



FDA Inc. Course #

NEC 2017 Code Changes in Equipment for General Use



WWW.DISCOUNTPDH.COM

Equipment for General Use

Articles 404 – 480

- 404** Switches
- 406** Receptacles, Cord Connectors, and Attachment Plugs (Caps)
- 408** Switchboards, Switchgear, and Panelboards
- 409** Industrial Control Panels
- 410** Luminaires, Lamp holders, and Lamps
- 411** Lighting Systems Operating at 30 Volts or Less and Lighting Equipment
Connected to Class-2 Power Sources
- 422** Appliances
- 424** Fixed Electric Space-Heating Equipment
- 425** Fixed Resistance and Electrode Industrial Process Heating Equipment
- 426** Fixed Outdoor Electric Deicing and Snow-Melting Equipment
- 430** Motors, Motor Circuits, and Controllers
- 440** Air-Conditioning and Refrigerating Equipment
- 445** Generators
- 480** Storage Batteries

The *National Electrical Code* is updated on a three-year *Code* cycle. The International Association of Electrical Inspectors publishes its *Analysis of Changes* every three years on the same publishing schedule as the *NEC*. This course is based on the revisions to the 2017 *NEC*.

The 2017 *NEC* experienced a change in the revision process. In the past, the first public meeting for the *NEC* revision process was known as the Report on Proposals. This was replaced with the 2017 *NEC* First Draft meeting.

Suggested changes to the *NEC*, which were known as Proposals, were replaced with Public Inputs. The PIs that were acted upon favorably resulted in a First Revision to the First Draft of the 2017 *NEC*.

The second public meeting for the *NEC* revision process was known as the Report on Comments meeting, which was replaced with the 2017 *NEC* Second Draft meeting. Submitted Comments were replaced with Public Comments.

Successful PCs resulted in Second Revisions to the Second Draft of 2017 *NEC*. Appeals will be heard and voting for acceptance of the 2017 *NEC* will take place at the NFPA Annual Conference in June 2016. The NFPA Standards Council will issue the 2017 *NEC* in August 2016 with a publication date of September of 2016.

There were 4102 Public Inputs submitted from interested participants, which resulted in 1233 First Revisions to the First Draft of the 2017 *NEC*. A total of 1513 Public Comments resulted in 559 Second Revisions to the Second Draft of the *NEC*.

In this book, IAELI has reported on the most significant changes to the 2017 *NEC*. The revisions reported on in this publication were based on the Second Draft of the 2017 *NEC*. While IAELI takes every precaution to deliver the most

accurate account of the changes to the latest edition of the *NEC*, these revisions are subject to alterations from the time of publication of the *Analysis of Changes* to the deliverance of the final version of the 2017 *NEC*.

404.2(C) **Switch Connections**

Revision Change

Summary of Change: Revisions clarified that a grounded conductor of the lighting circuit at switch locations shall be connected to the electronic device.

Code Language: 210.6 Branch-Circuit Voltage Limitations.

(C) Switches Controlling Lighting Loads. The grounded circuit conductor for the controlled lighting circuit shall be ~~provided~~ installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallways, stairways, or rooms suitable for human habitation or occupancy as defined in the applicable building code. Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location. ~~for other than the following~~ A grounded conductor shall not be required to be installed at lighting switch locations under any of the following

conditions:

- (1) Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor
- (2) Where the box enclosing the switch is accessible for the installation of an additional or replacement cable without removing finish materials
- (3) Where snap switches with integral enclosures comply with

300.15(E)-(4) ~~Where a switch does not serve a habitable room or bathroom~~ [moved to parent text of

404.2(C)]

~~(5) Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations~~ [moved to parent text of 404.2(C)]

~~(6)~~ (4) Where lighting in the area is controlled by automatic means

~~(7)~~ (5) Where a switch controls a receptacle load
The grounded conductor shall be extended to any switch location as necessary and shall be connected to switching devices that require line-to-neutral voltage to operate the electronics of the switch in the standby mode and shall meet the requirements of 404.22.

Exception: The connection requirement shall become effective on January 1, 2020. It shall not apply to replacement or retrofit switches installed in locations prior to local adoption of 404.2(C) and where the grounded conductor cannot be extended without removing finish materials. The number of electronic lighting control switches on a branch circuit shall not exceed five, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25. For the purpose of this exception, a neutral busbar, in compliance with 200.2(B) and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

Informational Note: The provision for a (future) grounded conductor is to complete a circuit path for electronic lighting control devices.

What caused the 2017 NEC Change?

The previous seven conditions in which a grounded conductor was not required to be installed at lighting switch locations has been revised and reduced to only five conditions. Previous conditions (4) and (5) were moved to the parent text of 404.2(C) and reworded into positive language. Enforceable language was added to require the grounded conductor to be connected and used by the switching device rather than simply be “present” at the switch enclosure. A new exception was also added to exclude replacement or retrofit switches installed in locations before the local adoption of 404.2(C) where the grounded conductor cannot be extended without removing finish materials. This new exception also puts a limit to the number of electronic lighting control switches on a branch circuit or feeder.

404.22

Branch-Circuit Voltage Limitations

Type of Change: New

Summary of the new code: New provisions were added for “Electronic Lighting Controlled Switches” prohibiting current on the equipment grounding conductor with a future effective date.

404.22 Electronic Lighting Control Switches. Electronic lighting control switches shall be listed. Electronic lighting control switches shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020.

Exception: Electronic lighting control switches that introduce current on the equipment grounding conductor shall be permitted for applications covered by 404.2(C), Exception. Electronic lighting control switches that introduce current on the equipment grounding conductor shall be listed and marked for use in replacement or retrofit applications only.

What caused the 2017 NEC Change?

In conjunction with revisions to 404.2(C), new text was added at 404.22 stating that electronic lighting control switching devices are required to be listed and “shall not introduce current on the equipment grounding conductor during normal operation.” This prohibition on introducing current on the equipment grounding conductor has a future effective date of January 1, 2020.

406.2

Receptacles, Cord Connectors, and Attachment Plugs (Caps)

Type of Change: New

Summary of New Change: A new definition for “Outlet Box Hood” was added at 406.2.

Code Language: 406.2 Definitions. [Receptacles, Cord Connectors, and Attachment Plugs (Caps)]

Outlet Box Hood. A housing shield intended to fit over a faceplate for flush-mounted wiring devices, or an integral component of an outlet box, or a faceplate for flush-mounted wiring devices. The hood does not serve to complete the electrical enclosure; it reduces the risk of water coming in contact with electrical components within the hood, such as attachment plugs, current taps, surge protective devices, direct plug-in transformer

units, or wiring devices.

What caused the 2017 NEC Change?

A clear and expressive definition for the term “outlet box hood” was added at 406.2.

