

# NEC 2017 Code Changes

## Chapter 4 - Equipment for General Use

Changes from the 2014 code are highlighted in yellow.

### ARTICLE 404 – Switches

#### Part I. Installation

**404.1 Scope.** The provisions of this article apply to all switches, switching devices, and circuit breakers used as switches operating at 1000 volts and below, unless specifically referenced elsewhere in this Code for higher voltages.

#### **404.2 Switch Connections.**

**(A) Three-Way and Four-Way Switches.** Three-way and fourway switches shall be wired so that all switching is done only in the ungrounded circuit conductor. Where in metal raceways or metal-armored cables, wiring between switches and outlets shall be in accordance with 300.20(A).

**Exception:** *Switch loops shall not require a grounded conductor.*

**(B) Grounded Conductors.** Switches or circuit breakers shall not disconnect the grounded conductor of a circuit.

**Exception:** *A switch or circuit breaker shall be permitted to disconnect a grounded circuit conductor where all circuit conductors are disconnected simultaneously, or where the device is*

*arranged so that the grounded conductor cannot be disconnected until all the ungrounded conductors of the circuit have been disconnected.*

**(C) Switches Controlling Lighting Loads.** The grounded circuit conductor for the controlled lighting circuit shall be 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. 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 lighting in the area is controlled by automatic means
- (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.

#### **404.3 Enclosure.**

**(A) General.** Switches and circuit breakers shall be of the externally operable type mounted in an enclosure listed for the intended use. The minimum wire-bending space at terminals and minimum gutter space provided in switch enclosures shall be as required in 312.6.

**Exception No. 1:** *Pendant- and surface-type snap switches and knife switches mounted on an open-face switchboard or panelboard shall be permitted without enclosures.*

**Exception No. 2:** *Switches and circuit breakers installed in accordance with 110.27(A)(1), (A)(2), (A)(3), or (A)(4) shall be permitted without enclosures.*

**(B) Used as a Raceway.** Enclosures shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices, unless the enclosure complies with 312.8.

#### **404.4 Damp or Wet Locations.**

**(A) Surface-Mounted Switch or Circuit Breaker.** A surface mounted switch or circuit breaker shall be enclosed in a weatherproof enclosure or cabinet that complies with 312.2.

**(B) Flush-Mounted Switch or Circuit Breaker.** A flush mounted switch or circuit breaker shall be equipped with a weatherproof cover.

**(C) Switches in Tub or Shower Spaces.** Switches shall not be installed within tubs or shower spaces unless installed as part of a listed tub or shower assembly.

**404.5 Time Switches, Flashers, and Similar Devices.** Time switches, flashers, and similar devices shall be of the enclosed type or shall be mounted in cabinets or boxes or equipment enclosures. Energized parts shall be barriered to prevent operator exposure when making manual adjustments or switching.

***Exception:** Devices mounted so they are accessible only to qualified persons shall be permitted without barriers, provided they are located within an enclosure such that any energized parts within 152 mm (6.0 in.) of the manual adjustment or switch are covered by suitable barriers.*

#### **404.6 Position and Connection of Switches.**

**(A) Single-Throw Knife Switches.** Single-throw knife switches shall be placed so that gravity will not tend to close them. Single-throw knife switches, approved for use in the inverted

position, shall be provided with an integral mechanical means that ensures that the blades remain in the open position when so set.

**(B) Double-Throw Knife Switches.** Double-throw knife switches shall be permitted to be mounted so that the throw is either vertical or horizontal. Where the throw is vertical, integral mechanical means shall be provided to hold the blades in the open position when so set.

**(C) Connection of Switches.** Single-throw knife switches and switches with butt contacts shall be connected such that their blades are de-energized when the switch is in the open position. Bolted pressure contact switches shall have barriers that prevent inadvertent contact with energized blades. Singlethrow knife switches, bolted pressure contact switches, molded case switches, switches with butt contacts, and circuit breakers used as switches shall be connected so that the terminals supplying the load are de-energized when the switch is in the open position.

