No. 1:*** *Any of the other electrodes identified in 250.52(A) shall be used if the electrodes specified by 250.30(A)(4) are not available.*~~

Exception ~~No. 2 to (1) and (2):~~ *If a separately derived system originates in equipment that is listed and identified* ~~equipment~~ *as suitable for use as service equipment, the grounding electrode used for the service or feeder equipment shall be permitted to be used as the grounding electrode for the separately derived system.*

(5) Grounding Electrode Conductor, Single Separately Derived System. A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived ungrounded conductors. It shall be used to connect the grounded conductor of the derived system to the grounding electrode ~~as specified~~ in accordance with 250.30(A)(4), or as permitted in 250.68(C)(1) and (2). This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.
[See NEC text for Exception No. 1, 2, and 3 to 250.30(A)(5)]

■Reason for the Change

For the 2017 *NEC*, any of the building or structure grounding electrode(s) that are present can now be used as the grounding electrode(s) for a separately derived system. The grounding electrode(s) for the separately derived system do not have to be located near the grounding electrode conductor connection. The metal water piping and the structural metal frame as covered in 250.68(C)(1) and (2) have been recognized as conductors to extend the grounding electrode connection at 250.30(A)(5).

250.30(A)(6)(a) Grounding Separately Derived Alternating-Current Systems

(a)Common Grounding Electrode Conductor. The common grounding electrode conductor shall be permitted to be one of the following:

(1) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(2) A metal water pipe that complies with 250.68(C)(1)

(3) The metal structural frame of the building or structure that complies with ~~250.52(A)(2)~~ 250.68(C)(2) or is connected to the grounding

electrode system by a conductor ~~that shall~~ not ~~be~~ smaller than 3/0 AWG copper or 250 kcmil aluminum

■**Reason for the Change**

A metal water pipe that complies with 250.68(C)(1) was added to the allowable methods for a common grounding electrode conductor for multiple separately derived systems. Revisions were also made to the provisions of a metal structural frame of a building or structure qualifying as a common grounding electrode conductor for multiple separately derived systems.

250.52(A)(2) Grounding Electrodes

(2) Metal Frame of the Building or In-Ground Support Structure(s). The metal frame of the building or structure that is connected to the earth by one or more of the following methods:

(1) At least One or more structural metal in-ground support structure(s) member that is in direct contact with the earth vertically for 3.0 m (10 ft) or more, with or without concrete encasement. If multiple metal in-ground support structures are present at a building or a structure, it shall be permissible to bond only one into the grounding electrode system.

(2) Hold-down bolts securing the structural steel column that are connected to a concrete-encased electrode that complies with 250.52(A)(3) and is located in the support footing or foundation. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, the usual steel tie wires, or other approved means.

Informational Note: Metal in-ground support structures include, but are not limited to, pilings, casings, and other structural metal.

■**Reason for the Change**

The title of 250.52(A)(2) was changed from "Metal Frame of a Building" to "Metal In-Ground Support Structure." Only one item remains that would qualify as a "metal in-ground support structure" grounding electrode: an in-ground support structure that is in direct contact with the earth vertically for 3.0 m (10 ft) or more, with or without concrete encasement.

250.52(B)(3) Grounding Electrodes

(B) Not Permitted for Use as Grounding Electrodes. The following systems and materials shall not be used as grounding electrodes:

(1) Metal underground gas piping systems

(2) Aluminum

(3) The structures and structural reinforcing steel described in 680.26(B) (1) and (B)(2)

■**Reason for the Change**

A third item was added to the list of objects that are prohibited from being used as a grounding electrode defined at 250.52(B). The structures and structural reinforcing steel of an in-ground swimming pool as described in 680.26(B)(1) and (B)(2) are now prohibited from being used as a grounding electrode, as well as the two items identified in the previous edition of the *Code*.

250.66(A), (B), and (C) Size of Alternating-Current Grounding Electrode Conductor

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

(B) Connections to Concrete-Encased Electrodes. ~~Where~~ If the grounding electrode conductor or bonding jumper ~~is~~ connected to a single or multiple concrete-encased electrode(s) as ~~permitted~~ described in 250.52(A)(3), that portion of the conductor that is the sole connection to the grounding electrode(s) does

not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than 4 AWG copper wire.