406.3(E) Controlled Receptacle Marking

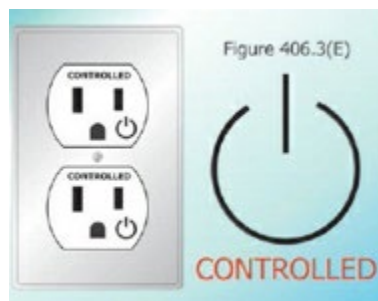
Type of Change: Revision

Summary of Change: Receptacles that are controlled by an automatic control device must be permanently marked with the symbol shown in Figure 406.3(E) and the word “Controlled.” Required marking must be on the receptacle face (not the cover plate) and be visible after installation.

Code Language: 406.3 Receptacle Rating and Type.

(E) Controlled Receptacle Marking. All nonlocking-type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device, or that incorporate control features that remove power from the receptacle outlet for the purpose of energy management or building automation, shall be marked with the symbol shown in Figure 406.3(E) and the word “controlled.” For receptacles controlled by an automatic control device, the marking shall be located on the controlled receptacle outlet face where and visible after installation. In both cases where a multiple receptacle device is used, the required marking of the word “controlled” and symbol shall denote which contact device(s) are automatically controlled.

Figure 406.3(E) Controlled Receptacle Marking Symbol.



Exception: The marking is not required for receptacles controlled by a wall switch that provide the required room lighting outlets as permitted by 210.70.

What caused the 2017 NEC Change?

The word “Controlled” is now required to be placed on the controlled receptacle along with the previous symbol. The word “Controlled” was also added to Figure 406.3(E). The controlled receptacle symbol and the word “Controlled” are to be placed on the controlled receptacle face (not the faceplate or cover) and visible

406.3(F) **Receptacle Rating and Type**

Type of Change: New

Summary of Change: New requirements were added for receptacle outlets with USB charger(s).

Code Language: 406.3 Receptacle Rating and Type.

(F) Receptacle with USB Charger. A 125-volt 15- or 20-ampere receptacle that additionally provides Class 2 power shall be listed and constructed such that the Class 2 circuitry is integral with the receptacle.

What caused the 2017 NEC Change?

New provisions were added pertaining to 125-volt 15- or 20-ampere receptacle that additionally provides Class 2 power in the form of a USB charger. These new provisions require these devices to be listed and constructed such that the Class 2 circuitry is integral with the receptacle.

406.4(D)(4), Ex. No. 1 and Ex. No. 2 **Replacement Receptacles (AFCI)**

Type of Change: New

Summary of Change: Two new exceptions were added for AFCI requirements for replacement of existing receptacles.

Code Language: 406.4 General Installation Requirements.

Receptacle outlets shall be located in branch circuits in accordance with Part III of Article 210. General installation requirements shall be in accordance with 406.4(A) through (F).

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

(4) Arc-Fault Circuit-Interrupter Protection. Where a receptacle outlet is supplied by a branch circuit that requires arc fault circuit interrupter protection as specified elsewhere in this Code located in any areas specified in 210.12(A) or (B), a replacement receptacle at this outlet shall be one of the following:

- (1) A listed outlet branch-circuit type arc-faultcircuit-interrupter receptacle
- (2) A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
- (3) Areceptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

Exception No. 1: *Arc-fault circuit-interrupter protection shall not be required where all of the following apply:*

- (1) *The replacement complies with 406.4(D)(2)(b).*
- (2) *It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).*
- (3) *A listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.*
- (4) *GFCI/AFCI dual function receptacles are not commercially available.*

Exception No. 2: *Section 210.12(B), Exception shall not apply to replacement of receptacles. This requirement becomes effective January 1, 2014.*

What caused 2017 NEC Change?

The main requirement of AFCI protection at replacement receptacles as described in the 2014 *NEC* holds true with two new exceptions added. The first new exception recognizes applications where an existing two-wire receptacle is replaced and no equipment grounding conductor can be installed. The second new exception stipulates that the exception to 210.12(B) does not apply when replacing existing receptacles.

406.4(D)(5) Receptacle Replacement Tamper-Resistant Receptacles

Type of Change: Revision

Summary of change: Tamper-resistant receptacles are required for replacement receptacles “except where a non-grounding receptacle is replaced with another non-grounding receptacle.”

Code Language: 406.4 General Installation Requirements.

Receptacle outlets shall be located in branch circuits in accordance with Part III of Article 210. General installation requirements shall be in accordance with 406.4(A) through (F).

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

(5) Tamper-Resistant Receptacles. Listed tamper-resistant receptacles shall be provided where replacements are made at receptacle outlets that are required to be tamper-resistant elsewhere in this *Code*, except where a non-grounding receptacle is replaced with another non-grounding receptacle.

What caused the 2017 NEC Change?

406.4(D)(5) still requires listed tamper-resistant receptacles where replacements are made at receptacle outlets that are required to be tamper-resistant elsewhere in the *Code* “except where a non-grounding receptacle is replaced with another non-grounding receptacle.” The tamper-resistant receptacle requirements at 406.12 remained basically the same for dwelling units, guest rooms and guest suites of hotels and motels, and for a child care facility (see complete change report for 406.12 in this periodical).

406.6(D) Receptacle Faceplates (Cover Plates) with Integral Night Light and/or USB Charger

Type of Change: New

Summary of change: New requirements were added for receptacle faceplates with integral night lights and/or USB chargers.

Code Language: 406.6 Receptacle Faceplates (Cover Plates).

Receptacle faceplates shall be installed so as to completely cover the opening and seat against the mounting surface. Receptacle faceplates mounted inside a box having a recess-mounted receptacle shall effectively close the opening and seat against the mounting surface.

(D) Receptacle Faceplate (Cover Plates) with Integral Night Light and/or USB Charger. A flush device cover plate that additionally provides a night light and/or Class 2 output connector(s) shall be listed and constructed such that the night light and/or Class 2 circuitry is integral with the flush device cover plate.

What caused the 2017 NEC Change?

New requirements were added at 406.6(D) about receptacle faceplates with integral night lights and/or USB chargers. These faceplates must be listed and constructed such that the night light and/or Class 2 circuitry is “integral with the flush device cover plate.”

406.9(B)(1)

Extra-Duty Outlet Box Hoods

Type of Change: Revision

Summary of change: New provisions allowing “other listed products,” enclosures, or assemblies providing weatherproof protection that do not utilize an outlet box hood need not be marked “extra duty” as required for the outlet box hoods.

Code Language: 406.9 Receptacles in Damp or Wet Locations. (B) Wet Locations.

(1) Receptacles of 15 and 20 Amperes in a Wet Location. Receptacles of 15 and 20 amperes, 125 and 250 volts installed in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted. An outlet box hood installed for this purpose shall be listed and shall be identified as “extra duty.” Other listed products, enclosures, or assemblies providing weatherproof protection that do not utilize an outlet box hood need not be marked “extra duty.”