***Exception:*** *The blades and terminals supplying the load of a switch shall be permitted to be energized when the switch is in the open position where the switch is connected to circuits or equipment inherently capable of providing a backfeed source of power. For such installations, a permanent sign shall be installed on the switch enclosure or immediately adjacent to open switches with the following words or equivalent:*

**WARNING — LOAD SIDE TERMINALS MAY BE ENERGIZED BY BACKFEED.**

*The warning sign or label shall comply with 110.21(B).*

**404.7 Indicating.** General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in an enclosure as described in 404.3, shall clearly indicate whether they are in the open (off) or closed (on) position. Where these switch or circuit breaker handles are operated vertically rather than rotationally or horizontally, the up position of the handle shall be the closed (on) position.

***Exception No. 1:** Vertically operated double-throw switches shall be permitted to be in the closed (on) position with the handle in either the up or down position.*

***Exception No. 2:** On busway installations, tap switches employing a center-pivoting handle shall be permitted to be open or closed with either end of the handle in the up or down position. The switch position shall be clearly indicating and shall be visible from the floor or from the usual point of operation.*

#### **404.8 Accessibility and Grouping.**

**(A) Location.** All switches and circuit breakers used as switches shall be located so that they may be operated from a readily accessible place. They shall be installed such that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform.

***Exception No. 1:** On busway installations, fused switches and circuit breakers shall be permitted to be located at the same level as the busway. Suitable means shall be provided to operate the handle of the device from the floor.*

**Exception No. 2:** *Switches and circuit breakers installed adjacent to motors, appliances, or other equipment that they supply shall be permitted to be located higher than 2.0 m (6 ft 7 in.) and to be accessible by portable means.*

**Exception No. 3:** *Hookstick operable isolating switches shall be permitted at greater heights.*

**(B) Voltage Between Adjacent Devices.** A snap switch shall not be grouped or ganged in enclosures with other snap switches, receptacles, or similar devices, unless they are arranged so that the voltage between adjacent devices does not exceed 300 volts, or unless they are installed in enclosures equipped with identified, securely installed barriers between adjacent devices.

**(C) Multipole Snap Switches.** A multipole, general-use snap switch shall not be permitted to be fed from more than a single circuit unless it is listed and marked as a two-circuit or three circuit switch.

**Informational Note:** See 210.7 for disconnect requirements where more than one circuit supplies a switch.

#### **404.9 Provisions for General-Use Snap Switches.**

**(A) Faceplates.** Faceplates provided for snap switches mounted in boxes and other enclosures shall be installed so as to completely cover the opening and, where the switch is flush mounted, seat against the finished surface.

**(B) Grounding.** Snap switches, including dimmer and similar control switches, shall be connected to an equipment grounding conductor and shall provide a means to connect metal faceplates to the equipment grounding conductor, whether or not a metal faceplate is installed.

**Metal faceplates shall be grounded.** Snap switches shall be considered to be part of an effective ground-fault current path if either of the following conditions is met:

- (1) The switch is mounted with metal screws to a metal box or metal cover that is connected to an equipment grounding conductor or to a nonmetallic box with integral means for connecting to an equipment grounding conductor.
- (2) An equipment grounding conductor or equipment bonding jumper is connected to an equipment grounding termination of the snap switch.

**Exception No. 1 to (B):** *Where no means exists within the snap-switch enclosure for connecting to the equipment grounding conductor, or where the wiring method does not include or provide an equipment grounding conductor, a snap switch without a connection to an equipment grounding conductor shall be permitted for replacement purposes only. A snap switch wired under the provisions of this exception and located within 2.5 m (8 ft) vertically, or 1.5 m (5 ft) horizontally, of ground or exposed grounded metal objects shall be provided with a faceplate of nonconducting noncombustible material with nonmetallic attachment screws, unless the switch mounting strap or yoke is nonmetallic or the circuit is protected by a ground-fault circuit interrupter.*

**Exception No. 2 to (B):** *Listed kits or listed assemblies shall not be required to be connected to an equipment grounding conductor if all of the following conditions are met:*