(C) Connections to Ground Rings. ~~Where~~ If the grounding electrode conductor or bonding jumper ~~is~~ connected to a ground ring as ~~permitted~~ described in 250.52(A)(4), ~~that portion of the conductor that is the sole connection to the grounding electrode~~ does not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than the conductor used for the ground ring.

■Reason for the Change

The sizing requirements of 250.66(A), (B), and (C) are still the same as the previous edition of the *Code*, but the "sole connection" requirement in all three subsections was replaced with language indicating that a grounding electrode conductor that does not extend to other types of electrodes requiring a larger size conductor still qualifies for the smaller size conductors (instead of the size spelled out in Table 250.66).

250.94(A) and (B) Bonding for Communication Systems

250.94 Bonding for ~~Other~~ Communication Systems. Communications system bonding terminations shall be connected in accordance with (A) or (B).

(A)The Intersystem Bonding Termination Device. An intersystem bonding termination (IBT) for connecting intersystem bonding conductors ~~required for other systems~~ shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any additional buildings or structures. The intersystem ~~bonding termination~~ If an IBT is used, it shall comply with the following: (Remainder of 250.94(A) unchanged. See *NEC* for complete text.)

(B)Other Means. Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1/4 in. thick × 2 in. wide) and of sufficient length to accommodate at least three terminations for communication systems in addition to other connections. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector. If aluminum busbars are used, the installation shall also comply with 250.64(A).

Exception to (A) and (B): *Means for connecting intersystem bonding conductors are not required where communications systems are not likely to be used.*

Informational Note: The use of an IBT can reduce electrical noise on communication systems.

■Reason for the Change

The title of the section was changed to "Bonding for Communication Systems." The existing text for the intersystem bonding termination was placed under List Item (A) and titled, "The Intersystem Bonding Termination Device." The six conditions that must be met to qualify as an intersystem bonding termination have not changed, and the one exception for existing buildings or structures remains the same. A new 250.94(B) was added titled, "Other Means," which permits intersystem bonding connections to an aluminum or copper busbar that will accommodate at least three terminations for communication systems as well as "other connections." A new exception was added for 250.94(A) and (B) offering relief from an intersystem bonding connection means "where communications systems are not likely to be used."

250.102 Grounded Conductors, Bonding Conductors, and Jumpers

250.102 Grounded Conductors, Bonding Conductors, and Jumpers.

(A)Material. Bonding jumpers shall be of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material. A bonding

jumper shall be a wire, bus, screw, or similar suitable conductor.

(2)Size for Parallel Conductor Installations in Two or More Raceways or Cables.

■Reason for the Change

"Grounded Conductor" was added to the title of 250.102 to reflect more accurately what the section addresses.

250.122(F) Size of Equipment Grounding Conductors

250.122 Size of Equipment Grounding Conductors. (F) Conductors in Parallel. ~~Where conductors are installed in~~ For circuits of parallel conductors ~~in multiple raceways or cables~~ as permitted in 310.10(H), the equipment grounding conductors, ~~where used~~, shall be installed in parallel in accordance with (1) or (2): ~~each raceway or cable.~~

(1) Conductor Installations in Raceways, Auxiliary Gutters, or Cable Trays.

(a) Single Raceway or Cable Tray. If ~~Where~~ conductors are installed in parallel in the same raceway, ~~cable~~, or cable tray ~~as permitted in 310.10(H)~~, a single wire-type conductor shall be permitted as the equipment grounding conductor ~~shall be permitted. Each~~ The wire-type equipment grounding conductor shall be sized in ~~accordance~~ compliance with 250.122, based on the overcurrent protective device for the feeder or branch circuit. Wire-type equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c). Metal raceways or auxiliary gutters in accordance with 250.118 or cable trays complying with 392.60(B) shall be permitted as the equipment grounding conductor.

(b) Multiple Raceways. If conductors are installed in parallel in multiple raceways, wire-type equipment grounding conductors, where used, shall be installed in parallel in each raceway. The equipment grounding conductor installed in each raceway shall be sized in compliance with 250.122 based on the overcurrent protective device for the feeder or branch circuit. Metal raceways or auxiliary gutters in accordance with 250.118 or cable trays complying with 392.60(B) shall be permitted as the equipment grounding conductor.

(2) Multiconductor Cables

(a) If multiconductor cables are installed in parallel, the equipment grounding conductor(s) in each cable shall be connected in parallel. Except as provided in 250.122(F)(2)(b) for raceway or cable tray installations, the equipment grounding conductor in each multiconductor cable shall be sized in accordance with 250.122 based on the overcurrent protective device for the feeder or branch circuit.