Informational Note No. 1: Requirements for extra-duty outlet box hoods are found in ANSI/UL 514D-2000 2013, Cover Plates for Flush-Mounted Wiring Devices. “Extra duty” identification and requirements are not applicable to listed receptacles, faceplates, outlet boxes, enclosures, or assemblies that are identified as either being suitable for wet locations or rated as one of the outdoor enclosure-type numbers of Table 110.28 that does not utilize an outlet box hood.

Exception: 15- and 20-ampere, 125- through 250-volt receptacles installed in a wet location and subject to routine high-pressure spray washing shall be permitted to have an enclosure that is weatherproof when the attachment plug is removed.

All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles shall be listed and so identified as the weather-resistant type.

Informational Note No. 2: The types configuration of weather-resistant receptacles covered by this requirement are identified as 5-15, 5-20, 6-15, and 6-20 in ANSI/NEMA WD 6-2002 2012, Standard for Dimensions of Attachment Plugs and Receptacles Wiring Devices — Dimensional Specifications.

What caused the 2017 NEC Change?

The previous requirements for 15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location still holds true with language added to indicate that other listed products, enclosures, or assemblies providing weatherproof protection that do not utilize an outlet box hood need not be marked “extra duty.”

406.12 Tamper-Resistant Receptacles

Type of Change: Revision/New

Summary of change: Requirements for tamper-resistant receptacles were expanded to mobile homes, preschools and elementary education facilities, as well as other locations where small children are likely to congregate. TR receptacles were expanded to 250-volt receptacles as well as 125-volt receptacles.

Code Language: 406.12 Tamper-Resistant Receptacles.

~~Tamper-resistant receptacles shall be installed as~~ All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in the areas specified in ~~406.12(A) through (C)~~ 406.12(1) through (7) shall be listed tamper-resistant receptacles.

- (1) Dwelling units in all areas specified in 210.52 and 550.13
- (2) Guest rooms and guest suites of hotels and motels
- (3) Child care facilities
- (4) Preschools and elementary education facilities
- (5) Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities
- (6) Subset of assembly occupancies described in Article 518.2 to include places of waiting transportation, gymnasiums, skating rinks, and auditoriums
- (7) Dormitories

Informational Note: This requirement would include receptacles identified as 5-15, 5-20, 6-15, and 6-20 in ANSI/NEMA WD 6-2016, Wiring Devices — Dimensional Specifications.

Exception to ~~(A), (B), and (C)~~ (1), (2), (3), (4), (5), (6), and (7):

Receptacles in the following locations shall not be required to be tamper-resistant:

- (1) Receptacles located more than 1.7 m (5½ ft) above the floor
- (2) Receptacles that are part of a luminaire or appliance
- (3) A single receptacle or a duplex receptacle for two appliances located within the dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and-plug-connected in accordance with 400.10(A)(6), (A)(7), or (A)(8)
- (4) Nongrounding receptacles used for replacements as permitted in 406.4(D)(2)(a)

What caused the 2017 NEC Change?

Along with the tamper-resistant receptacle requirements of the 2014 *NEC*, tamper-resistant receptacle requirements were expanded to mobile and manufactured homes, preschools and elementary education facilities, dormitories, business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities, assembly occupancies including places of waiting, transportation, gymnasiums, skating rinks, and auditoriums. The voltage rating at which tamper-resistant receptacle requirements are applicable was expanded to include both 125 volts and 250 volts.

406.15

Dimmer-Controlled Receptacles

Type of Change: Deletion

Summary of change: Dimmer-controlled receptacle provisions have been deleted.

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

What caused the 2017 NEC Change?

The requirements for dimmer-controlled receptacles at 406.15 have been deleted. This section sought to correct incompatibilities between certain types of dimmers and certain cord-and-plug connected loads. Such incompatibilities are currently dealt with in the listing of specific load types and the listing of specific dimmer types.

408.3(A)(2)

Barriers at Service Panelboards

Type of Change: Revision/New

Summary of change: New requirements were added for barriers to be placed in all service panelboards so that no uninsulated, ungrounded service busbar or service terminal will be exposed to inadvertent contact by persons.

Code Language: **408.3 Support and Arrangement of Busbars and Conductors. (Switchboards, Switchgear, and Panelboards)**

(A) Conductors and Busbars on a Switchboard, Switchgear, or Panelboard. Conductors and busbars on a switchboard, switchgear, or panelboard shall comply with 408.3(A)(1), (A)(2), and (A)(3) as applicable.

(2) Service Switchboards and Switchgear. Barriers shall be placed in all service panelboards, switchboards, and switchgear such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

Exception: *This requirement shall not apply to service panelboards with provisions for more than one service disconnect within a single enclosure as permitted in 408.36, Exceptions No. 1, 2, and 3.*

What caused the 2017 NEC Change?

The barrier requirements of 408.3(A)(2) were expanded to all service panelboards as well as service switchboards and switchgear. An exception also was added eliminating the barriers at panelboards installed to comply with the requirements of 408.36, Ex. No. 1, 2, and 3.

409.22(B)

Short-Circuit Current Rating

Type of Change: Revision/New

Summary of change: New requirements were added for documentation of available short-circuit current at industrial control panels and the date the short-circuit current calculation was performed.

Code Language: 409.22(B) Short-Circuit Current Rating. (Industrial Control Panels).

(A) Installation. An industrial control panel shall not be installed where the available ~~fault~~ short-circuit current exceeds its short-circuit current rating as marked in accordance with 409.110(4).

(B) Documentation. If an industrial control panel is required to be marked with a short-circuit current rating in accordance with 409.110(4), the available short-circuit current at the industrial control panel, and the date the

short-circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

What caused the 2017 NEC Change?

The missing companion component for documentation of the available short-circuit current (fault current) at industrial control panels was added at 409.22(B). This new requirement also required documentation of the date the short-circuit current calculation was performed.

410.62(C)(1)

Cord-Connected Lamp holders and Luminaires

Type of Change: Revision

Summary of change: Reorganization occurred to the requirements for cord-connected lampholders and luminaires of the electric-discharge and LED types.

Code Language: 410.62 Cord-Connected Lamp holders and Luminaires.

Electric-Discharge and LED Luminaires. Electric-discharge and LED luminaires shall comply with (1), (2), and (3) as applicable.

(1) Cord-Connected Installation. A luminaire or a listed assembly in compliance with any of the conditions in (a) through (c) shall be permitted to be cord connected ~~if the following conditions apply:~~ provided the luminaire is located directly below the outlet or busway, the flexible cord ~~meets all the following:~~ is not subject to strain or physical damage, and the cord is visible over its entire length ~~outside the luminaire except at terminations.~~

(a) A luminaire shall be permitted to be connected with a cord terminating ~~terminated~~ in a grounding-type attachment plug or busway plug.

