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WORKING DRAFT OF NEC CODE-MAKING PANEL 9 MEETING OUTPUT

CONTENT NOT FINAL – SUBJECT TO REVISION PRIOR TO LETTER BALLOT AND PUBLICATION OF FIRST DRAFT REPORT

Document: National Electrical Code®

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Panel Activity: Input Stage

This is a working draft, prepared by NFPA staff, to record the output generated at the Code-Making Panel 9 First Draft Meeting. It includes draft copies of the First Revisions and any Global Revisions.

It is being made available to Panel members for the purpose of facilitating early review, particularly for those Panel members who may be seeking input from their respective organizations in preparation for the First Draft Ballot.

First Revision No. 7835-NFPA 70-2024 [Global Input]

[See attached word document "70_NEC_CMP9_A2025NEC_FD_Article404_FR_7835" for revisions to Article 404 and relocations to Article 406]

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_Article404_FR_7835.docx	For staff use only	
70_NEC_CMP9_A2025NEC_FD_Article404_FR_7835.docx	For prod use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 11:28:40 EST 2024

Committee Statement

Committee Statement: The scope of Article 404 should be revised, and content related to general-use snap switch, pendant switch, surface switch, dimmer, and electronic control switches and lighting control switches should be relocated to Article 406.

Deleted the information that remained in 404.14 after the content was moved to 404.2.

Response Message: FR-7835-NFPA 70-2024

Public Input No. 535-NFPA 70-2023 [Section No. 404.1]

Public Input No. 4191-NFPA 70-2023 [Section No. 404.1]

Public Input No. 2433-NFPA 70-2023 [Section No. 404.1]

Public Input No. 3703-NFPA 70-2023 [Section No. 404.2]

Public Input No. 1543-NFPA 70-2023 [Article 404]

Public Input No. 3704-NFPA 70-2023 [Section No. 404.3]

Public Input No. 3701-NFPA 70-2023 [New Section after 404.2]

Public Input No. 3762-NFPA 70-2023 [Section No. 404.2]

Article 404 Switches

Part I. General

404.1 Scope. [Move text to (A) and (B)]

(A) Covered.
This article covers the installation of general-use switches, motor-circuit switches, isolating switches, circuit breakers used as switches and molded case switches, operating at voltages not over 1000 volts ac, 1500 volts dc, nominal.

(B) Not Covered.
This article does not cover the installation of the following:

(1) Wireless control equipment to which circuit conductors are not connected.
(2) Wiring Devices.

Informational Note: See 406.1 for wiring devices.

404.2 Switch Connections. [Move to Article 406.30]

(A) Three-Way and Four-Way Switches.
Three-way and four-way 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, and habitable rooms or occupiable spaces 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 snap switches with integral enclosures comply with 300.15(E)

(3) Where lighting in the area is controlled by automatic means

(4) 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 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 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 grounded conductor is to complete a circuit path for electronic lighting control devices.

404.2 Listing Requirements.
Switches shall be listed.

Informational Note No. 1: See 600.6 for switches for signs and outline lighting.

Informational Note No. 2: See 430.83, 430.109, and 430.110 for switches controlling motors.

404.5 Enclosure. [Renumber as 404.5]

(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.

404.6 Damp or Wet Locations. [Renumber as 404.6]

(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 tub or shower spaces unless installed as part of a listed tub or shower assembly.

404.7 Adjustable Switches or Circuit Breakers. [Renumber as 404.7]
Adjustable switches or circuit breakers 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.

404.8 Position and Connection of Switches. .[Renumber as 404.8]

(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. Single-throw 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. 9 Indicating. **[Renumber as 404.9]**
General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in an enclosure as described in 404.5, shall indicate, in a location that is visible when accessing the external operating means, 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.

404.10 Accessibility and Grouping. **[Renumber as 404.10]**
All switches and circuit breakers used as switches shall be located so that they can 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, except as follows:

(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.

(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.

(3) Hookstick operable isolating switches shall be permitted at greater heights.

[Move text to 404.10]
(B) Voltage Between Adjacent Devices. **[Move to 406.38(B)]**
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. **[Move to 406.38(C)]**
A multipole, general-use snap switch shall not 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 General-Use Snap Switches, Dimmers, and Control Switches. **[Move 406.40]**

(A) Faceplates.
Faceplates provided for snap switches, dimmers, and control 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, dimmers, and 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 bonded to the equipment grounding conductor. Snap switches, dimmers, control switches, and metal faceplates shall be connected to an equipment grounding conductor using either of the following methods:

(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: Where no means exists within the enclosure for bonding 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: Listed kits or listed assemblies shall not be required to be bonded to an equipment grounding conductor if all of the following conditions are met:

(1) The device is provided with a nonmetallic faceplate, and the device is designed such that no metallic faceplate replaces the one provided.

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

(3) The device is equipped with a nonmetallic yoke.

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

Exception No. 3: A snap switch with integral nonmetallic enclosure complying with 300.15(E) shall be permitted without a bonding 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 General-Use Snap Switches, Dimmers, and Control Switches.[Move to 406.42]

(A) Surface Type.
General-use snap switches, dimmers, and control 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 general-use snap switches, dimmers, and control 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 devices 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 device is seated against the box. Screws used for the purpose of attaching a device to a box shall be of the type provided with a listed device, 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 240.81 and 240.83 for requirements for circuit breakers relative to indication of state and required markings.

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, they shall comply with 314.3, Exception No. 1 or No. 2.

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 Article 100 for the definition of *general-use switch*.

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

Informational Note: See Article 100for the definition of *motor-circuit switch*.

404.14 Rating and Use of Switches.
Switches shall be listed and marked with their ratings.

Informational Note No. 1: See 600.6 for switches for signs and outline lighting.

Informational Note No. 2: See 430.83, 430.109, and 430.110 for switches controlling motors.

(A) Alternating-Current General-Use Snap Switch. **[Move to 406.46(A)]**
This form of switch shall only be used on ac circuits and used 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) Electric discharge lamp loads not exceeding the marked ampere and voltage rating of the switch

(4) Motor loads not exceeding 80 percent of the ampere rating of the switch at its rated voltage

(5) Electronic ballasts, self-ballasted lamps, compact fluorescent lamps, and LED lamp loads with their associated drivers, not exceeding 20 amperes and not exceeding the ampere rating of the switch at the voltage applied

(B) Alternating-Current or Direct-Current General-Use Snap Switch. **[Move to 406.46(B)]**
This form of switch shall be permitted on either ac or dc circuits and used only 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.

(4) Electronic ballasts, self-ballasted lamps, compact fluorescent lamps, and LED lamp loads with their associated drivers, not exceeding the ampere rating of the switch at the voltage applied.

(D) Snap Switch Terminations. **[Move to 406.46(C)]**
Snap switch terminations shall be in accordance with the following:

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

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

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

(E) Alternating-Current General-Use Snap Switches Rated for 347 Volts. **[Move to 406.46(D)]**

This form of switch shall not be rated less than 15 amperes at a voltage of 347 volts ac, and they shall not be readily interchangeable in box mounting with switches covered in 404.14(A) and (B). These switches shall be used only for controlling any of the following:

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

(2) 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.

(3) Electronic ballasts, self-ballasted lamps, compact fluorescent lamps, and LED lamp loads with their associated drivers, not exceeding 20 amperes and not exceeding the ampere rating of the switch at the voltage applied.

(F) Dimmer and Electronic Control Switches. **[Move to 406.46(E)]**General-use dimmer switches and electronic control switches, such as timing switches and occupancy sensors, shall be used only to control permanently connected loads, such as incandescent luminaires, unless listed for the control of other loads and installed accordingly. They shall be marked by their

manufacturer with their current and voltage ratings and used for loads that do not exceed their ampere rating at the voltage applied.

(G) Cord- and-Plug-Connected Loads. **[Move to 406.46(F)]**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.

404.3 Reconditioned Equipment. **[Move to 404.3]**

(A) Lighting, Dimmer, and Electronic Control Switches.
Reconditioned lighting, dimmer, and electronic control switches shall not be permitted.

(B) Snap Switches.
Reconditioned snap switches of any type shall not be permitted.

(C) Knife Switches, Switches with Butt Contacts, and Bolted Pressure Contact Switches.
Reconditioned knife switches, switches with butt contacts, and bolted pressure contact switches shall be permitted. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

(D) Molded-Case Switches.
Reconditioned molded-case switches shall not be permitted.

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.

404.50 Electronic Control Switches. **[Move to 406.50]**Electronic control switches shall be listed. Electronic control switches shall not introduce current on the equipment grounding conductor during normal operation.

Exception: Electronic control switches that introduce current on the equipment grounding conductor shall be permitted for applications covered by 404.2(C), Exception. Electronic 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 404.5 shall meet Table 312.6(B)(2) spacings to the enclosure wall opposite the line and load terminals.