(b) If multiconductor cables are installed in parallel in the same raceway, auxiliary gutter, or cable tray, a single equipment grounding conductor that is sized in accordance with 250.122 shall be permitted in combination with the equipment grounding conductors provided within the multiconductor cables and shall all be connected together. Equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c). Cable trays complying with 392.60(B), metal raceways in accordance with 250.118, or auxiliary gutters, shall be permitted as the equipment grounding conductor.

■Reason for the Change

In addition to the existing rules for equipment grounding conductors installed in parallel in multiple raceways or cables and the same raceway, cable, or cable tray, these rules for parallel installations were revised to allow equipment grounding conductors installed as part of a multiconductor cable to be used in combination with a separate equipment grounding conductor in a raceway, cable tray or auxiliary gutter. The requirements for 250.122(F) have been expanded into two separate Second Level Subdivisions (1) and (2) with third level subdivisions for each.

250.148 Continuity and Attachment of Equipment Grounding Conductors to Boxes

250.148 Continuity and Attachment of Equipment Grounding Conductors to Boxes.

~~Where~~ If circuit conductors are spliced within a box, or terminated on equipment within or supported by a box, ~~any~~ all 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).

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.*

■Reason for the Change

Clear directions in 250.148 specify that all of the equipment grounding conductors present in a box or enclosure are required to be connected, regardless of the circuit with which they are associated. The existing exception to 250.148 still applies, giving relief to the equipment grounding conductor of an isolated ground circuit for an isolated ground receptacle not being required to be connected to the other equipment grounding conductors or the box.

250.187(B) Impedance Grounded Neutral Systems

(B) Identified and Insulated. The neutral conductor of an impedance grounded neutral system shall be identified, as well as fully insulated with the same insulation as the phase conductors. shall comply with both of the following:

(1) The neutral conductor shall be identified.

(2) The neutral conductor shall be insulated for the maximum neutral voltage.

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

■Reason for the Change

The neutral conductor of an impedance grounded neutral system still must be identified, but it must be insulated to the maximum neutral voltage rather than fully insulated with the same insulation as the phase conductors.

CHAPTER 3 GENERAL

ARTICLE 300
Wiring Methods and Materials

Table 300.5 Underground Installations

Code Language: Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches) (See *NEC* text for complete table.)(See below for notes to table.)

[a]A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b]A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in ~~millimeters~~ mm ~~(inches~~ in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

■Reason for the Change

Two new footnotes were added below Table 300.5. These notes address a reduction of burial depth of 150 mm (6 in.) for pool, spa, and fountain lighting that is limited to not more than 30 volts. The installation is required to be within a nonmetallic raceway and part of a listed low-voltage lighting system.

Table 300.5

Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial to Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column (1) Direct-Buried Cables or Conductors		Column (2) Rigid Metal Conduit or Intermediate Metal Conduit		Column (3) Nonmetallic Raceways Listed for Direct Burial (No Concrete Encasement)		Column (4) Residential BC (120 Volts or Less, GFCI, Max. OCPD of 20 Amperes)		Column (5) Irrigation and Landscape Lty (30 Volts Max., Type IE or Other Identified Cable or Raceway	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
All locations not specified below	600	24	150	6	450	18	300	12	150[a]	6[a]
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6
Under a building (in NEC text)	0	0	0	0	0	0	0	0	0	0
Under min. 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic [slab extending not less than 152 mm (6 in.)]	450	18	100	4	100	4	150 (direct burial) 100 (in raceway)	6 4	150 (direct burial) 100 (in raceway)	6 4
Under streets, highways, roads, alleys, driveways, parking lots	600	24	600	24	600	24	600	24	600	24
One- and two-family dwelling driveways/parking areas, (dwelling-related purposes only)	450	18	450	18	450	18	300	12	450	18
In or under airport runways	450	18	450	18	450	18	450	18	450	18

300.5(D)(4) Underground Installations

(4) Enclosure or Raceway Damage.

Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

■Reason for the Change

Electrical metallic tubing (EMT) was added to the list of acceptable wiring methods that can be used to provide protection from physical damage for conductors installed underground and subject to physical damage.

ARTICLE 310
Conductors for General Wiring

Table 310.15(B)(3)(c) Ampacities for Conductors Rated 0-2000 Volts

(c)Raceways and Cables Exposed to Sunlight on Rooftops.