(b) A luminaire assembly equipped with a strain relief and canopy shall be permitted to use a cord connection between the luminaire assembly and the canopy. The canopy shall be permitted to include a section of raceway ~~having a maximum~~ not over 152 mm 150 mm (6 in.) in length and intended to facilitate the connection to an outlet box mounted above a suspended ceiling.

(c) Listed luminaires connected using listed assemblies that incorporate manufactured wiring system connectors in accordance with ~~604.6(C)~~ 604.100(C) shall be permitted to be cord connected.

What caused the 2017 NEC Change?

The same basic requirements still apply to cord-connected electric-discharge and LED luminaires with the information re-organized into an easier to understand list format that improves the clarity of the content.

Article 411

Low-Voltage Lighting

Type of Change: Revision

Summary of change: Article 411 was re-organized and renamed.

Code Language: ~~Article 411 Low-Voltage Lighting Systems Operating at 30 Volts or Less and Lighting Equipment Connected to Class 2 Power Sources.~~

411.1 Scope. This article covers lighting systems and their associated components operating at no more than 30 volts or less and their associated components. This article also covers lighting equipment connected to a Class 2 power source ac or 60 volts dc. Where wet contact is likely to occur, the limits are 15 volts ac or 30 volts dc.

Informational Note: Refer to Article 680 for applications involving immersion.

411.3 Low-Voltage Lighting Systems.

411.4 Listing Required.

411.5 Specific Location Requirements.

411.6 Secondary Circuits.

411.8 Hazardous (Classified) Locations.

(See *NEC* for complete text of Article).

What caused the 2017 NEC Change?

The limitations of 411.3(A) and (B) for low-voltage lighting systems operating at 30 volts or less and the limitations of Class 2 low-voltage lighting systems conforming to *NEC* Chapter 9, Table 11(A) or Table 11(B) was removed for the 2017 *NEC*. These low-voltage lighting systems addressed by Article 411 are now basically limited by the maximum rating of 25 amperes for the output circuits of the power supply under all load conditions.

422.2 Definition. (Appliances)

Type of Change: Deletion

Summary of change: Previous definition of “Vending Machine” has been deleted.

Code Language: 422.2 Definition. (Appliances)

~~**Vending Machine.** Any self service device that dispenses products or merchandise without the necessity of replenishing the device between each vending operation and is designed to require insertion of coin, paper currency, token, card, key, or receipt of payment by other means.~~

What caused the 2017 NEC Change?

Vending machines are still required to be GFCI-protected, but the requirement has been relocated to 422.5(A) (5). All appliances operating at 50 volts or more are now required be listed (see new 422.6). In determining what constitutes a vending machine, the user of the *Code* will need to rely on the listing and the product standards for vending machines.

422.5 GFCI Protection for Appliances

Type of Change: New/Revision

Summary of change: GFCI requirements from 210.8 and throughout Article 422 are related to personnel hazards from specific equipment (contact with equipment with excessive leakage current) and provide those requirements in a single location in Article 422.

Code Language: 422.5 Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.

~~The device providing GFCI protection required in this article shall be readily accessible.~~

(A) **General.** Appliances identified in 422.5(A)(1) through (5) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective devices shall be permitted but shall not be required.

- (1) Automotive vacuum machines provided for public use
- (2) Drinking fountains water coolers
- (3) High-pressure spray washing machines — cord- and plug-connected
- (4) Tire inflation machines provided for public use
- (5) Vending machines

(B) **Type.** The GFCI shall be readily accessible, listed, and located in one or more of the following locations: (1) Within the branch circuit overcurrent device

- (2) A device or outlet within the supply circuit
- (3) An integral part of the attachment plug
- (4) Within the supply cord not more than 300 mm (12 in.) from the

attachment plug (5) Factory installed within the appliance.

What caused the 2017 NEC Change?

The five appliances requiring GFCI protection in Article 422 were grouped together, and the GFCI requirements for these appliances were relocated to one location at 422.5(A). A new 422.5(B) was also added allowing five options for the location and type of GFCI protective device provided to deliver GFCI protection to the specific appliances listed at 422.5(A).

422.5 Listing Required. (Appliances)

Type of Change: New

Summary of change: New listing requirement enforced for all appliances operating at 50 volts or more.

Code Language: 422.6 Listing Required. (Appliances)

All appliances operating at 50 volts or more shall be listed.

What caused the 2017 NEC Change

A new section has been added to Article 422 requiring that all appliances operating at 50 volts or more must be listed.

422.14 I ~~Infrared Lamp Industrial Heating Appliances~~

Type of Change: Deletion/Relocation

Summary of change: Rules for industrial infrared lamp heating appliances have been deleted and relocated in new [Article 425](#).

Code Language: ~~422.14 Infrared Lamp Industrial Heating Appliances.~~

~~In industrial occupancies, infrared heating appliance lampholders shall be permitted to be operated in series on circuits of over 150 volts to ground, provided the voltage rating of the lampholders is not less than the circuit voltage.~~

~~Each section, panel, or strip carrying a number of infrared lampholders (including the internal wiring of such section, panel, or strip) shall be considered an appliance. The terminal connection block of each such assembly shall be considered an individual outlet.~~

What caused the 2017 NEC Change?

Section 422.14 titled, "Infrared Lamp Industrial Heating Appliances," was deleted and the information relocated to new [Article 425](#) at 425.14.

422.16(B)(2)

Flexible cords for Built-In Dishwashers

Type of Change: Revision

Summary of change: Maximum length of flexible cord for built-in dishwashers increased from 1.2 m (4 ft) to 2.0 m (6.5 ft) while the receptacle outlet for a built-in dishwasher can only be located in the space adjacent to the dishwasher.

Code Language: 422.16 Flexible Cords. (Appliances)

(B) Specific Appliances.

(2) Built-in Dishwashers and Trash Compactors. Built-in dishwashers and trash compactors shall be permitted to be cord- and plug-connected with a flexible cord identified as suitable for the purpose in the installation instructions of the appliance manufacturer where all of the following conditions are met:

(1) The flexible cord shall be terminated with a grounding-type attachment plug.

Exception: *A listed dishwasher or trash compactor distinctly marked to identify it as protected by a system of double insulation, or its equivalent, shall not be required to be terminated with a grounding-type attachment plug.*

(2) For a trash compactor, the length of the cord shall be 0.9 m to 1.2 m (3 ft to 4 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

(3) For a built-in dishwasher, the length of the cord shall be 0.9 m to 2.0 m (3 ft to 6.5 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

(4) Receptacles shall be located to avoid protect against physical damage to the flexible cord.