*(1) The device is provided with a nonmetallic faceplate that cannot be installed on any other type of device,*

*(2) The device does not have mounting means to accept other configurations of faceplates,*

*(3) The device is equipped with a nonmetallic yoke, and*

*(4) All parts of the device that are accessible after installation of the faceplate are manufactured of nonmetallic materials.*

**Exception No. 3 to (B):** *A snap switch with integral nonmetallic enclosure complying with 300.15(E) shall be permitted without a connection to an equipment grounding conductor.*

**(C) Construction.** Metal faceplates shall be of ferrous metal not less than 0.76 mm (0.030 in.) in thickness or of nonferrous metal not less than 1.02 mm (0.040 in.) in thickness. Faceplates of insulating material shall be noncombustible and not less than 2.54 mm (0.100 in.) in thickness, but they shall be permitted to be less than 2.54 mm (0.100 in.) in thickness if formed or reinforced to provide adequate mechanical strength.

#### **404.10 Mounting of Snap Switches.**

**(A) Surface Type.** Snap switches used with open wiring on insulators shall be mounted on insulating material that separates the conductors at least 13 mm (1/2 in.) from the surface wired over.

**(B) Box Mounted.** Flush-type snap switches mounted in boxes that are set back of the finished surface as permitted in 314.20 shall be installed so that the extension plaster ears are seated

against the surface. Flush-type snap switches mounted in boxes that are flush with the finished surface or project from it shall be installed so that the mounting yoke or strap of the switch is seated against the box. Screws used for the purpose of attaching a snap switch to a box shall be of the type provided with a listed snap switch, or shall be machine screws having 32 threads per inch or part of listed assemblies or systems, in accordance with the manufacturer's instructions.

**404.11 Circuit Breakers as Switches.** A hand-operable circuit breaker equipped with a lever or handle, or a power-operated circuit breaker capable of being opened by hand in the event of a power failure, shall be permitted to serve as a switch if it has the required number of poles.

***Informational Note:*** See the provisions contained in 240.81 and 240.83.

**404.12 Grounding of Enclosures.** Metal enclosures for switches or circuit breakers shall be connected to an equipment grounding conductor as specified in Part IV of Article 250. Metal enclosures for switches or circuit breakers used as service equipment shall comply with the provisions of Part V of Article 250. Where nonmetallic enclosures are used with metal raceways or metal-armored cables, provision shall be made for connecting the equipment grounding conductor(s). Except as covered in 404.9(B), Exception No. 1, nonmetallic boxes for switches shall be installed with a wiring method that provides or includes an equipment grounding conductor.

#### **404.13 Knife Switches.**

**(A) Isolating Switches.** Knife switches rated at over 1200 amperes at 250 volts or less, and at over 1000 amperes at 251 to 1000 volts, shall be used only as isolating switches and shall not be opened under load.

**(B) To Interrupt Currents.** To interrupt currents over 1200 amperes at 250 volts, nominal, or less, or over 600 amperes at 251 to 1000 volts, nominal, a circuit breaker or a switch listed for such purpose shall be used.

**(C) General-Use Switches.** Knife switches of ratings less than specified in 404.13(A) and (B) shall be considered general-use switches.

**Informational Note:** See the definition of General-Use Switch in Article 100.

**(D) Motor-Circuit Switches.** Motor-circuit switches shall be permitted to be of the knife-switch type.

**Informational Note:** See the definition of a Motor-Circuit Switch in Article 100.

**404.14 Rating and Use of Switches.** Switches shall be used within their ratings and as indicated in 404.14(A) through (F).