404.30 Switch Enclosures with Doors.

Switch mechanisms mounted within enclosures with doors that, when opened, expose uninsulated live parts shall be constructed so that when the switch is in the closed position access to the switch interior is restricted. Access to the interior with the switch in the closed position shall require the use of a tool or an approved design that provides equivalent protection from access by unqualified persons.

First Revision No. 7932-NFPA 70-2024 [Global Input]

[Use attached word document "70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_FR_7932" to create structure for revised Article 235 and New Proposed Articles 236, 237, and 238]

[Use attached word document "70_NEC_CMP9_A2025NEC_FD_MovingArticle395intoNewArticle237_FR_7932" to show Article 395.30 relocations into Article 237 without showing as new material]

[Attached word document "70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_CommitteeStatements_FR_7932" provides all Committee Statements]

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_FR_7932.docx		
70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_CommitteeStatements_FR_7932.docx	Committee Statements for Proposed Revisions	
70_NEC_CMP9_A2025NEC_FD_MovingArticle395intoNewArticle237_FR_7932.docx		
70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_Global_FR_7932.docx	For editorial use	

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Thu Jan 18 10:20:37 EST 2024

Committee Statement

Committee Statement: Attached word document "70_NEC_CMP9_A2025NEC_FD_Article235_236_237_238_CommitteeStatements_FR_7932" provides all committee statements for this proposed revision.

Response Message: FR-7932-NFPA 70-2024

Public Input No. 2647-NFPA 70-2023 [Section No. 235.410]
Public Input No. 273-NFPA 70-2023 [Section No. 235.63]
Public Input No. 199-NFPA 70-2023 [Section No. 395.30(B)]
Public Input No. 1611-NFPA 70-2023 [New Article after 225]
Public Input No. 3748-NFPA 70-2023 [Section No. 235.202(C)]
Public Input No. 2026-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]
Public Input No. 514-NFPA 70-2023 [Section No. 235.3]
Public Input No. 1613-NFPA 70-2023 [Article 235]
Public Input No. 2644-NFPA 70-2023 [Section No. 235.339]
Public Input No. 2418-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]
Public Input No. 3736-NFPA 70-2023 [Section No. 235.5(C)(1)]

Public Input No. 981-NFPA 70-2023 [Section No. 235.3]
Public Input No. 3797-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]
Public Input No. 2643-NFPA 70-2023 [Section No. 235.301]
Public Input No. 4227-NFPA 70-2023 [Section No. 235.63]
Public Input No. 2646-NFPA 70-2023 [Section No. 235.409]
Public Input No. 1604-NFPA 70-2023 [New Article after 210]
Public Input No. 3731-NFPA 70-2023 [Section No. 235.205]
Public Input No. 3224-NFPA 70-2023 [New Article after 235]
Public Input No. 4334-NFPA 70-2023 [Article 225]
Public Input No. 435-NFPA 70-2023 [Section No. 235.23 [Excluding any Sub-Sections]]
Public Input No. 3223-NFPA 70-2023 [New Article after 235]
Public Input No. 2591-NFPA 70-2023 [Section No. 235.19(B)]
Public Input No. 2590-NFPA 70-2023 [Section No. 235.9]
Public Input No. 3974-NFPA 70-2023 [Section No. 235.212(C)(1)]
Public Input No. 3215-NFPA 70-2023 [Article 235]
Public Input No. 3225-NFPA 70-2023 [New Article after 235]
Public Input No. 2645-NFPA 70-2023 [Section No. 235.401]
Public Input No. 1194-NFPA 70-2023 [Sections 235.23(A), 235.23(B), 235.23(C), 235.23(D)]

ARTICLE 395 Moves into Article 237

~~Article 395~~ ~~Outdoor Overhead Conductors over 1000 Volts~~

~~395.1~~ ~~Scope.~~

~~This article covers the use and installation for outdoor overhead conductors over 1000 volts, nominal.~~

~~395.10~~ ~~Uses Permitted.~~

~~Outdoor overhead conductors over 1000 volts, nominal, shall be permitted only for systems rated over 1000 volts, nominal, as follows:~~

1. ~~Outdoors in free air~~
2. ~~For service conductors, feeders, or branch circuits~~

~~Informational Note: See IEEE C2, *National Electrical Safety Code*, and ANSI/IEEE 3001.2, *Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems*, for additional information on outdoor overhead conductors over 1000 volts.~~

~~395.30~~ ~~Support~~.

(A) Conductors. STAFF NOTE → 395.30(A) MOVED to 237.21(A) [do not show as new material]

Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems for the spacing between conductors shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

1. Applied voltage
2. Conductor size
3. Distance between support structures
4. Type of structure
5. Wind/ice loading
6. Surge protection

(B) Structures. STAFF: 395.30(B) moved to 237.21(B) with only 1st sentence struck out.

~~Structures of wood, metal, or concrete, or combinations of those materials, shall be provided for support of overhead conductors over 1000 volts, nominal.~~ Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

1. Soil conditions
2. Foundations and structure settings
3. Weight of all supported conductors and equipment
4. Weather loading and other conditions such as, but not limited to, ice, wind, temperature, and lightning
5. Angle where change of direction occurs
6. Spans between adjacent structures
7. Effect of dead-end structures
8. Strength of guy wires and guy anchors
9. Structure size and material(s)
10. Hardware

(C) Insulators. STAFF: 395.30(C) moved 237.21(C) [Do not show as new material except for the I.N]]

Insulators used to support conductors shall be rated for all of the following:

ARTICLE 395 Moves into Article 237

1. Applied phase-to-phase voltage
2. Mechanical strength required for each individual installation
3. Impulse withstand BIL in accordance with Table 495.24

~~Informational Note: See 395.30(A), (B), and (C), which are not all-inclusive lists.~~ STAFF: Leave THIS Informational Note STRUCK OUT

END

First Revision No. 8012-NFPA 70-2024 [Global Input]

[See attached word document "70_NEC_CMP9_A2025NEC_FD_Article305Global_FR_8012" for proposed revisions to Article 305]

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_Article305Global_FR_8012.docx		
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Submitter Information Verification

Committee: NEC-P09
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Committee Statement

Committee Statement: Article 305

Task Group 2 is recommending Article 305 be a “Standalone “article. This will allow the NEC user to not have to rely on the low voltage requirements in other articles.

305.3

Section 4.1.4 of the NEC Style manual prohibits reference to entire articles except Article 100 or where required for context. This change converts the approved wiring methods into a list form. With this list the user can still easily identify the article required.

[old] 305.4 [new] 305.13(B)

Conductors of differing voltages terminated within a motor control enclosure is acceptable in accordance with 305.13(B) items (2) and (3). Conductors that run to a motor control enclosure in the same raceway or cable shall have an insulation rating equal to the maximum circuit voltage applied to any conductor within that raceway, cable or junction box.

305.15(A)

The existing burial depth table 305.15(A) was inadequate for the voltage ranges in Article 305. The addition of mandatory concrete protection for shallower installations is a notable safety improvement to this updated table. Removed “In industrial establishments” from Note 4 because the important factor is the conditions of maintenance and supervision. Clarified how trespassing is prohibited.

Response Message: FR-8012-NFPA 70-2024

Public Input No. 2417-NFPA 70-2023 [Section No. 305.15(A) [Excluding any Sub-Sections]]

Public Input No. 3968-NFPA 70-2023 [Article 305]

Public Input No. 986-NFPA 70-2023 [Section No. 305.3]

Public Input No. 1619-NFPA 70-2023 [Section No. 305.15(A)]

Public Input No. 2416-NFPA 70-2023 [Section No. 305.15(A)]

Public Input No. 516-NFPA 70-2023 [Section No. 305.4]

Article 305 General Requirements for Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

305.1 Scope.

(A) Wiring Installations Covered.

This article covers wiring methods and materials for systems rated over 1000 volts ac, 1500 volts dc, nominal.

(B) Integral Parts of Equipment.

The requirements of this article are not intended to apply to the conductors that form an integral part of equipment, such as motors, controllers, motor control centers, or factory-assembled control equipment or listed utilization equipment.

(C) Metric Designators and Trade Sizes.

Metric designators and trade sizes for conduit, tubing, and associated fittings and accessories shall be in accordance with Table 305.1(C).

Table 305.1(C) Metric Designators and Trade Sizes

Metric Designator	Trade Size
12	3/8
16	1/2
21	3/4
27	1
35	1 1/4
41	1 1/2
53	2
63	2 1/2
78	3
91	3 1/2
103	4
129	5
155	6

Note: The metric designators and trade sizes are for identification purposes only and are not actual dimensions.

305.12 Limitations [Relocate to 305.12]

(A) Voltage.

Wiring methods, as specified in Table 305.12(A), shall be permitted as identified in the table.