Where raceways or cables are exposed to direct sunlight on or above rooftops, ~~the adjustments shown in~~ Table 310.15(B)(3)(c) raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (7/8 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: *Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.*

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

~~**Informational Note to Table 310.15(B)(3)(c):** The temperature adders in~~ Table 310.15(B)(3)(c) ~~are based on the measured~~

~~temperature rise above the local climatic ambient temperatures due to sunlight heating. Table 310.15(B)(3)(c) Ambient Temperature Adjustment for Raceways or Cables Exposed to Sunlight on or Above Rooftops~~ (see 2014 *NEC* for complete content of deleted table).

■Reason for the Change

Table 310.15(B)(3)(c) was deleted and replaced with text added at 310.15(B)(3)(c). This new text requires a temperature adder of 33°C (60°F) only when a raceway or cable is installed directly on or less than 23 mm (7/8 in.) above a rooftop.

Table 310.15(B)(7) Ampacities for Conductors Rated 0-2000 Volts

(7) ~~120/240-Volt,~~ Single-Phase Dwelling Services and Feeders.

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.15(B)(7)(1) through (4). For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, single-phase feeder conductors consisting of 2 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).

(1) For a service rated 100 through 400 ~~A~~ 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.

(2) For a feeder rated 100 through 400 ~~A~~ 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.

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

(4) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, ~~provided that~~ 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), they shall be permitted to be applied to the ampacity associated with the temperature rating of the conductor.

Informational Note No. 1: ~~The conductor ampacity may require other correction or adjustment factors applicable to the conductor installation.~~ The service or feeder ratings addressed by this section are based on the standard ampacity ratings from 240.6(A).

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

■Reason for the Change

The provisions of 310.15(B)(7) for sizing dwelling unit service and certain feeder conductors was expanded to single-phase, 208Y/120-volt systems as well as single-phase, 120/240-volt systems. Explanatory language was added to address the permitted application of correction or adjustment factors required by 310.15(B)(2) or (3) applied to the ampacity associated with the temperature rating of the conductors. A new informational note directs the user of the *Code* to 240.6(A) for service ratings based on standard ampacity ratings for application of 310.15(B)(7). Previous Table 310.15(B)(7) was added back into the *Code* as part of Example D7 in Informational Annex D.

ARTICLE 312
Cabinets, Cutout Boxes, and Meter Socket Enclosures

312.5(C), Exception, Item (g) Cabinets, Cutout Boxes, and Meter Socket Enclosures.

(C) Cables. Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure.

Exception: *Cables with entirely nonmetallic sheaths shall be permitted to enter the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 450 mm (18 in.) and not more than 3.0 m (10 ft) in length, provided all of the following conditions are met:*

(g) Where installed as conduit or tubing, the cable fill does not exceed the amount that would be permitted for complete conduit or tubing systems by Table 1 of Chapter 9 of this Code and all applicable notes thereto. Note 2 to the tables in Chapter 9 does not apply to this condition.

■Reason for the Change

A new sentence was added to 312.5(C), Exception, Item (g) to indicate that Note 2 to the tables in Chapter 9 does not apply to this "sleeve" of conduit or tubing required if 312.5(C), Exception is employed.

312.6(A) Deflection of Conductors

Table 312.6(A) Minimum Wire-Bending Space at Terminals and Minimum Width of Wiring Gutters

(See *NEC* for complete table content).

Notes [to Table 312.6(A)]:

1. Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall, barrier, or obstruction.

2. This column shall be permitted to be used to determine the minimum wire-bending space for compact stranded aluminum conductors in sizes up to 1000 kcmil and manufactured using AA-8000 series electrical grade aluminum alloy conductor material in accordance with 310.106(B). The minimum width of the wire gutter space shall be determined using all other conductors' value in this table.