**Informational Note No. 1:** For switches on signs and outline lighting, see 600.6.

**Informational Note No. 2:** For switches controlling motors, see 430.83, 430.109, and 430.110.

**(A) Alternating-Current General-Use Snap Switch.** A form of general-use snap switch suitable only for use on ac circuits for controlling the following:

- (1) Resistive and inductive loads not exceeding the ampere rating of the switch at the voltage applied
- (2) Tungsten-filament lamp loads not exceeding the ampere rating of the switch at 120 volts
- (3) Motor loads not exceeding 80 percent of the ampere rating of the switch at its rated voltage

**(B) Alternating-Current or Direct-Current General-Use Snap Switch.** A form of general-use snap switch suitable for use on either ac or dc circuits for controlling the following:

- (1) Resistive loads not exceeding the ampere rating of the switch at the voltage applied.
- (2) Inductive loads not exceeding 50 percent of the ampere rating of the switch at the applied voltage. Switches rated in horsepower are suitable for controlling motor loads within their rating at the voltage applied.
- (3) Tungsten-filament lamp loads not exceeding the ampere rating of the switch at the applied voltage if T-rated.

**(C) CO/ALR Snap Switches.** Snap switches rated 20 amperes or less directly connected to aluminum conductors shall be listed and marked CO/ALR.

**(D) Alternating-Current Specific-Use Snap Switches Rated for 347 Volts.** Snap switches rated 347 volts ac shall be listed and shall be used only for controlling the loads permitted by (D)(1) and (D)(2).

**(1) Noninductive Loads.** Noninductive loads other than tungsten-filament lamps not exceeding the ampere and voltage ratings of the switch.

**(2) Inductive Loads.** Inductive loads not exceeding the ampere and voltage ratings of the switch. Where particular load characteristics or limitations are specified as a condition of the listing, those restrictions shall be observed regardless of the ampere rating of the load. The ampere rating of the switch shall not be less than 15 amperes at a voltage rating of 347 volts ac. Flush-type snap switches rated 347 volts ac shall not be readily interchangeable in box mounting with switches identified in 404.14(A) and (B).

**(E) Dimmer Switches.** General-use dimmer switches shall be used only to control permanently installed incandescent luminaires unless listed for the control of other loads and installed accordingly.

**(F) Cord- and Plug-Connected Loads.** Where a snap switch or control device is used to control cord- and plug-connected equipment on a general-purpose branch circuit, each snap switch or control device controlling receptacle outlets or cord connectors that are supplied by permanently connected cord pendants shall be rated at not less than the rating of the maximum permitted ampere rating or setting of the overcurrent device protecting the receptacles or cord connectors, as provided in 210.21(B).

**Informational Note:** See 210.50(A) and 400.10(A)(1) for equivalency to a receptacle outlet of a cord connector that is supplied by a permanently connected cord pendant.

**Exception:** Where a snap switch or control device is used to control not more than one receptacle on a branch circuit, the switch or control device shall be permitted to be rated at not less than the rating of the receptacle.

## **Part II. Construction Specifications**

### **404.20 Marking.**

**(A) Ratings.** Switches shall be marked with the current, voltage, and, if horsepower rated, the maximum rating for which they are designed.

**(B) Off Indication.** Where in the off position, a switching device with a marked OFF position shall completely disconnect all ungrounded conductors to the load it controls.

**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.

**404.26 Knife Switches Rated 600 to 1000 Volts.** Auxiliary contacts of a renewable or quick-break type or the equivalent shall be provided on all knife switches rated 600 to 1000 volts and designed for use in breaking current over 200 amperes.

**404.27 Fused Switches.** A fused switch shall not have fuses in parallel except as permitted in 240.8.

**404.28 Wire-Bending Space.** The wire-bending space required by 404.3 shall meet Table 312.6(B) spacings to the enclosure wall opposite the line and load terminals.

## **ARTICLE 406 - Receptacles, Cord Connectors, and Attachment Plugs (Caps)**

**406.1 Scope.** This article covers the rating, type, and installation of receptacles, cord connectors, and attachment plugs (cord caps).

### **406.2 Definitions.**

**Child Care Facility.** A building or structure, or portion thereof, for educational, supervisory, or personal care services for more than four children 7 years old or less.

**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 of 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 plugin transformer units, or wiring devices.

### **406.3 Receptacle Rating and Type.**

**(A) Receptacles.** Receptacles shall be listed and marked with the manufacturer's name or identification and voltage and ampere ratings.