(5) The receptacle for a trash compactor shall be located in the space occupied by the appliance or adjacent thereto.

(6) The receptacle for a built-in dishwasher shall be located in the space adjacent to the space occupied by the dishwasher.

(7) The receptacle shall be accessible.

The receptacle outlet for both a built-in dishwasher and a trash compactor could be located in the space occupied by the appliance or adjacent to it, and the receptacle must be accessible.

What caused the 2017 NEC Change?

Dishwashers are now only permitted to have the receptacle outlet for a cord- and plug-connected built-in dishwasher to be located in the space adjacent to the space occupied by the dishwasher. The maximum length of a cord for a built-in dishwasher was extended from the previous maximum length of 1.2 m (4 ft) to 2.0 m (6.5 ft) measured from the face of the attachment plug to the plane of the rear of the appliance. Other requirements for dishwashers and trash compactors remain the same as in the 2014 *NEC*.

422.16(B)(4) Range Hoods

Type of Change: Revision

Summary of change: The maximum length of a flexible cord for a cord-and plug-connected range hood has been increased from 900 mm (36 in.) to 1.2 m (4 ft).

Code Language: 422.16 Flexible Cords. (Appliances) (B) Specific Appliances.

(4) Range Hoods. Range hoods shall be permitted to be cord- and plug-connected with a flexible cord identified as suitable for use on range hoods in the installation instructions of the appliance manufacturer, where all of the following conditions are met:

(1) The flexible cord is terminated with a grounding-type attachment plug.

Exception: *A listed range hood distinctly marked to identify it as protected by a system of double insulation, or its equivalent, shall not be required to be terminated with a grounding-type attachment plug.*

(2) The length of the cord is not less than 450 mm (18 in.) and not over ~~900 mm (36 in.)~~ 1.2 m (4 ft).

(3) Receptacles are located to ~~avoid~~ protect against physical damage to the flexible cord.

(4) The receptacle is accessible.

(5) The receptacle is supplied by an individual branch circuit.

What caused the 2017 NEC Change?

The requirements for a cord- and plug-connected range hood are much the same as the 2014 *NEC* with the length of the flexible cord expanded to 1.2 m (4 ft). The language pertaining to the receptacle needing to be located to “avoid” physical damage was changed to “protect against” physical damage to incorporate more enforceable language.

Article 424 Part V Electric Space-Heating Cables

Type of Change: Revision

Summary of change: Part V (424.34 through 424.47) of [Article 424](#) was revised for clarity.

Code Language: Article 424 Fixed Electric Space-Heating Equipment

Heating Cable Construction.

424.34 Marking of Heating Cables.

424.35 Clearances of Wiring in Ceilings.

424.38 Area Restrictions.

424.39 Clearance from Other Objects and Openings.

424.40 Splices.

424.41 Ceiling Installation of Heating Cables on Dry Board, in Plaster, and on Concrete Ceilings.

424.42 Finished Ceilings.

424.43 Installation of Non heating Leads of Cables.

424.44 Installation of Cables in Concrete or Poured Masonry Floors.

424.45 ~~Inspection and Tests.~~ Installation of Cables Under Floor Covering.

424.46 Inspection and Test.

424.47 Label Provided by Manufacturer.

(See NEC for complete text)

What caused the 2017 NEC Change?

Part V of Article 424 was revised for simpler interpretation and application. Two new sections were added. These sections (424.45 and 424.47) address proper installations of cables under floor coverings and labels provided by the manufacturer. The previous edition of the *Code* did not properly address these added items in Part V.

424.45

Heating Cables Under Floor Coverings

Type of Change: New

Summary of change: New requirements were added for the installation of heating cables installed under floor coverings.

Code Language: **424.45 Installation of Cables Under Floor Coverings.**

(A) **Identification.** Heating cables for installation under floor covering shall be identified as suitable for installation under floor covering.

(B) **Expansion Joints.** Heating cables shall not be installed where they bridge expansion joints unless provided with expansion and contraction fittings applicable to the manufacture of the cable.

(C) **Connection to Conductors.** Heating cables shall be connected to branch-circuit and supply wiring by wiring methods described in the installation instructions or as recognized in [Chapter 3](#).

(D) **Anchoring.** Heating cables shall be positioned or secured in place under the floor covering, per the manufacturer's instructions.

(E) **Ground-Fault Circuit-Interrupter Protection.** Ground-fault circuit-interrupter protection for personnel shall be provided.

(F) **Grounding Braid or Sheath.** Grounding means, such as copper braid, metal sheath, or other approved means, shall be provided as part of the heated length.

What caused the 2017 NEC Change?

New requirements were added at 424.45 (Part V of Article 424) to give direction for the installation of heating cables installed under floor coverings.

424.47

Label Provided by Manufacturer

Type of Change: New

Summary of change: New provisions were added for manufacturers of electric space-heating cables to provide marking labels to be affixed to panelboards to identify which branch circuits supply the circuits to those space-heating installations.

Code Language: **424.47 Label Provided by Manufacturer.**

The manufacturers of electric space-heating cables shall provide marking labels that indicate that the space-heating installation incorporates electric space-heating cables, and instructions that the labels shall be affixed to the panelboards to identify which branch circuits supply the circuits to those space-heating installations. If the electric space-heating cable installations are visible and distinguishable after installation, the labels shall not be required to be provided and affixed to the panelboards.

What caused the 2017 NEC Change?

New requirements for manufacturer's labels were added at 424.47 in Part V of [Article 424](#) for application to electric space-heating cables. The manufacturer's label requirements for heating panels and panel sets at 424.92(D) remained the same.

Article 424 Part X

Fixed Electric Space-Heating Equipment

Type of Change: New

Summary of change: A new Part X was added to [Article 424](#) for low-voltage fixed electric space-heating equipment.

Code Language: **Article 424 Fixed Electric Space-Heating Equipment.**

Part X. Low-Voltage Fixed Electric Space-Heating Equipment

424.100 Scope. Low-voltage fixed electric space-heating equipment shall consist of an isolating power supply, low-voltage heaters, and associated equipment that are all identified for use in dry locations.

424.101 Energy Source.

(A) **Power Unit.** The power unit shall be an isolating type with a rated output not exceeding 25 amperes, 30 volts (42.4 volts peak) ac, or 60 volts dc under all load conditions.

(B) **Alternate Energy Sources.** Listed low-voltage fixed electric space-heating equipment shall be permitted to be supplied directly from an alternate energy source such as solar photovoltaic (PV) or wind power. When supplied from such a source, the source and any power conversion equipment between the source and the heating equipment and its supply shall be listed and comply with the applicable section of the *NEC* for the source used. The output of the source shall meet the limits of 424.101(A).

424.102 **Listed Equipment.** Low-voltage fixed electric space-heating equipment shall be listed as a complete system.