Table 312.6(A)

Wire Size (AWG or kcmil)		Wires per Terminal									
		1		2		3		4		5	
All Other Conductors	Compact Stranded AA-8000 Aluminum Alloy Conductors (see Note 2)	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
14-10	12-8	Not Specified		—	—	—	—	—	—	—	—
8 6	6-4	38.1	1½	—	—	—	—	—	—	—	—
4 3	2 1	50.8	2	—	—	—	—				
2	1/0	63.5	2½	—	—	—	—	—	—	—	—
1	2/0	76.2	3	—	—	—	—	—	—	—	—
1/0-2/0	3/0-4/0	88.9	3½	127	5	178	7	—	—	—	—
3/0-4/0	250-300	102	4	152	6	203	8	—	—	—	—
250	350	114	4½	152	6	230	8	254	10	—	—
300-350	400-500	127	5	203	8	254	10	305	12		
400-500	600-750	152	6	203	8	254	10	305	12	356	14
600-700	800-1000	203	8	254	10	305	12	356	14	406	16
750-900	—	203	8	305	12	356	14	406	16	457	18
1000-1250	—	254	10	—	—	—	—	—	—	—	—
1500-2000	—	305	12	—	—	—	—	—	—	—	—

Note 1: Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall, barrier, or obstruction.

Note 2: This column shall be permitted to be used to determine the minimum wire-bending space for compact stranded aluminum conductors in sizes up to 1000 kcmil and manufactured using AA-8000 series electrical grade aluminum alloy conductor material in accordance with 310.106(B). The minimum width of the wire gutter space shall be determined using the all other conductors value in this table.

■Reason for the Change

The requirements for wire-bending space at terminals and the use of Table 312.6(A) or Table 312.6(B) remained the same. A new column was added to Table 312.6(A) addressing wire-bending space for compact stranded AA-8000 aluminum alloy conductors for consistency.

312.8(B) Switch and Overcurrent Device Enclosures

312.8 Switch and Overcurrent Device Enclosures ~~with Splices, Taps, and Feed-Through Conductors~~.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment subject to limitations for specific equipment as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors. The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, and taps installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Power Monitoring Equipment. The wiring space of enclosures for switches or overcurrent devices shall be permitted to contain power monitoring equipment where all of the following conditions are met:

(1) The power monitoring equipment is identified as 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) The total area of all conductors, splices, taps, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

■Reason for the Change

A new 312.8(B) was added to allow power monitoring equipment within the wiring space of enclosures for switches or overcurrent devices with specific conditions.

ARTICLE 314

Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

314.16(A) and (B) Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies

(A) Box Volume Calculations. The volume of a wiring enclosure (box) shall be the total volume of the assembled sections and, where used, the space provided by plaster rings, domed covers, extension rings, and so forth, that are marked with their volume or are made from boxes the dimensions of which are listed in Table 314.16(A). Where a box is provided with one or more securely installed barriers, the volume shall be apportioned to each of the resulting spaces. Each barrier, if not marked with its volume, shall be considered to take up 8.2 cm^3 (1/2 $in.^3$) if metal and 16.4 cm^3 (1 $in.^3$) if nonmetallic.

(1) Standard Boxes. (No change to *Code* text; see *NEC* for complete text)

(2) Other Boxes. (No change to *Code* text; see *NEC* for complete text)

(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.

(B)(1) through (B)(5) (No change to *Code text;* see *NEC* for complete text)

■Reason for the Change

The volume or space that is occupied by an

internal barrier in a box or enclosure was added to the items previously addressed for preforming a box fill calculation.

314.17(B) Conductors Entering Boxes, Conduit Bodies, or Fittings

(B) Metal Boxes and Conduit Bodies. Where metal boxes or conduit bodies are installed with messenger-supported wiring, open wiring on insulators, or concealed knob-and-tube wiring, conductors shall enter through insulating bushings or, in dry locations, through flexible tubing extending from the last insulating support to not less than 6 mm (1/4 in.) inside the box and beyond any cable clamps. Where nonmetallic-sheathed cable or multiconductor Type UF cable is used, the sheath shall extend not less than 6 mm (1/4 in.) inside the box and beyond any cable clamp. Except as provided in 300.15(C), the wiring shall be firmly secured to the box or conduit body. Where raceway or cable is installed with metal boxes or conduit bodies, the raceway or cable shall be secured to such boxes and conduit bodies.

■Reason for the Change

New text added at 314.17(B) will now require nonmetallic-sheathed (Type NM) cable or multiconductor Type UF cable used with metal boxes or conduit bodies to have its sheath extend not less than 6 mm (1/4 in.) inside the box and beyond any cable clamp.