**(B) Rating.** Receptacles and cord connectors shall be rated not less than 15 amperes, 125 volts, or 15 amperes, 250 volts, and shall be of a type not suitable for use as lampholders.

**Informational Note:** See 210.21(B) for receptacle ratings where installed on branch circuits.

**(C) Receptacles for Aluminum Conductors.** Receptacles rated 20 amperes or less and designed for the direct connection of aluminum conductors shall be marked CO/ALR.

**(D) Isolated Ground Receptacles.** Receptacles incorporating an isolated grounding conductor connection intended for the reduction of electrical noise (electromagnetic interference) as permitted in 250.146(D) shall be identified by an orange triangle located on the face of the receptacle.

**(1) Isolated Equipment Grounding Conductor Required.** Receptacles so identified shall be used only with equipment grounding conductors that are isolated in accordance with 250.146(D).

**(2) Installation in Nonmetallic Boxes.** Isolated ground receptacles installed in nonmetallic boxes shall be covered with a nonmetallic faceplate.

**Exception:** *Where an isolated ground receptacle is installed in a nonmetallic box, a metal faceplate shall be permitted if the box contains a feature or accessory that permits the effective grounding of the faceplate.*



**(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 for the purpose of energy management or building automation, shall be permanently 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 receptacle face 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 controlled.

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

**(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.

**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).

**(A) Grounding Type.** Except as provided in 406.4(D), receptacles installed on 15- and 20-ampere branch circuits shall be of the grounding type. Grounding-type receptacles shall be installed only on circuits of the voltage class and current for which they are rated, except as provided in Table 210.21(B)(2) and Table 210.21(B)(3).

**(B) To Be Grounded.** Receptacles and cord connectors that have equipment grounding conductor contacts shall have those contacts connected to an equipment grounding conductor.

**Exception No. 1:** Receptacles mounted on portable and vehicle-mounted generator sets and generators in accordance with 250.34.

**Exception No. 2:** Replacement receptacles as permitted by 406.4(D).

**(C) Methods of Grounding.** The equipment grounding conductor contacts of receptacles and cord connectors shall be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacle or cord connector.

**Informational Note:** For installation requirements for the reduction of electrical noise, see 250.146(D).

The branch-circuit wiring method shall include or provide an equipment grounding conductor to which the equipment grounding conductor contacts of the receptacle or cord connector are connected.

**Informational Note No. 1:** See 250.118 for acceptable grounding means.

**Informational Note No. 2:** For extensions of existing branch circuits, see 250.130.

**(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.



Controlled

**FIGURE 406.3(E) Controlled Receptacle Marking Symbol.**

**(1) Grounding-Type Receptacles.** Where a grounding means exists in the receptacle enclosure or an equipment grounding conductor is installed in accordance with 250.130(C), grounding-type receptacles shall be used and shall be connected to the equipment grounding conductor in accordance with 406.4(C) or 250.130(C).

**(2) Non–Grounding-Type Receptacles.** Where attachment to an equipment grounding conductor does not exist in the receptacle enclosure, the installation shall comply with (D)(2)(a), (D)(2)(b), or (D)(2)(c).

(a) A non–grounding-type receptacle(s) shall be permitted to be replaced with another non–grounding-type receptacle(s).

(b) A non–grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter-type of receptacle(s). These receptacles **or their cover plates** shall be marked “No Equipment Ground.” An equipment grounding conductor shall not be connected from the ground-fault circuit-interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle.

(c) A non-grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit interrupter. Where grounding-type receptacles are supplied through the ground fault circuit interrupter, grounding-type receptacles or their cover plates shall be marked "GFCI Protected" and "No Equipment Ground," visible after installation. An equipment grounding conductor shall not be connected between the grounding type receptacles.

**Informational Note No. 1:** Some equipment or appliance manufacturers require that the branch circuit to the equipment or appliance includes an equipment grounding conductor.

**Informational Note No. 2:** See 250.114 for a list of a cord-and plug- connected equipment or appliances that require an equipment grounding conductor.