424.103 **Installation.**

(A) **General.** Equipment shall be installed per the manufacturer's installation instructions.

(B) **Ground.** Secondary circuits shall not be grounded.

(C) **Ground-Fault Protection.** Ground-fault protection shall not be required.

424.104 **Branch Circuit.**

(A) Equipment shall be permitted to be supplied from branch circuits rated not over 30 amperes.

(B) The equipment shall be considered a continuous duty load.

What caused the 2017 NEC Change?

To address products identified as low-voltage fixed electric space-heating equipment, a new Part X was added to Article 424 for the 2017 *NEC*.

Article 425

Fixed Resistance and Electrode Industrial Process Heating Equipment

Type of Change: New

Summary of change: New Article: Fixed Resistance and Electrode Industrial Process Heating Equipment.

Code Language: Article 425 Fixed Resistance and Electrode Industrial Process Heating Equipment

Part I. General

425.1 Scope. This article covers fixed industrial process heating employing electric resistance or electrode heating technology. For the purpose of this article, heating equipment shall include boilers, electrode boilers, duct heaters, strip heaters, immersion heaters, process air heaters, or other approved fixed electric equipment used for industrial process heating. This article shall not apply to heating and room air conditioning for personnel spaces covered by Article 424, fixed heating equipment for pipelines and vessels covered by Article 427, and induction and dielectric heating equipment covered by Article 665, and industrial furnaces incorporating silicon carbide, molybdenum, or graphite process heating elements.

425.2 Other Articles.

425.3 Branch Circuits.

(A) Branch-Circuit Requirements.

(B) Branch-Circuit Sizing.

425.6 Listed Equipment.

Part II. Installation

425.8 General.

(A) Location.

(B) Working Space.

(C) Above Grade Level, Floor, or Work Platform.

425.9 Approval.

425.10 Special Permission.

425.11 Supply Conductors.

425.12 Locations.

(A) Exposed to Physical Damage.

(B) Damp or Wet Locations

425.13 Spacing from Combustible Materials.

425.14 Infrared Lamp Industrial Heating Equipment.

Part III. Control and Protection of Fixed Industrial Process Heating Equipment

425.19 Disconnecting Means.

(A) Heating Equipment with Supplementary Overcurrent Protection.

(B) Heating Equipment Without Supplementary Overcurrent Protection.

(C) Unit Switch(es) as Disconnecting Means.

425.21 Switch and Circuit Breaker to Be Indicating.

425.22

- (A) Branch-Circuit Devices.**
- (B) Resistance Elements.**
- (C) Overcurrent Protective Devices.**
- (D) Branch-Circuit Conductors.**
- (E) Conductors for Subdivided Loads.**

Part IV. Marking of Heating Equipment

425.28 Nameplate.

- (A) Marking Required.**
- (B) Location.**

425.29 Marking of Heating Elements.

425.45 Concealed Fixed Industrial Heating Equipment — Inspection and Tests.

Part V. Fixed Industrial Process Duct Heaters

425.57 General.

425.58 Identification.

425.59 Airflow.

425.60 Elevated Inlet Temperature.

425.63 Fan Circuit Interlock.

425.64 Limit Controls.

425.65 Location of Disconnecting Means.

Part VI. Fixed Industrial Process Resistance-Type Boilers

425.70 Scope.

425.71 Identification.

425.72 Overcurrent Protection.

- (A) Boiler Employing Resistance-Type Immersion Heating Elements in an ASME-Rated and Stamped Vessel.**
- (B) Boiler Employing Resistance-Type Heating Elements Rated More Than 48 Amperes and Not Contained in an ASME-Rated and Stamped Vessel.**
- (C) Supplementary Overcurrent Protective Devices.**
- (D) Suitable for Branch-Circuit Protection.**
- (E) Conductors Supplying Supplementary Overcurrent Protective Devices.**
- (F) Conductors for Subdivided Loads.**

425.73 Overtemperature Limit Control.

425.74 Overpressure Limit Control.

Part VII. Fixed Industrial Process Electrode-Type Boilers

425.80 Scope.

425.81 Identification.

425.82 Branch-Circuit Requirements.

425.83 Overtemperature Limit Control.

425.84 Overpressure Limit Control.

425.85 Grounding.

425.86 Markings.

(See NEC for complete text)

What caused the 2017 NEC Change?

New Article 425 (Fixed Resistance and Electrode Industrial Process Heating Equipment) has been incorporated into the 2017 *NEC*. In previous editions, the *NEC* did not adequately address requirements for industrial process heating equipment. Section 422.14, which covered appliances with infrared heat lamps, has been relocated to new Article 425 at 425.14.

426.32

Impedance Heating Voltage Limitation Fixed Outdoor Electric Deicing and Snow Melting Equipment

Type of Change: Revision

Summary of change: The allowance for voltage output greater than 30 volts ac if an impedance heating system for fixed outdoor electric deicing and snow-melting equipment is provided with Class A GFCI protection has been deleted.

Code Language: 426.32 Voltage Limitations. (Fixed Outdoor Electric Deicing and Snow-Melting Equipment)

~~Unless protected by ground fault circuit interrupter protection for personnel, the~~ The secondary winding of the isolation transformer connected to the impedance heating elements shall not have an output voltage greater than 30 volts ac.

~~Where ground fault circuit interrupter protection for personnel is provided, the voltage shall be permitted to be greater than 30 but not more than 80 volts.~~

What caused the 2017 NEC Change?

The secondary winding of an isolation transformer connected to an impedance heating element cannot have an output voltage greater than 30 volts ac. The allowance for voltage output greater than 30 volts ac if the system is provided with Class A GFCI protection has been deleted.

430.2 and 430.4

Definitions: Part-Winding Motors

Type of Change: Relocation/New

Summary of change: A new definition was added at 430.2 for “Part-Winding Motors.”

Code Language: 430.2 Definitions. (Motors, Motor Circuits, and Controllers)

430.2 Part-Winding Motors. A part-winding start induction or synchronous motor is one that is arranged for starting by first energizing part of its primary (armature) winding and, subsequently, energizing the remainder of this winding in one or more steps. A standard part-winding start induction motor is arranged so that one-half of its primary winding can be energized initially, and, subsequently, the remaining half can be energized, both halves then carrying equal current. A hermetic refrigerant compressor motor shall not be considered a standard part-winding start induction motor.

~~**430.4 Part-Winding Motors.** A part-winding start induction or synchronous motor is one that is arranged for starting by first energizing part of its primary (armature) winding and, subsequently, energizing the remainder of this winding in one or more steps. A standard part-winding start induction motor is arranged so that one-half of its primary winding can be energized initially, and, subsequently, the remaining half can be energized, both halves then carrying equal current. A hermetic refrigerant compressor motor shall not be considered a standard part-winding start induction motor.~~

Where separate overload devices are used with a standard part-winding start induction motor, each half of the motor winding shall be individually protected in accordance with 430.32 and 430.37 with a trip current one-half that specified.