Table 305.12(A) Wiring Methods Permitted for Use in Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

Wiring Methods Permitted for Use Above 1000 Volts ac, 1500 Volts dc Voltage Levels	
Pull and junction boxes, conduit bodies, and handhole enclosures	Over 1000
Metal-clad cable (Type MC)	1000–35,000
Type MV cable, MV cable joints, MV cable terminations Type P cable	2001- 35,000 ac 2001-2500 dc 1000–2000
Intermediate metal conduit (IMC)	Over 1000
Nonmetallic underground conduit with conductors (NUCC)	Over 1000
High density polyethylene conduit (HDPE)	Over 1000
Rigid metal conduit (RMC)	Over 1000
Rigid polyvinyl chloride conduit (PVC)	Over 1000
Reinforced thermosetting resin conduit (RTRC)	Over 1000
Electrical metallic tubing (EMT)	Over 1000
Auxiliary gutters	Over 1000
Busway	Over 1000
Cablebus	1000–35,000 ac 2001 – 2500 dc
Cable trays	1000–35,000
Messenger-supported wiring	1000–35,000
Outdoor overhead conductors	Over 1000
Insulated bus pipe (IBP)	1000–35,000 ac

Exposed runs of Type MV cables, bare conductors, and bare busbars shall be permitted in locations accessible only to qualified persons. Busbars shall be permitted to be either copper or aluminum.

Exception: Airfield lighting cable used in series circuits that are powered by regulators and installed in restricted airport lighting vaults shall be permitted as exposed cable installations.

Informational Note: An example of a common application is FAA L-824 cables installed as exposed runs within a restricted vault area.

(B) Temperature.

No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved. In no case shall conductors be associated together in such a way, with respect to type of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of any conductor is exceeded. Temperature limitations of conductors shall be in accordance with 315.60.

305.13 Conductors.

(A) Conductors of the Same Circuit.

All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors and bonding conductors shall be contained within the same raceway, conduit body, auxiliary gutter, cable tray, cablebus assembly, trench, cable, or cord unless otherwise permitted in accordance with 305.3(B)(1) through (B)(3).

(1) Paralleled Installations.

(a.) Conductors shall be permitted to be run in parallel in accordance with 310.10(G)(1), (2), (3), (5), and (6).
(b.) The ampacity correction and adjustment shall be in accordance with 315.60.
(c.) The requirement to run all circuit conductors within the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation, and the equipment grounding conductors shall comply with 250.122.

(d.) Connections, taps, or extensions made from paralleled conductors shall connect to all conductors of the paralleled set, grounded and ungrounded, as applicable. Parallel runs in cable trays shall comply with 392.20(C).

Exception: Conductors installed in nonmetallic raceways run underground shall be permitted to be arranged as isolated phase, neutral, and grounded conductor installations. The raceways shall be installed in close proximity, and the isolated phase, neutral, and grounded conductors shall comply with 305.36(B).

(2) Grounding and Bonding Conductors.

Equipment grounding conductors shall be permitted to be installed outside a raceway or cable assembly in accordance with 250.130(C) for certain existing installations or in accordance with 250.134, Exception No. 2, for dc circuits. Equipment bonding conductors shall be permitted to be installed on the outside of raceways in accordance with 250.102(E).

(3) Nonferrous Wiring Methods.

Conductors in wiring methods with a nonmetallic or other nonmagnetic sheath, where run in different raceways, auxiliary gutters, cable trays, trenches, cables, or cords, shall comply with 305.20(B). Conductors of single-conductor Type MC cable with a nonmagnetic sheath shall comply with 330.31, 330.116, and 305.36(B).**(B) Conductors of Different Systems.**

Conductors of circuits rated over 1000 volts ac, 1500 volts dc, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 1000 volts ac, 1500 volts dc, nominal, or less unless otherwise permitted as follows:

(1) Where contained within the individual wiring enclosure, primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

(2) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor-circuit conductors.

(3) Conductors of different voltage ratings shall be permitted in motors, transformers, switchgear, switchboards, control assemblies, and similar equipment.

(4) If the conductors of each system in a manhole are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.

Conductors having nonshielded insulation and operating at different voltage levels shall not occupy the same junction or pull box, cable, or raceway.

(C) Conductor Bending Radius.

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

305.14 Protection Against Physical Damage.

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

(A) Cables and Raceways Through Wood Members.

(1) Bored Holes.

In both exposed and concealed locations, where a raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1¼ in.) from the edges of the wood member. Where this distance cannot be maintained, the raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s) at least 1.6 mm (1/16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid PVC conduit, RTRC, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(2) Notches in Wood.

Where there is no objection because of weakening the building structure, in both exposed and concealed locations, raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the raceway at those points is protected from penetration by nails or screws by a steel plate at least 1.6 mm (1/16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(B) Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the raceway shall be installed and supported so that the nearest outside surface of the raceway is not less than 32 mm (1 1/4 in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (1/16 in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(C) Raceways or Boxes Installed in or Under Metal-Corrugated Roof Decking.

A raceway or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1 1/2 in.) measured from the lowest surface of the roof decking to the top of the raceway or box. A raceway or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway and roofing installation and might be penetrated by screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception No. 1: Rigid metal conduit and intermediate metal conduit, with listed steel or malleable iron fittings and boxes, shall not be required to comply with 305.4(C).

Exception No. 2: The 38 mm (1 1/2in.) spacing is not required where metal-corrugated sheet roof decking is covered with a minimum thickness 50 mm (2 in.) concrete slab, measured from the top of the corrugated roofing.

(D) Raceways Installed in Shallow Grooves.

Raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, or similar finish, shall be protected by 1.6 mm (1/16 in.) thick steel plate, sleeve, or equivalent or by not less than 32-mm (1 1/4-in.) free space for the full length of the groove in which the raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid PVC conduit, RTRC, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(E) Fittings.

Where raceways contain insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, prior to the installation of conductors, the conductors shall be protected in accordance with any of the following:

(1) An identified fitting providing a smoothly rounded insulating surface

(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

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

(F) Structural Joints.

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction, or deflection, used in buildings, bridges, parking garages, or other structures.

(G) Moisture or Mechanical Protection for Metal-Sheathed Cables.

Where cable conductors emerge from a metal sheath and where protection against moisture or physical damage is necessary, the insulation of the conductors shall be protected by a cable sheath terminating device.

305.15 Underground Installations.

(A) General.

Underground conductors shall be identified for the voltage and conditions under which they are installed. Conductors used for direct-burial applications shall be of a type identified for such use. Buried cables, conductors, and raceways shall be installed in accordance with 305.15(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 305.15(A).

Table 305.15(A) Minimum Cover Requirements for Buried Cables, Conductors, and Raceways

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit											
	Column 1 Direct Burial Cables or Conductors[a]						Column 2 Electrical Metallic Tubing, RTRC, PVC, HDPE Conduit, Rigid Metal Conduit and Intermediate Metal Conduit[b]					
	22 kV or less		Over 22 kV to 40 kV		Over 40 kV		22 kV or less		Over 22 kV to 40 kV		Over 40 kV	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
All locations not specified below	750	30	900	36	1000	42	450[c]	18[c]	600[c]	24[c]	750[c]	30[c]
Under a building	750	30	900	36	1000	42	100	4	100	4	100	4
Under minimum of 102 mm (4 in.) thick concrete with no vehicular traffic and the concrete extends not less than 152 mm (6 in.) beyond the underground installation	750	30	900	36	1000	42	100	4	100	4	100	4
Under paved streets,	600	24	600	24	600	24	600	24	600	24	600	24

highways, roads, alleys, driveways, and parking lots												
In or under paved airport runways, including adjacent areas where the likelihood of trespassing is reduced by signs and barriers.	450	18	450	18	450	18	450	18	450	18	450	18

Footnotes:
[a] Underground direct-buried cables that are not encased or protected by concrete shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.
[b] Listed as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.
[C] Raceway systems encased in not less than 50 mm (2 in.) of concrete shall be permitted to be 150 mm (6 in.) below grade.

Notes:
1. Cover shall be defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.
2. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
3. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.
4. Where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements for other than rigid metal conduit and intermediate metal conduit shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

(1) Shielded Cables and Nonshielded Cables in Metal-Sheathed Cable Assemblies.

Underground cables, including nonshielded, Type MC and moisture-impervious metal sheath cables, shall have those sheaths grounded through an effective grounding path meeting the requirements of 250.4(A)(5) or 250.4(B)(4). They shall be direct buried or installed in raceways identified for the use.

(2) Industrial Establishments.

In industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installed cable, nonshielded single-conductor cables with insulation types up to 2000 volts that are listed for direct burial shall be permitted to be directly buried.

(3) Other Nonshielded Cables.