314.27(E) Outlet Boxes

(E)Separable Attachment Fittings. Outlet boxes required in 314.27 shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings. The combination shall be identified for the support of equipment within the weight and mounting orientation limits of the listing. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

■Reason for the Change

In addition to the previous requirements at 314.27(A) through (D) for a box supporting a luminaire, lampholder, ceiling-suspended (paddle) fan, or other types of utilization equipment, 314.27(E) will now permit listed locking support and mounting receptacles and support means for supporting a luminaire, lampholder, or ceiling-suspended (paddle) fan.

ARTICLE 320
Armored Cable: Type AC

320.6 Listing Requirements. (Armored Cable: Type AC)

320.6 Listing Requirements. (Armored Cable: Type AC).

Type AC cable and associated fittings shall be listed.

■Reason for the Change

New listing requirements were added in a number of the cable-type wiring method articles that will require the wiring method (cable) and associated fittings to be listed.

NOTE: For the 2017 *NEC*, the requirement that the wiring method (cable) and associated fittings be listed occurred at the following locations:

- 320.6 Type AC cable
- 322.6 Type FC cable
- 328.6 Type MV cable
- 330.6 Type MC cable
- 332.6 Type MI cable
- 334.6 Type NM, NMC, and NMS cable
- 336.6 Type TC cable
- 338.6 Type SE cable
- 340.6 Type UF cable

ARTICLE 324
Flat Conductor Cable: Type FCC

324.12(5) Uses Not Permitted. (Flat Conductor Cable: Type FCC)

324.12 Uses Not Permitted. (Flat Conductor Cable: Type FCC)

FCC systems shall not be used in the following locations:

(1) Outdoors or in wet locations

(2) Where subject to corrosive vapors

(3) In any hazardous (classified) location

(4) In residential, school, and hospital buildings

(5) In school, and hospital buildings, other than administrative office areas

■Reason for the Change

Type FCC cable systems are still prohibited in outdoor or in wet locations, where subject to corrosive vapors, in any hazardous (classified) location, or in residential buildings. Type FCC cable is still prohibited in school and hospital buildings, but not in the "administrative office areas" of a school or hospital building.

ARTICLE 336
Power and Control Tray Cable: Type TC

336.10(9) Uses Permitted. (Power and Control Tray Cable: Type TC)

Code Language: 336.10 Uses Permitted. (Power and Control Tray Cable: Type TC)

Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.

(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).

(3) In raceways.

(4) In outdoor locations supported by a messenger wire.

(5) For Class 1 circuits as permitted in Parts II and III of Article 725.

(6) For non–power-limited fire alarm circuits if conductors comply with the requirements of 760.49.

(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:

(a) The cable is Type TC-ER.

(b) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.

(c) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.

(d) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC-ER."

(e) The cable is secured at intervals not exceeding 1.8 m (6 ft).

(f) Equipment grounding for the utilization equipment ~~shall be~~ is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor ~~shall~~ must be provided within the cable or, at the time of installation, one or more insulated conductors shall be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(8) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

(9) In one- and two-family dwelling units, Type TC-ER cable containing both power and control

conductors that is identified for pulling through structural members shall be permitted. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Exception: *Where used to connect a generator and associated equipment having terminals rated 75°C (167°F) or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.*

Informational Note No. 1: TC-ER cable that is suitable for pulling through structural members is marked "JP."

Informational Note No. 2: See 725.136 for limitations on Class 2 or 3 circuits contained within the same cable with conductors of electric light, power, or Class 1 circuits.

(10) Direct buried, ~~unless~~ where identified for such use. (*was located in "Uses Not Permitted"*)

■**Reason for the Change**

There are now 11 different list items under "Uses Permitted" for Type TC cable. New List Item (9) now permits Type TC-ER cable containing both power and control conductors that are identified for pulling through structural members to be installed in one-and two-family dwelling units.

ARTICLE 344
Rigid Metal Conduit: Type RMC

344.14 Dissimilar Metals. (Rigid Metal Conduit: Type RMC)

Code Language: 344.14 Dissimilar Metals. (Rigid Metal Conduit: Type RMC)

Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences. Stainless steel RMC shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.

■**Reason for the Change**

Revisions occurred at 344.14 to clarify the acceptable fittings that can be used with different types of RMC, based on galvanic compatibility. With this revision, stainless steel RMC can only be used with stainless steel fittings, approved accessories, stainless steel outlet boxes, and stainless steel enclosures.

ARTICLE 350
Liquid tight Flexible Metal Conduit: Type LFMC

350.28 Trimming. (Liquid tight Flexible Metal Conduit: Type LFMC)

350.28 Trimming. (Liquid tight Flexible Metal Conduit: Type LFMC)

All cut ends of conduit shall be trimmed inside and outside to remove rough edges.