Each motor-winding connection shall have branch-circuit short-circuit and ground-fault protection rated at not more than one-half that specified by 430.52.

***Exception:** A short-circuit and ground-fault protective device shall be permitted for both windings if the device will allow the motor to start. Where time-delay (dual-element) fuses are used, they shall be permitted to have a rating not exceeding 150 percent of the motor full-load current.*

What caused the 2017 NEC Change?

The definition of a part-winding motor was moved from 430.4 to its proper location at 430.2.

430.53(D)(4)

Single Motor Taps on One Branch Circuit

Type of Change: New

Summary of change: New tap rule for a single motor allows 7.5 m (25 ft) taps with the same conditions as is allowed in other areas of the *NEC*.

Code Language: 430.53 Several Motors or Loads on One Branch Circuit.

Two or more motors or one or more motors and other loads shall be permitted to be connected to the same branch circuit under conditions specified in 430.53(D) and 430.53(A), (B), or (C). The branch-circuit protective device shall be fuses or inverse time circuit breakers.

(D) Single Motor Taps. For group installations described above, the conductors of any tap supplying a single motor shall not be required to have an individual branch-circuit short-circuit and ground-fault protective device, provided they comply with one of the following:

(1) No conductor to the motor shall have an ampacity less than that of the branch-circuit conductors.

(2) No conductor to the motor shall have an ampacity less than one-third that of the branch-circuit conductors, with a minimum in accordance with 430.22. The conductors from the point of the tap to the motor overload device shall be not more than 7.5 m (25 ft) long and be protected from physical damage by being enclosed in an approved raceway or by use of other approved means.

(3) Conductors from the point of the tap from the branch circuit ~~short-circuit and ground-fault protective device~~ to a listed manual motor controller additionally marked "Suitable for Tap Conductor Protection in Group Installations," or to a branch-circuit protective device, shall be permitted to have an ampacity not less than one-tenth the rating or setting of the branch-circuit short-circuit and ground-fault protective device. The conductors from the controller to the motor shall have an ampacity in accordance with 430.22. The conductors from the point of the tap to the controller(s) shall (1) be suitably protected from physical damage and enclosed either by an enclosed controller or by a raceway and be not more than 3 m (10 ft) long or (2) have an ampacity not less than that of the branch-circuit conductors.

(4) Conductors from the point of the tap from the branch circuit to a listed manual motor controller additionally marked "Suitable for Tap Conductor Protection in Group Installations," or to a branch-circuit protective device, shall be permitted to have an ampacity not less than one-third that of the branch-circuit conductors. The conductors from the controller to the motor shall have an ampacity in accordance with 430.22. The conductors from the point of the tap to the controller(s) shall (1) be suitably protected from physical damage and enclosed either by an enclosed controller or by a raceway and be not more than 7.5 m (25 ft) long or (2) have an ampacity not less than that of the branch-circuit conductors.

What caused the 2017 NEC Change?

New 430.53(D)(4) increases the maximum length of the conductors of any tap supplying a single motor to 7.5 m (25 ft) when the ampacity is not less than one-third that of the branch-circuit conductors.

430.99

Available Fault Current for Motor Control Centers

Type of Change: New

Summary of change: New requirements were added for available short-circuit current at the motor control center and the date the short-circuit current calculation was performed.

Code Language: 430.99 Available Fault Current. (Motors, Motor Circuits, and Controllers)

The available short-circuit current at the motor control center and the date the short-circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

What caused the 2017 NEC Change?

New provisions were added at 430.99 requiring documentation of the available short-circuit current (fault current) at motor control centers along with the date the short-circuit current calculation was performed.

440.9

Grounding and Bonding—Rooftop Equipment

Type of Change: New

Summary of change: A new requirement was added requiring a wire-type equipment grounding conductor for non-threaded conduit systems on rooftops supplying such things as HVAC equipment.

Code Language: 440.9 Grounding and Bonding. (Air-Conditioning and Refrigerating Equipment)

Where multi motor and combination-load equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use non-threaded fittings.

What caused the 2017 NEC Change?

The outdoor portions of metallic raceway systems that use non-threaded fittings are now required to contain a wire-type equipment grounding conductor when installed outdoors on a roof to supply multi motor and combination-load equipment.

440.65

Protection Devices for Room AC Units

Type of Change: Revision and Deletion

Summary of change: Heat detecting circuit interrupter (HDCI) was added to a list of devices for protection of single-phase room airconditioners.

Code Language: 440.65 ~~Leakage-Current Detector-Interrupter (LCDI) and Arc-Fault Circuit-Interrupter (AFCI) Protection Devices.~~

Single-phase cord- and plug-connected room air conditioners shall be provided with one of the following factory-installed ~~LCDI or AFCI protection~~ devices:

- (1) Leakage-current detector-interrupter (LCDI)
- (2) Arc-fault circuit interrupter (AFCI)
- (3) Heat detecting circuit interrupter (HDCI)

The ~~LCDI or AFCI~~ protection device shall be an integral part of the attachment plug or be located in the power supply cord within 300 mm (12 in.) of the attachment plug.

What caused the 2017 NEC Change?

In addition to the previously allowed protection for single-phase, cord-and plug-connected room air conditioners of LCDI or AFCI protection, a new form of protection was introduced at 440.65 allowing heat detecting circuit interrupter (HDCI) protection for room air conditioners. These three forms of protection for room air conditioners were placed in a list format for better clarity to the user of the *Code*.

445.11

Marking. (Generators)

Type of Change: Revision/New

Summary of change: Nameplate marking requirements for generators have been revised and put into a list format.

Code Language: 445.11 Marking. (Generators)

Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, ~~the power factor, the normal volts and amperes corresponding to the rating, the rated revolutions per minute,~~ and the rated ambient temperature, ~~or and~~ rated temperature rise.

Nameplates ~~or manufacturer's instructions~~ shall provide the following information for all stationary generators and portable generators rated more than 15 kW: ~~shall also give the power factor, the subtransient and transient impedances, the insulation system class, and the time rating.~~

(1) Subtransient, and transient, synchronous, and zero sequence impedances reactances

(2) Power time rating category

(3) Insulation system class

(4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse

(5) Maximum short-circuit current for inverter-based generators, in lieu of the synchronous, subtransient, and transient reactances

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

What caused the 2017 NEC Change?