Other nonshielded cables not covered in 305.15(A)(1) or (A)(2) shall be installed in rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit encased in not less than 75 mm (3 in.) of concrete.

(B) Wet Locations.

The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall be either moisture-impervious metal-sheathed or of a type listed for use in wet locations. Any connections or splices in an underground installation shall be identified for wet locations.

(C) Protection from Damage.

Conductors emerging from the ground shall be enclosed in listed raceways. Raceways installed on poles shall be of rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent, extending from the minimum cover depth specified in Table 305.15(A) to a point 2.5 m (8 ft) above finished grade. Conductors entering a building shall be protected by an approved enclosure or raceway from the minimum cover depth to the point of entrance. Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, they shall be installed to prevent damage to the enclosed conductors or to the equipment connected to the raceways. Metallic enclosures shall be grounded.

(D) Splices and Taps.

Direct burial cables shall be permitted to be spliced or tapped without the use of splice boxes if they are installed using materials suitable for the application. The taps and splices shall be watertight and protected from mechanical damage. Where cables are shielded, the shielding shall be continuous across the splice or tap.

Exception: At splices of an engineered cabling system, metallic shields of direct-buried single-conductor cables with maintained spacing between phases shall be permitted to be interrupted and overlapped. Where shields are interrupted and overlapped, each shield section shall be grounded at one point.

(E) Backfill.

Backfill containing large rocks, paving materials, cinders, large or sharply angular substances, or corrosive materials shall not be placed in an excavation where materials can damage or contribute to the corrosion of raceways, cables, or other substructures or where it might prevent adequate compaction of fill. Protection in the form of granular or selected material or suitable sleeves shall be provided to prevent physical damage to the raceway or cable.

(F) Raceway Seal.

Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound to prevent the entrance of moisture.

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

(G) Earth Movement.

Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, direct-buried conductors, raceways, or cables shall be arranged so as to prevent damage to the enclosed conductors or to equipment connected to the raceways.

Informational Note: This section recognizes "S" loops in underground direct burial cables and conductors to raceway transitions, expansion fittings in raceway risers to fixed equipment, and, generally, the provision of flexible connections to equipment subject to settlement or frost heaves.

(H) Directional Boring.

Cables or raceways installed using directional boring equipment shall be approved for the purpose.

305.16 Protection Against Corrosion and Deterioration.

Raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, fittings, supports, and support hardware shall be of materials suitable for the environment in which they are to be installed.

(A) Ferrous Metal Equipment.

Ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, nipples, fittings, supports, and support hardware shall be suitably protected against corrosion inside and outside (except threads at joints) by a coating of approved corrosion-resistant material. Where corrosion protection is necessary and the conduit is threaded anywhere other than at the factory where the product is listed, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

Exception: Stainless steel shall not be required to have protective coatings.

(1) Protected from Corrosion Solely by Enamel.

Where protected from corrosion solely by enamel, ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, nipples, fittings, supports, and support hardware shall not be used outdoors or in wet locations as described in 305.14(D).

(2) Organic Coatings on Boxes or Cabinets.

Where boxes, cabinets, or enclosures (other than surrounding fences and walls) have an approved system of organic coatings and are marked "Raintight," "Rainproof," or "Outdoor Type," they shall be permitted outdoors.

(3) In Concrete or in Direct Contact with the Earth.

Ferrous metal raceways, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, nipples, fittings, supports, and support hardware shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where made of material approved for the condition or where provided with corrosion protection approved for the condition.

(B) Aluminum Metal Equipment.

Aluminum raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, nipples, fittings, supports, and support hardware embedded or encased in concrete or in direct contact with the earth shall be provided with supplementary corrosion protection.

(C) Nonmetallic Equipment.

Nonmetallic raceways, cable trays, cablebus, auxiliary gutters, boxes, cables with a nonmetallic outer jacket and internal metal armor or jacket, cable sheathing, cabinets, enclosures (other than surrounding fences and walls), elbows, couplings, nipples, fittings, supports, and support hardware shall be made of material approved for the condition and shall comply with 305.14(C)(1) and (C)(2) as applicable to the specific installation.

(1) Exposed to Sunlight.

Where exposed to sunlight, the materials shall be listed as sunlight resistant or shall be identified as sunlight resistant.

(2) Chemical Exposure.

Where subject to exposure to chemical solvents, vapors, splashing, or immersion, materials or coatings shall either be inherently resistant to chemicals based on their listing or be identified for the specific chemical reagent.

(D) Indoor Wet Locations.

In portions of dairy processing facilities, laundries, canneries, and other indoor wet locations, and in locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, where installed exposed, including all boxes, cabinets, enclosures (other than surrounding fences and walls), fittings, raceways, and cable used therewith, shall

be mounted so that there is at least a 6 mm (1/4 in.) airspace between it and the wall or supporting surface.

Exception: Nonmetallic raceways, boxes, and fittings shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

Informational Note: In general, areas where acids and alkali chemicals are handled and stored might present such corrosive conditions, particularly when wet or damp. Severe corrosive conditions might also be present in portions of meatpacking plants, tanneries, glue houses, and some stables; in installations immediately adjacent to a seashore and swimming pool areas; in areas where chemical deicers are used; and in storage cellars or rooms for hides, casings, fertilizer, salt, and bulk chemicals.

305.17 Raceways Exposed to Different Temperatures.

(A) Sealing.

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

(B) Expansion, Expansion-Deflection, and Deflection Fittings.

Raceways shall be provided with expansion, expansion-deflection, or deflection fittings where necessary to compensate for thermal expansion, deflection, and contraction.

Informational Note No. 1: Table 352.44(A) and Table 355.44 provide the expansion information for polyvinyl chloride (PVC) and for reinforced thermosetting resin conduit (RTRC), respectively. A nominal number for steel conduit can be determined by multiplying the expansion length in Table 352.44(A) by 0.20. The coefficient of expansion for steel electrical metallic tubing, intermediate metal conduit, and rigid metal conduit is 1.170×10^{-5} (0.0000117 mm per mm of conduit for each °C in temperature change) [0.650×10^{-5} (0.0000065 in. per in. of conduit for each °F in temperature change)].

A nominal number for aluminum conduit and aluminum electrical metallic tubing can be determined by multiplying the expansion length in Table 352.44(A) by 0.40. The coefficient of expansion for aluminum electrical metallic tubing and aluminum rigid metal conduit is 2.34×10^{-5} (0.0000234 mm per mm of conduit for each °C in temperature change) [1.30×10^{-5} (0.000013 in. per in. of conduit for each °F in temperature change)].

Informational Note No. 2: See NEMA FB 2.40-2019, *Installation Guidelines for Expansion and Expansion/Deflection Fittings*, for further information on expansion and expansion deflection fittings.

305.18 Installation of Conductors With Other Systems.

Raceways or cable trays containing electrical conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical.

305.19 Raceways in Wet Locations Above Grade.

Where raceways are installed in wet locations above grade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations above grade shall be either moisture-impervious metal-sheathed or of a type listed for use in wet locations.

305.20 Electrical Continuity of Metal Raceways, Cable Armor, and Enclosures.

Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets to provide effective electrical continuity. Unless specifically permitted elsewhere in this *Code*, raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Exception: Equipment enclosures to be isolated, as permitted by 250.96(B), shall not be required to be metallically joined to the metal raceway.

305.21 Securing and Supporting.

(A) Secured in Place.

Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place.

(B) Wiring Systems Installed Above Suspended Ceilings.

Support wires that do not provide secure support shall not be the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

(1) Fire-Rated Assemblies.

Wiring located within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.

Informational Note: See ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, for one method of testing to determine fire rating.

(2) Non-Fire-Rated Assemblies.

Wiring located within the cavity of a non-fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

(C) Cables Not Used as Means of Support.

Cable wiring methods shall not be used as a means of support for other cables, raceways, or nonelectrical equipment.

305.22 Mechanical Continuity — Raceways and Cables.

Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, conduit bodies, fittings, or other enclosures or outlets.

Exception: Raceways and cables installed into the bottom of open bottom equipment, such as switchgear, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

305.23 Mechanical and Electrical Continuity — Conductors.

Conductors in raceways shall be continuous between outlets, boxes, devices, and so forth. There shall be no splice or tap within a raceway unless permitted by 305.28, 368.56(A), 376.56, 378.56, 384.56, 386.56, 388.56, or 390.56.

305.25 Boxes, Conduit Bodies, or Fittings — Where Required.

Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed.

Where the wiring method is conduit, tubing, Type MC cable, or Type MV cable, a box or conduit body shall be installed at each outlet point, switch point, conductor splice point, conductor junction point, conductor termination point, wiring method transition point, or conductor pull point, unless otherwise permitted in 305.28(A) through (F).

(A) Wiring Methods with Interior Access.