■**Reason for the Change**

Language was added at 350.28 requiring cut ends of LFMC to be trimmed inside and outside to remove rough edges.

ARTICLE 358
Electrical Metallic Cable: Type EMT

358.10 Uses Permitted. (Electrical Metallic Tubing: Type EMT)

358.10 Uses Permitted. (Electrical Metallic Tubing: Type EMT)

(A) Exposed and Concealed. The use of EMT shall be permitted for both exposed and concealed work for the following:

(1) In concrete, in direct contact with the earth or in areas subject to severe corrosive influences where installed in accordance with 358.10(B)

(2) In dry, damp, and wet locations

(3) In any hazardous (classified) location ~~except~~ as permitted by other articles in this *Code* (Was in "Uses Not Permitted")

(B) Corrosion ~~Protection~~ Environments.

(1) Galvanized Steel and Stainless Steel EMT, Elbows, and Fittings. ~~Ferrous or nonferrous~~ Galvanized steel and stainless steel EMT, elbows, ~~couplings~~, and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and approved as suitable for the condition.

(2) Supplementary Protection of Aluminum EMT. Aluminum EMT shall be provided with approved supplementary corrosion protection where encased in concrete or in direct contact with the earth.

(C) Cinder Fill. Galvanized steel and stainless steel EMT shall be permitted to be installed in cinder concrete or cinder fill where subject to permanent moisture ~~unless~~ when protected on all sides by a layer of non-cinder concrete at least 50 mm (2 in.) thick or when ~~unless~~ the tubing is installed at least 450 mm (18 in.) under the fill. (Was in "Uses Not Permitted")

(D) Wet Locations. All supports, bolts, straps, screws, and so forth shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials.

Informational Note: See 300.6 for protection against corrosion.

■Reason for the Change

Section 358.10 for "Uses Permitted" for EMT was revised for consistency with other steel conduit articles. The requirements for installations in cinder concrete and hazardous (classified) locations for EMT were moved from 358.12 for "Uses Not Permitted" for EMT and reworded into positive text. Provisions for stainless steel EMT were also added to 358.10.

ARTICLE 366
Auxiliary Gutters

366.20 Conductors Connected in Parallel

366.20 Conductors Connected in Parallel.

Where single conductor cables comprising each phase, neutral, or grounded conductor of an alternating-current circuit are connected in parallel as permitted in 310.10(H), the conductors shall be installed in groups consisting of not more than one conductor per phase, neutral, or grounded conductor to prevent current imbalance in the paralleled conductors due to inductive reactance.

■Reason for the Change

The new requirements were added at 366.20 for the safe and proper installation of parallel conductors in an auxiliary gutter.

ARTICLE 370
Cablebus

370.80 Ampacity of Conductors. (Cablebus)

Code Language: 370.80 Ampacity of Conductors. (Cablebus)

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

(B) Ampacity of Cables Rated 2000 Volts or Less. In cablebus that terminates at equipment with conductor temperature limitations, the allowable ampacity of single-conductor cables shall be as permitted by 310.15(A)(2). The adjustment factors of 310.15(B)(3) (a) shall not apply to the ampacity of cables in cablebus. The ampacity of single-

conductor cables, nominally rated 2000 volts or less, shall comply with the following:

(1) The ampacities for 600 kcmil and larger single conductor cables in ventilated cablebus shall not exceed 75 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(2) Where cablebus are continuously covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 600 kcmil and larger cables shall not exceed 70 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(3) The ampacities for 1/0 AWG through 500 kcmil single conductor cables in ventilated cablebus shall not exceed 65 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(4) Where cablebus are continuously covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 1/0 AWG through 500 kcmil cables shall not exceed 60 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(C) Ampacity of Type MV and Type MC Cables Rated 2001 Volts or Over. The ampacity of Type MV and Type MC cables, nominally rated 2001 volts or over, in cablebus shall comply with the following:

(1) The ampacities for 1/0 AWG and larger single-conductor cables in ventilated cablebus shall not exceed 75 percent of the allowable ampacities in Table 310.60(C)(69) and Table 310.60(C)(70).

(2) Where the cablebus are covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 1/0 AWG and larger single-conductor cables shall not exceed 70 percent of the allowable ampacities in Table 310.60(C)(69) and Table 310.60(C)(70).