This section involving a generator's nameplate marking was revised into a list format for stationary and portable generators rated more than 15 kW. The word "impedance" was replaced with the word "reactance." Generators rated more than 15 kW are now also required to be marked with the maximum short-circuit current for inverter-based generators. The requirement for the nameplate to provide the "power factor" for all stationary and portable generators rated more than 15 kW has been moved to the first sentence of 445.11 so as to apply to all sizes of generators. For stationary and portable generators rated more than 15 kW, the term "time rating" was replaced with "power rating category."

445.13(B) Generator OCPD Provided

Type of Change: New

Summary of change: A new requirement clarifies that feeder taps can be used if the generator is equipped with an overcurrent relay or other overcurrent protective device.

Code Language: 445.13 Ampacity of Conductors. (Generators) (A) General. The ampacity of the conductors from the generator output terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. It shall be permitted to size the neutral conductors in accordance with 220.61. Conductors that must carry ground-fault currents shall not be smaller than required by 250.30(A). Neutral conductors of dc generators that must carry ground-fault currents shall not be smaller than the minimum required size of the largest conductor.

Exception: *Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator.*

(B) Overcurrent Protection Provided. Where the generator set is equipped with a listed overcurrent protective device, including or a combination of a current transformer and overcurrent relay, conductors shall be permitted to be tapped from the load side of the protected terminals in accordance with 240.21(B).

Tapped conductors shall not be permitted for portable generators rated 15 kW or less where field wiring connection terminals are not accessible.

What caused the 2017 NEC Change?

The existing provisions of the 2014 *NEC* for ampacity of conductors for generators were carried forward for the 2017 *NEC* and reassigned to 445.13(A) and exception. New provisions were added at 445.13(B) to clarify that the feeder tap rules of 240.21(B) can be used if the generator or generator set is equipped with an overcurrent relay or other overcurrent device, unless the tapped conductors are for portable generators rated 15 kW or less where field wiring connection terminals are not accessible.

445.18

Disconnecting Means and Shutdown of Prime Mover

Type of Change: Revision/New

Summary of change: Generator disconnecting means have been reorganized. Provisions for disconnecting means, shut down of the prime mover, and provisions for generators installed in parallel have been added.

Code Language: 445.18 Disconnecting Means Required for Generators and Shutdown of Prime Mover.

~~Generators shall be equipped with a disconnect(s), lockable in the open position by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where the following conditions apply:~~

~~(1) Portable generators are cord- and plug-connected, or~~

~~(2) Both of the following conditions apply:~~

~~a. The driving means for the generator can be readily shut down, is rendered incapable of restarting, and is lockable in the OFF position in accordance with 110.25.~~

~~b. The generator is not arranged to operate in parallel with another generator or other source of voltage.~~

~~**Informational Note:** See UL 2200-2012, Standard for Safety of Stationary Engine Generator Assemblies.~~

(A) Disconnecting Means. Generators other than cord- and plug-connected portable shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be lockable in the open position in accordance with 110.25.

(B) Shutdown of Prime Mover. Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

(1) Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting

(2) Initiate a shutdown mechanism that requires a mechanical reset

The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25.

Generators with greater than 15 kW rating shall be provided with an additional requirement to shut down the prime mover. This additional shutdown means shall be located outside the equipment room or generator enclosure and shall also meet the requirements of 445.18(B)(1) and (B)(2).

(C) Generators Installed in Parallel. Where a generator is installed in parallel with other generators, the provisions of 445.18(A) shall be capable of isolating the generator output terminals from the paralleling equipment. The disconnecting means shall not be required to be located at the generator.

What caused the 2017 NEC Change?

Revisions and new requirements were incorporated into 445.18 by installing three subsections for disconnecting means for a generator. The provisions of 445.18(A) retain the existing requirements, with revisions, for a disconnecting means for a generator. New 445.18(B) adds requirements for the shutdown of the prime mover for a generator or generator set.

New 445.18(C) was added to clarify that when generators are installed in parallel, it is not necessary to provide a disconnecting means at each generator and the paralleling equipment as long as the generator is capable of isolating the generator output terminals from the paralleling equipment.

445.20

Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators

Type of Change: Revision/New

Summary of change: Listed cord sets incorporating GFCI protection for portable generators manufactured or rebuilt prior to January 1, 2015, are now permitted. GFCI requirements have been separated into unbonded (floating neutral) generators versus bonded neutral generators.

Code Language: 445.20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

~~All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator either shall have listed ground-fault circuit-interrupter protection (GFCI) for personnel integral to the generator or receptacle or shall not be available for use when the 125/250-volt locking-type receptacle is in use. If the generator does not have a 125/250-volt locking-type receptacle, this requirement~~

shall not apply, as indicated in either (A) or (B):

(A) Unbonded (Floating Neutral) Generators. Unbonded generators with both 125-volt and 125/250-volt receptacle outlets shall have listed GFCI protection for personnel integral to the generator or receptacle on all 125-volt and 15- and 20-ampere receptacle outlets.

Exception: *GFCI protection shall not be required where the 125-volt receptacle outlets(s) is interlocked such that it is not available for use when any 125/250-volt receptacle(s) is in use.*

(B) Bonded Neutral Generators. Bonded generators shall be provided with GFCI protection on all 125-volt and 15- and 20-ampere receptacle outlets.

Informational Note: Refer to 590.6(A)(3) for GFCI requirements for 15-kW or smaller portable generators used for temporary electric power and lighting.

Exception to (A) and (B): *If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed ~~ground-fault circuit interrupter~~ GFCI protection for personnel identified for portable use shall be permitted. (See 2014 NEC TIA 14-2)*

What caused the 2017 NEC Change?

The requirements of 445.20 were revised to separate GFCI requirements for unbonded (floating neutral) generators at 445.20(A) and bonded neutral generators at 445.20(B). Unbonded (floating neutral) generators requires GFCI protection at all 125-volt, 15- and 20-ampere receptacles, but only where both 125-volt and 125/250-volt receptacles exist on the generator. An exception to 445.20(A) eliminates GFCI protection where the 125-volt receptacle outlets(s) is interlocked such that it is not available for use when any 125/250-volt receptacle(s) is in use.

New 445.20(B) requires all 125-volt, 15- and 20-ampere receptacles on bonded neutral generators to be provided with GFCI protection. An exception to 445.20(A) and (B) permits GFCI protection in the form of listed cord sets or devices incorporating listed GFCI protection if the generator was manufactured or remanufactured prior to January 1, 2015.

480.3 Equipment. (Storage Batteries)

Type of Change: New

Summary of change: Storage batteries and battery management equipment are now required to be listed (other than lead-acid batteries).

Code Language: **480.3 Equipment. (Storage Batteries)**

Storage batteries and battery management equipment shall be listed. This requirement shall not apply to lead-acid batteries.

What caused the 2017 NEC Change?

New listing requirement was added at 480.3, which will require storage batteries and battery management equipment to be listed. This listing requirement does not apply to lead-acid batteries.