A box or conduit body shall not be required for each splice, junction, switch, pull, termination, or outlet points in wiring methods with removable covers, such as wireways, auxiliary gutters, and surface raceways. The covers shall be accessible after installation.

(B) Equipment.

An integral junction box or wiring compartment as part of approved equipment shall be permitted in lieu of a box.

(C) Fitting.

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

(D) Direct-Buried Conductors and Cables.

As permitted in 305.5(D), a box or conduit body shall not be required for splices and taps in direct-buried conductors and cables.

(E) Enclosures.

A box or conduit body shall not be required where a splice, switch, terminal, or pull point is in an enclosure (other than surrounding fences and walls).

(F) Manholes and Handhole Enclosures.

A box or conduit body shall not be required for conductors in manholes or handhole enclosures, except where connecting to electrical equipment. The installation shall comply with Part V of Article 110 for manholes, and Part III of Article 314 for handhole enclosures.

(G) Covers Required.
Suitable covers shall be installed on all boxes, fittings, and similar enclosures to prevent accidental contact with energized parts or physical damage to parts or insulation.

305.27 Number and Size of Conductors and Cables in Raceway.

The number and size of conductors and cables in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductors or cables without damage to the conductors or cables, or to their insulation.

305.28 Raceway Installations.

(A) Complete Runs.

Raceways other than busways, or exposed raceways having hinged or removable covers, shall be installed complete between outlet, junction, or splicing points prior to the installation of conductors or cables. Where required to facilitate the installation of utilization equipment, the raceway shall be permitted to be initially installed without a terminating connection at the equipment. Prewired raceway assemblies shall be permitted only where specifically permitted in this *Code* for the applicable wiring method.

(B) Welding.

Metal raceways shall not be supported, terminated, or connected by welding to the raceway unless specifically designed to be or otherwise specifically permitted to be in this *Code*.

305.29 Supporting Conductors in Vertical Raceways.

(A) Spacing Intervals — Maximum.

Conductors in vertical raceways shall be supported if the vertical rise exceeds the values in Table 305.34(A). At least one support method shall be provided for each conductor at the top of the vertical raceway or as close to the top as practical. Intermediate supports shall be provided as necessary to limit supported conductor lengths to not greater than those values specified in Table 305.34(A).

Table 305.29(A) Spacings for Conductor Supports

Conductor Size	Support of Conductors in Vertical Raceways	Conductors			
		Aluminum or Copper-Clad Aluminum		Copper	
		m	ft	m	ft
8 AWG	Not greater than	30	100	30	100
6 AWG through 1/0 AWG	Not greater than	60	200	30	100
2/0 AWG through 4/0 AWG	Not greater than	55	180	25	80
Over 4/0 AWG through 350 kcmil	Not greater than	41	135	18	60
Over 350 kcmil through 500 kcmil	Not greater than	36	120	15	50
Over 500 kcmil through 750 kcmil	Not greater than	28	95	12	40
Over 750 kcmil	Not greater than	26	85	11	35

(B) Fire-Resistive Cables and Conductors.

Support methods and spacing intervals for fire-resistive cables and conductors shall comply with any restrictions provided in the listing of the electrical circuit protective system or fire-resistive cable system used and in no case shall exceed the values in Table 305.34(A).

(C) Support Methods.

One of the following methods of support shall be used:

(1) Clamping devices constructed of or employing insulating wedges inserted in the ends of the raceways. Where clamping of insulation does not adequately support the cable, the conductor also shall be clamped.

(2) Inserting boxes at the required intervals in which insulating supports are installed and secured in an approved manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

(3) In junction boxes, deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, with the cables being carried on two or more insulating supports and additionally secured thereto by tie wires, if desired. Where this method is used, cables shall be supported at intervals not greater than 20 percent of the support spacing in Table 305.34(A).

(4) Other approved means.

305.30 Induced Currents in Ferrous Metal Enclosures or Ferrous Metal Raceways.

(A) Unshielded Conductors Grouped Together.

Where conductors carrying alternating current are installed in ferrous metal enclosures or ferrous metal raceways, they shall be arranged so as to avoid heating the surrounding ferrous metal by induction. To accomplish this, all phase conductors and, where used, the grounded conductor and all equipment grounding conductors shall be grouped together.

(B) Individual Conductors.

Where a single unshielded conductor carrying alternating current passes through metal with magnetic properties, the inductive effect shall be minimized by either cutting slots in the metal between the individual holes through which the individual conductors pass or passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.

Informational Note: Because aluminum is not a magnetic metal, there will be no heating due to hysteresis; however, induced currents will be present. They will not be of sufficient magnitude to require grouping of conductors or special treatment in passing conductors through aluminum wall sections.

305.31 Spread of Fire or Products of Combustion.

Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations into or through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

Informational Note: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire-resistance-rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with the requirements of 305.38 can be found in building codes, fire resistance directories, and product listings.

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

The requirements of this section shall apply to the installation and uses of electrical wiring and equipment in ducts used for dust, loose stock, or vapor removal; ducts specifically fabricated for environmental air; and other spaces used for environmental air (plenums).

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

(A) Ducts for Dust, Loose Stock, or Vapor Removal.

No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors. No wiring system of any type shall be installed in any duct, or shaft containing only such ducts, used for vapor removal or for ventilation of commercial-type cooking equipment.

(B) Ducts Specifically Fabricated for Environmental Air.

Equipment, devices, and the wiring methods specified in this section shall be permitted within such ducts only if necessary for the direct action upon, or sensing of, the contained air. Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type luminaires shall be permitted.

Only wiring methods consisting of Type MI cable without an overall nonmetallic covering, Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering, electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, or rigid metal conduit without an overall nonmetallic covering shall be installed in ducts specifically fabricated to transport environmental air. Flexible metal conduit shall be permitted, in lengths not to exceed 1.2 m (4 ft), to connect physically adjustable equipment and devices permitted to be in these fabricated ducts. The connectors used with flexible metal conduit shall effectively close any openings in the connection.

Exception: Wiring methods and cabling systems, listed for use in other spaces used for environmental air (plenums), shall be permitted to be installed in ducts specifically fabricated for environmental air-handling purposes under both of the following conditions:

(1) The wiring methods or cabling systems shall be permitted only if necessary to connect to equipment or devices associated with the direct action upon or sensing of the contained air.

(2) The total length of such wiring methods or cabling systems shall not exceed 1.2 m (4 ft).

(C) Other Spaces Used for Environmental Air (Plenums).

This section shall apply to spaces not specifically fabricated for environmental air-handling purposes but used for air-handling purposes as a plenum. This section shall not apply to habitable rooms or areas of buildings, the prime purpose of which is not air handling.

Informational Note No. 1: The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which this section applies.

Informational Note No. 2: See NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and other mechanical codes for information on how the term *other spaces used for environmental air (plenum)*, as used in this section, correlates with the use of the term *plenum* where the plenum is used for return air purposes, as well as some other air-handling spaces.

Exception: This section shall not apply to the joist or stud spaces of dwelling units where the wiring passes through such spaces perpendicular to the long dimension of such spaces.

(1) Wiring Methods.

The wiring methods for other spaces used for environmental air shall be limited to totally enclosed, nonventilated, insulated busway having no provisions for plug-in connections or Type MC cable without an overall nonmetallic covering.

Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties.

Informational Note: See UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for one method of testing low smoke and heat release properties for nonmetallic cable ties and other nonmetallic cable accessories to determine a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less.

(2) Cable Tray Systems.

The requirements in 305.40(C)(2)(a) or (C)(2)(b) shall apply to the use of metallic cable tray systems in other spaces used for environmental air (plenums), where accessible.

(a) ***Metal Cable Tray Systems.***
Metal cable tray systems shall be permitted to support the wiring methods specified in 305.40(C)(1).

(b) ***Solid Side and Bottom Metal Cable Tray Systems.***
Solid side and bottom metal cable tray systems with solid metal covers shall be permitted to enclose wiring methods and cables not already covered in 305.40(C)(1) in accordance with 392.10(A) and (B).

(3) Equipment.

Electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure listed for use within an air-handling space and having low smoke and heat release properties, and associated wiring material suitable for the ambient temperature shall be permitted to be installed in such other spaces unless prohibited elsewhere in this *Code*.

Informational Note: See UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for one method of testing low smoke and heat release properties to determine that the equipment exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less.

Exception: Integral fan systems shall be permitted where specifically identified for use within an air-handling space.

305.33 Panels Designed to Allow Access.

Raceways, and equipment installed behind panels designed to allow access, including suspended ceiling panels, shall be arranged and secured to allow the removal of panels and access to the equipment.

305.35 Exit Enclosures (Stair Towers).

Where an exit enclosure is required to have a fire resistance rating, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

Informational Note: See NFPA *101*-2021, *Life Safety Code*, 7.1.3.2.1(10)(b), for more information.