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 to 35,000 volts.

Reason for the Change

With the same requirements for ampacity tables to use with cablebus remaining, new requirements have been added for ampacities of typical cablebus that align with the same requirements for single conductors installed in a cable tray. New informational notes will direct users of Article 370 back to the conductor termination requirements of 110.14(C) and 110.40.

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The complete 2017 NEC can be accessed online for free at the following link. Be sure to select "Free access to the 2017 edition of NFPA 70"

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Additional, the code can be purchased in both a book and pdf from the same link.

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Quiz Questions

The following twenty (20) question quiz will test the student's comprehension of the course. The student must past this online quiz with a score greater than 70%.

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

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

2. **An organization or part of an organization that performs field evaluations of electrical or other equipment is called the?**

- o Field Evaluation Group (FEG)
- o Electrical Evaluation Board (EEB)
- o Field Evaluation Body (FEB)
- o Field Evaluation & Equipment Corp. (FEEC)

3. **Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a shall be used?**

- o calibrated torque tool
- o Wrench
- o quality control verification procedure
- o field label

4. **Ground fault protection is required within?**

- o 6 ft. from top inside edge of bowl
- o 6 ft. of edge of bowl
- o 8 ft. from top inside edge of sink bowl
- o 5 ft. of edge of sink bowl

5. **A branch circuit panelboard or distribution equipment label shall be.**

- o withstand the environment
- o permanently posted
- o not be handwritten
- o All of the Above

6. **At least one outlet receptacle in an attached garage is required to be?**

- o 240-volt, 60-ampere
- o 120-volt, 15-ampere
- o 240-volt, 20-ampere
- o 120-volt, 20-ampere

7. **What article lists the requirements for electric vehicle circuits in the 2017 NEC?**

- o 210.17
- o 217.10
- o 740.25
- o 625.40

8. **A meeting room that is at least 12 ft wide and that has a floor area of at least 215 ft² shall have at least receptacle outlet(s).**

- o One
- o Two
- o Three
- o Four

9. **Grounded conductors that are not connected to an over-current device shall be permitted to be sized at_____percent of the continuous and non-continuous load.**

- o 70
- o 90
- o 60
- o 100

10. **What table should be referenced for standard ampere ratings?**

- o Table 240.6(A)
- o Table 310.8(B)
- o Table 204.1(A)
- o Table 242.1(A)

11. **The acronym IBT refers to what?**

- o intrinsic bonding termination
- o internal bonding termination
- o intersystem bonding terminals
- o intersystem bonding termination

12. **In referencing Article 250.66, if a grounding electrode does not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than?**

- o 4 AWG copper wire
- o 6 AWG aluminum wire
- o 2 DOG aluminum wire
- o 6 AWG copper wire

13. **What is the minimum depth of a low-voltage lighting system for a pool which is installed in a non-metallic raceway?**

- o 6 inches
- o 12 inches
- o 30 inches
- o 36 inches

14. **What does EMT mean?**

- o Electrical Metallic Tape
- o Electrician Managed Task
- o Electrical Material Threat
- o Electrical Metallic Tubing

15. **Which table should be referenced to determine the minimum wire-bending space at terminals?**

- o Table 312.6(C)
- o Table 312.6(B)
- o Table 312.6(D)
- o Table 312.6(A)

16. **In reference to 312.8, the total area of all conductors, splices, taps, and equipment at any cross section of the wiring space does not exceed percent of the cross-sectional area of that space.**

- o 25
- o 75
- o 90
- o 50

17. **Where can Flat Conductor Cable: Type FCC be used?**

- o In school, and hospital buildings, other than administrative office areas
- o Outdoors or in wet locations
- o Where subject to corrosive vapors
- o In residential, school, and hospital buildings

18. **It is essential to trim the of Liquid tight Flexible Metal Conduit: Type LFMC.**

- o Inside and outside edge
- o Not required to Trim
- o Inside edge
- o Outside edge

19. **Where nonmetallic-sheathed cable or multi-conductor Type UF cable is used, the sheath shall extend not less than_____inside the box and beyond any cable clamp.**

- o 1/4 in
- o 5/8 in
- o 1 in
- o 1/2 in

20. **Which of the following are common materials for Electric Metallic Tubing (EMT)?**

- o Stainless Steel
- o Aluminum
- o All of the above
- o Galvanized Steel