305.38 Braid-Covered Insulated Conductors — Exposed Installation.
Exposed runs of braid-covered insulated conductors shall have a flame-retardant braid. If the conductors used do not have this protection, a flame-retardant saturant shall be applied to the braid covering after installation. This treated braid covering shall be stripped back a safe distance at conductor terminals, according to the operating voltage. Where practicable, this distance shall not be less than 25 mm (1 in.) for each kilovolt of the conductor-to-ground voltage of the circuit.

305.40 Insulation Shielding.

Metallic and semiconducting insulation shielding components of shielded cables shall be removed for a distance dependent on the circuit voltage and insulation. Stress reduction means shall be provided at all terminations of factory-applied shielding.
Metallic shielding components such as tapes, wires, or braids, or combinations of them, shall be connected to an equipment grounding conductor, an equipment grounding busbar, or a grounding electrode.

305.42 Danger Signs.
Danger signs shall be conspicuously posted at points of access to conductors in all raceway systems and cable systems. The sign(s) shall meet the requirements in 110.21(B), shall be readily visible, and shall state the following:
DANGER—HIGH VOLTAGE—KEEP OUT

First Revision No. 8537-NFPA 70-2024 [Global Input]

Wherever 1000 volts appears in CMP 9 scope, revise the text to say "1000 volts ac, 1500 volts dc, nominal", along with additional revisions to remain grammatically and technically correct.

See attached word document "70_NEC_CMP9_A2025NEC_FD_VoltageDemarcationGlobal_FR_8537" for locations identified by CMP 9, as well as the associated necessary corrections.

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_VoltageDemarcationGlobal_FR_8537.docx	For staff use only	

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 22 15:52:22 EST 2024

Committee Statement

Committee Statement: Requirements are revised to include the same voltage demarcation used in many places throughout the Code for consistency, and clarification of the voltage demarcation.
Response Message: FR-8537-NFPA 70-2024

Public Input No. 2425-NFPA 70-2023 [Global Input]

Reference	Revision	Substantiation
Article 100 Definition for "Voltage, High"	Voltage, High. (High Voltage) A potential difference ~~of more than~~ over 1000 volts ac, 1500 volts dc, nominal. (CMP-9) Informational Note: Circuits and equipment rated at potential differences of more than 1000 volts ac, 1500 volts dc, and up to 52 kV, are also commonly referred to as medium voltage.	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
Article 245 Title	Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal	Wording has been standardized to reflect the medium voltage demarcation. The use of common phrases improves usability by ensure consistency and ease of electronic searching. Preferred phrasing is to identify requirements as apply to "… not over 1000 Volts ac, 1500 volts dc, nominal…" and "…over 1000 volts ac, 1500 volts dc, nominal…".
Article 314, Part III	**Part III. Pull and Junction Boxes, Conduit Bodies, and Hand-hole Enclosures for Use on Systems Over 1000 Volts ac, 1500 Volts dc, Nominal**	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
314.70(A)	**Pull and Junction Boxes.** Where pull and junction boxes are used on systems over 1000 volts ac, 1500 volts dc, nominal, the installation shall comply with Part III and with the following general provisions of this article:…	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
314.70(B)	**Conduit Bodies.** Where conduit bodies are used on systems over 1000 volts ac, 1500 volts dc, nominal, the installation shall comply with Part III and with the following general provisions of this article:…	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
314.70(C)	**Handhole Enclosures.** Where handhole enclosures are used on systems over 1000 volts ac, 1500 volts dc nominal, the installation shall comply with Part III and with the following general provisions of this article:…	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
Article 368, Part IV	**Part IV. Requirements for Over 1000 Volts ac, 1500 Volts dc, Nominal**	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
368.240	**Wiring 1000 Volts ac, 1500 Volts dc, or Less, Nominal**	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
Article 395 Title	Outdoor Overhead Conductors Over 1000 Volts ac, 1500 Volts dc, Nominal	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
395.1	**Scope.** This article covers the use and installation for outdoor overhead conductors over 1000 volts ac, 1500 volts dc, nominal.	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
395.10	**Uses Permitted.** …Outdoor overhead conductors over 1000 volts ac, 1500 volts dc, nominal, shall be permitted only for system rated over 1000 volts ac, 1500 volts dc, nominal, as follows:	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
395.30(B)	Structures of wood, metal, or concrete, or combinations of those materials, shall be provided for support of overhead conductors ~~over 1000 volts, nominal~~. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall	With the identification in the title and scope of the Article that the requirements apply to certain voltage ranges, the inclusion of this detail in this section is unnecessary.

	be available upon request of the authority having jurisdiction and shall include consideration of the following:	
495.33	**Guarding of Energized Parts Operating at not over 1000 Volts ac, 1500 Volts dc, Nominal, ~~or less~~ Within Compartments.**	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
495.35(A)	**(A) High-Voltage Equipment.** … accordance with 110.21(B) shall be installed on panels or doors that provide access to live parts over 1000 volts ac, 1500 volts dc, nominal, and shall read DANGER — HIGH VOLTAGE — KEEP OUT.	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
495.35(B)	**Control Equipment.** Where operating at not over 1000 volts ac, 1500 volts dc, nominal, ~~or less,~~ control equipment, relays, motors, and the like shall…	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.
495.70	**General.** The provisions of Part V shall apply to boilers operating over 1000 volts ac, 1500 volts dc, nominal, in which heat is generated by the passage of current between electrodes through the liquid being heated.	Requirements are revised to include the same voltage demarcation used in many places throughout the Code.

First Revision No. 7792-NFPA 70-2024 [Detail]

[Add product safety standards to Annex A.1(a) and A.1(b) per attached word document "70_NEC_CMP9_A2025NEC_FD_AnnexA.1(a)_A.1(b)_FR_7792"]

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_AnnexA.1_a_A.1_b_FR_7792.docx	For staff use only	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 09:41:55 EST 2024

Committee Statement

Committee Statement: The changes to Annex A introduce standards to be referenced that are written for and intended for use in electrical systems where NFPA 70 applies. This allows AHJ's and others to reference product standards that are intended to be used in installations complying with NFPA 70.

Response Message: FR-7792-NFPA 70-2024

Public Input No. 4055-NFPA 70-2023 [Definition:]

Public Input No. 3098-NFPA 70-2023 [Annex A]

Public Input No. 4046-NFPA 70-2023 [Definition:]

Public Input No. 3411-NFPA 70-2023 [Definition:]

Annex A Product Safety Standards

Additions

Article	Standard	Title	Edition	Publication Date
495 A1.b	IEEE C37.20.2	IEEE Standard for Metal-Clad Switchgear		09/21/2022
	IEEE C37.20.3	IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)		06/29/2023
	IEEE C37.20.4	IEEE Standard for Indoor AC Switches (1 kV to 38 kV) for Use in Metal-Enclosed Switchgear		3/6/2013
	IEEE C37.20.9	IEEE Standard for Metal-Enclosed Switchgear Rated 1 kV to 52 kV Incorporating Gas Insulating Systems		03/21/2019
	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V		12/05/2018
	NEMA C37.54	American National Standard for Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear—Conformance Test Procedures		08/03/2023
	NEMA C37.55	American National Standard for Switchgear—Medium Voltage Metal-Clad Assemblies—Conformance Test Procedures		02/24/2020
	NEMA C37.57	American National Standard for Switchgear—Metal-Enclosed Interrupter Switchgear Assemblies—Conformance Testing		04/14/2003
	NEMA C37.58	American National Standard for Switchgear—Indoor AC Medium Voltage Switches for Use in Metal-Enclosed Switchgear—Conformance Test Procedures		2020
	IEEE C37.59	IEEE Standard for Requirements for Conversion of Power Switchgear Equipment		06/14/2018
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories		09/22/2016
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories		09/22/2016

	IEEE C37.60	IEEE International Standard - High-voltage switchgear and controlgear - Part 111: Automatic circuit reclosers for alternating current systems up to and including 38 kV		2019
	IEEE C37.74	IEEE Standard Requirements for Subsurface, Vault, and Padmounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems up to 38 kV		12/10/2014
	IEEE C37.23	IEEE Standard for Metal-Enclosed Bus		12/05/2015
	IEEE C37.20.6	IEEE Standard for 4.76 kV to 38 kV Rated Ground and Test Devices Used in Enclosures		02/16/2015
	UL 2748	Arcing Fault Quenching Equipment	1	09/22/2017
	UL 2877	Power Supplies, Medium Voltage	4	01/13/2022
	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes	2	10/10/2018
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers	7	11/23/2020
	UL 347A	Medium Voltage Power Conversion Equipment	2	01/05/2021
	UL 347C	Outline of Investigation for Medium Voltage Solid State Resistive Load Controllers, Up to 15KV	1	05/22/2014
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts	2	09/05/2017
450 A1.b	IEEE C57.12.00	IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers		11/09/2021
	IEEE C57.12.28	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity		05/16/2014
	IEEE C57.12.29	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity for Coastal Environments		05/15/2014
	UL 1562	Standard for Transformers, Distribution, Dry-Type Over 600 Volts	4	01/25/2013
	IEEE C57.16	IEEE Standard for Requirements, Terminology, and Test Code for Dry-Type Air-Core Series-Connected Reactors		10/31/2011
314 A1.b	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes	2	10/10/2018
230A1.a	Remove UL 347		7	11/23/2020

	Remove UL 1008A		2	09/05/2017
235A1.b	UL 6	Electrical Rigid Metal Conduit — Steel	15	11/28/2022
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel	2	10/31/2008
	UL 360	Liquid-Tight Flexible Metal Conduit	7	01/17/2013
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings	8	10/25/2011
	UL 1242	Electrical Intermediate Metal Conduit — Steel	4	02/16/2006
	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit	6	01/30/2019
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings	2	02/05/2019
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers	7	11/23/2020
	UL 486C	Splicing Wire Connectors	8	06/30/2023
	UL 514B	Conduit, Tubing and Cable Fittings	6	07/13/2012
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts	2	09/05/2017
	UL 2200	Stationary Engine Generator Assemblies	3	09/29/2020
	UL 2876	Remote Racking Devices for Switchgear and Controlgear	1	07/24/2014
245 A1.b	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V		12/05/2018
	NEMA C37.54	NEMA Standard Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear – Conformance Test Procedures		08/10/2023
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories		09/22/2016
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories		09/22/2016
430 A1.b	UL 347 (Move from A1.a)	Medium-Voltage AC Contactors, Controllers, and Control Centers	7	11/23/2020
	UL 347A (Move from A1.a)	Medium Voltage Power Conversion Equipment	2	01/05/2021

First Revision No. 8548-NFPA 70-2024 [Detail]

References to Part III in 314.70(A), 314.70(A)(3), 314.70(B), 314.70(B)(3), and 314.70(C) should be revised to refer to Part IV.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 22 16:13:17 EST 2024

Committee Statement

Committee Statement: The correct reference is located in Part IV, not Part III. 340.70 is located in Part III, so it would already apply.

Response Message: FR-8548-NFPA 70-2024

First Revision No. 8357-NFPA 70-2024 [New Section after 245.1]

245.2 Listing Requirements.

Overcurrent protection for systems rated over 1000 volts ac, 1500 volts dc, and not over 15,000 volts shall be listed. The listing requirements shall be effectove January 1, 2029.

Exception: Overcurrent protection that is integral to a listed assembly is not required to be individually listed.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Sun Jan 21 15:43:48 EST 2024

Committee Statement

Committee Statement: Requiring listing of overcurrent devices assists AHJ's and other interested parties in approving equipment in accordance with 110.2 & 110.3. Limiting the requirement to devices rated no more than 15,000 volts acknowledges that there may be limited options of listed products above 15,000 volts.

Response Message: FR-8357-NFPA 70-2024

Public Input No. 4039-NFPA 70-2023 [Section No. 245.2]

Public Input No. 4044-NFPA 70-2023 [Section No. 245.2]

Public Input No. 3954-NFPA 70-2023 [New Section after 245.27]

Public Input No. 3477-NFPA 70-2023 [New Section after 245.2]

First Revision No. 8364-NFPA 70-2024 [New Section after 245.2]

245.6 Adjustable Relays and Trip Units.

Where settings of relays or trip units can be adjusted, documentation of the settings shall be available to those authorized to design, install, operate, or inspect the installation, and the AHJ upon request.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Sun Jan 21 16:06:41 EST 2024

Committee Statement

Committee Statement: When relays and trip units are adjustable, it is important to have information on the settings available for all concerned.

Response Message: FR-8364-NFPA 70-2024

Public Input No. 1771-NFPA 70-2023 [Section No. 245.21(E)]

Public Input No. 1888-NFPA 70-2023 [Section No. 245.21(E)]

First Revision No. 8365-NFPA 70-2024 [Section No. 245.2]

245.2 ~~3~~ 3 Reconditioned Equipment.

(A) ~~Reconditioned Equipment Permitted~~ Permitted to be Installed .

The following reconditioned equipment shall be permitted to be installed :

(1) Medium- and high-voltage circuit breakers

(2) Electromechanical protective relays and current transformers

(B) ~~Reconditioned Equipment~~ Not Permitted to be Installed .

~~Medium~~ Reconditioned medium - and high- voltage fuseholders and medium- and high- voltage nonrenewable fuses shall not be ~~permitted~~ installed .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Sun Jan 21 16:08:54 EST 2024

Committee Statement

Committee Statement: The section is renumbered from 245.2 to 245.3 to comply with section 2.2.1 of the NEC Style Manual regarding parallel numbering, which coincides with the proposed addition of 245.2 in a separate FR. Also further revised the text into separate first level subdivisions to comply with section 2.2.1 of the NEC Style Manual for reconditioned equipment. Added high voltage to eliminate confusion.

Response Message: FR-8365-NFPA 70-2024

Public Input No. 2601-NFPA 70-2023 [Section No. 245.2]

Public Input No. 1320-NFPA 70-2023 [Section No. 245.2]

Public Input No. 3957-NFPA 70-2023 [Section No. 245.2(B)]

First Revision No. 7825-NFPA 70-2024 [Section No. 245.21(B)(4)]

(4) Identification of Fuse Mountings and Fuse Units.

Fuse mountings and fuse units shall have permanent and legible ~~nameplates~~ markings showing the manufacturer's type or designation, ~~continuous current~~ current rating, ~~interrupting current rating~~ interrupting rating , and ~~maximum~~ voltage rating.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 10:54:33 EST 2024

Committee Statement

Committee Statement: Revisions were made to be consistent with existing Code language.
Response Message: FR-7825-NFPA 70-2024

First Revision No. 7545-NFPA 70-2024 [Section No. 245.21(B)(7)]

(7)– Medium- and High-Voltage Fuses.

Switchgear and substations that use medium- and high-voltage fuses shall be provided with a gang-operated disconnecting switch. Isolation of the fuses from the circuit shall be provided by either connecting a switch between the source and the fuses or providing roll-out switch and fuse-type construction. The switch shall be of the load-interrupter type, unless mechanically or electrically interlocked with a load-interrupting device arranged to reduce the load to the interrupting capability of the switch.

Exception: More than one switch shall be permitted as the disconnecting means for one set of fuses where the switches are installed to provide connection to more than one set of supply conductors. The switches shall be mechanically or electrically interlocked to permit access to the fuses only when all switches are open. A conspicuous sign shall be placed at the fuses identifying the presence of more than one source.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 15 11:38:41 EST 2024

Committee Statement

Committee Statement: Medium voltage is a common term in the industry and is frequently interchanged with high voltage when referring to these types of fuses.
Response Message: FR-7545-NFPA 70-2024

Public Input No. 3961-NFPA 70-2023 [Section No. 245.21(B)(7)]

First Revision No. 7546-NFPA 70-2024 [Section No. 245.21(C)(2)]

(2) Operation.

Where fused cutouts are not suitable to interrupt the circuit manually while carrying ~~full~~ load, ~~an~~ the installation shall comply with all of the following:

(a) An approved means shall be installed to interrupt the ~~entire~~ load. ~~Unless the fused cutouts are interlocked with the switch to prevent opening of the cutouts under load, a~~

Exception: A permanently installed additional means to interrupt the load is not required where documented switching procedures are provided for qualified personnel to remove the load before operating the fused cutouts. The use of load-removal tools shall be permitted.

(b) A conspicuous sign shall be placed at ~~such~~ the fused cutouts identifying that they shall not be operated under load.

(c) Access to any permanently installed operating means of the fused cutouts by unqualified persons shall be prohibited by lock or location.

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-7546_245.21_C_2_.docx		

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 15 11:45:49 EST 2024

Committee Statement

Committee Statement: The text is revised to require the sign in all cases when the fused cutout is not suitable for interruption of load current. Prohibiting access to any permanently installed operation means by unqualified persons was added to prevent operation under load by unqualified persons. Interlocking of the additional switching device with the fused cutouts is removed, as it is unclear how this interlocking can be readily accomplished in all cases. This does not prohibit such interlocking if desirable for a particular installation. An exception was added to permit the additional approved means for interruption to be omitted when the fused cutouts are operable by qualified personnel and where documented switching procedures are provided.

Response Message: FR-7546-NFPA 70-2024

Public Input No. 3971-NFPA 70-2023 [Section No. 245.21(C)(2)]

(2) Operation.

Where fused cutouts are not suitable to interrupt the circuit manually while carrying ~~full~~ load, the installation shall comply with all of the following:~~an approved means shall be installed to interrupt the entire load. Unless the fused cutouts are interlocked with the switch to prevent opening of the cutouts under load, a conspicuous sign shall be placed at such cutouts identifying that they shall not be operated under load.~~

(a) An approved means shall be installed to interrupt the ~~entire~~ load.

Exception: A permanently installed additional means to interrupt the load is not required where documented switching procedures are provided for qualified personnel to remove the load before operating the fused cutouts. The use of load-removal tools shall be permitted.

(b) A conspicuous sign shall be placed at ~~such~~ the fused cutouts identifying that they shall not be operated under load.

(c) Access to any permanently installed operating means of the fused cutouts by unqualified persons shall be prohibited by lock or location.

First Revision No. 7827-NFPA 70-2024 [Section No. 245.21(C)(6)]

(6) Fuse Links.

Fuse links shall ~~have a permanent~~ have permanent and legible ~~identification~~ markings showing ~~continuous~~ current rating and type.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 11:01:05 EST 2024

Committee Statement

Committee Statement: Revisions were made to be consistent with existing Code language and to clarify that not all fuse current ratings are a continuous rating.

Response Message: FR-7827-NFPA 70-2024

First Revision No. 7829-NFPA 70-2024 [Section No. 245.21(D)(6)]

(6) Fuse Links.

Fuse links shall ~~have a permanent~~ have permanent and legible ~~identification~~ markings showing the ~~rated continuous~~ current rating and type .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 11:06:40 EST 2024

Committee Statement

Committee Statement: Revisions were made to be consistent with existing Code language and to clarify that not all fuse current ratings are a continuous rating.

Response Message: FR-7829-NFPA 70-2024

First Revision No. 7550-NFPA 70-2024 [Section No. 245.26(A) [Excluding any Sub-Sections]]

Feeder and branch-circuit conductors shall have overcurrent protection in each ungrounded conductor located at the point where the conductor receives its supply or at an alternative location in the circuit when designed under engineering supervision that includes but is not limited to considering the appropriate fault studies and time–current coordination analysis of the protective devices and the conductor damage curves. The overcurrent protection shall be permitted to be provided by either ~~250~~ 245 .~~184~~ 26 (~~B~~ A)(1) or (A)(2).

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 15 11:59:28 EST 2024

Committee Statement

Committee Statement: The text was changed to correct the reference from 250.184(B) to 245.26(A)(1).
Response Message: FR-7550-NFPA 70-2024

Public Input No. 513-NFPA 70-2023 [Section No. 245.26(A) [Excluding any Sub-Sections]]

First Revision No. 7577-NFPA 70-2024 [New Section after 315.1]

315.3 Reconditioned Equipment.
Reconditioned Type MV cable and conductors shall not be installed.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 15 14:11:57 EST 2024

Committee Statement

Committee Statement: The use of reconditioned Type MV cable and conductors may introduce additional hazards.
Response Message: FR-7577-NFPA 70-2024

Public Input No. 619-NFPA 70-2023 [New Section after 315.1]

First Revision No. 7762-NFPA 70-2024 [Section No. 315.6]

315.6 ~~–~~ **2** Listing Requirements.

Type MV cables, type MV cable joints, type MV cable terminations, connectors, and associated fittings shall be listed. The listing requirement for Type MV cable joints, cable terminations, and connectors shall be effective January 1, ~~2026~~ 2029 .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 17:19:29 EST 2024

Committee Statement

Committee Statement: The future effective date of 2026 is too short to allow the industry to obtain listing of these products. The effective date change to 2029 will allow manufacturers who want to offer a listed product to do so and work down current inventory of non-listed products. This change is also being moved to .2 to comply with the NEC Style Manual .

Response Message: FR-7762-NFPA 70-2024

Public Input No. 3185-NFPA 70-2023 [Section No. 315.6]

Public Input No. 3502-NFPA 70-2023 [Section No. 315.6]

First Revision No. 8602-NFPA 70-2024 [Sections 315.10(C)(1), 315.10(C)(2), 315.10(C)(3)]

Sections 315.10(C)(1), 315.10(C)(2), 315.10(C)(3)

(1) 100 Percent Insulation Level.

~~Cables~~ 100 percent insulated cables shall be permitted to be applied where the system is provided with relay protection such that ground faults will be cleared as rapidly as possible but, in any case, within 1 minute. These cables are applicable to cable installations that are on grounded systems and shall be permitted to be used on other systems provided the above clearing requirements are met in completely de-energizing the faulted section.

(2) 133 Percent Insulation Level.

~~Cables~~ 133 percent insulated cables shall be ~~permitted to be~~ applied in situations where the clearing time requirements of the 100 percent level category cannot be met and the faulted section will be de-energized in a time not exceeding 1 hour. ~~Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation.~~

(3) 173 Percent Insulation Level.

~~Cables~~ 173 percent insulated cables shall be ~~permitted to be~~ applied ~~under all of the following conditions:In industrial establishments~~ where ~~the conditions of maintenance and supervision ensure only qualified persons service the installation~~

- ~~Where the fault clearing time requirements of the 133 percent level category cannot be met~~
- ~~Where an orderly shutdown is required to protect equipment and personnel~~
- ~~Where the faulted section will be de-energized in an orderly shutdown~~

~~Cables shall be permitted to be used in 100 percent or 133 percent insulation level applications where the installation requires additional insulation~~ conditions of 315.10(C)(2) cannot be met .

Informational Note: See UL 1072-2023 , *Medium-Voltage Power Cable*, ANSI/ICEA S-93-639-2022 , *American National Standard for 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy*, and ICEA S-94-649- ~~2013~~ -2021 , *Standard for Concentric Neutral Cables Rated 5 through 46 kV for Medium Voltage Cables*.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 22 20:13:16 EST 2024

Committee Statement

Committee Statement: The requirements for thickness of insulation have been simplified and clarified.
Response Message: FR-8602-NFPA 70-2024

Public Input No. 3386-NFPA 70-2023 [Section No. 315.10(C)(2)]
Public Input No. 3284-NFPA 70-2023 [Section No. 315.10(C)(3)]
Public Input No. 3389-NFPA 70-2023 [Section No. 315.10(C)(3)]

First Revision No. 7622-NFPA 70-2024 [Section No. 315.10(C) [Excluding any Sub-Sections]]

[See attached word document "70_NEC_CMP9_A2025NEC_FD_Table315.10(C)_FR_7622" for Revisions to Table 315.10(C)]

Thickness of insulation for shielded solid dielectric insulated conductors rated 2001 volts to 35,000 volts shall comply with Table 315.10(C) and 315.10(C)(1) through (C)(3). Cables with an equivalent or higher insulation thickness shall be permitted.

Table 315.10(C) Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 35,000 Volts

Conductor Size (AWG or kcmil)	2001–5000 Volts						5001–8000 Volts					
	100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level			
	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
8	2.29	90	2.92	115	3.56	140	—	—	—	—	—	—
6–4	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4	
2	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4	
1	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4	
1/0–2000	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4	

Conductor Size (AWG or kcmil)	25,001–28,000 Volts						28,001–35,000 Volts					
	100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level	
	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
1	7.11	280	8.76	345	11.30	445	—	—	—	—	—	—
1/0–2000	7.11	280	8.76	345	11.30	445	8.76	345	10.67	420	14.73	580

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_Table315.10_C_FR_7622.docx		
NEC_CMP9_FR-7622_Table_315.10_C_.docx	For prod use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 07:17:29 EST 2024

Committee Statement

Committee Statement: The addition of the 133% and 173% insulation thickness column for 2-5KV cable in Table 315.10(C) would provide guidance for those 2-5KV systems designed with resistive grounding or requiring additional clearing time.

Response Message: FR-7622-NFPA 70-2024

Public Input No. 3280-NFPA 70-2023 [Section No. 315.10(C) [Excluding any Sub-Sections]]

Table 315.10(C) Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 35,000 Volts

Conductor Size (AWG or kcmil)	2001–5000 Volts						5001–8000 Volts						8001–15,000 Volts						15,001–25,000 Volts					
	100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level		100 Percent Insulation Level		133 Percent Insulation Level		173 Percent Insulation Level	
	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils	mm	mils
8	2.29	90	2.92	115	3.56	140	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6–4	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4.45	175	—	—	—	—	—	—	—	—	—	—	—	—
2	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	—	—	—	—	—	—
1	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	6.60	260	8.13	320	10.67	420
1/0–2000	2.29	90	2.92	115	3.56	140	2.92	115	3.56	140	4.45	175	4.45	175	5.59	220	6.60	260	6.60	260	8.13	320	10.67	420

First Revision No. 7569-NFPA 70-2024 [Section No. 315.30]

315.30 Installation.

A qualified person(s) with documented training and experience shall perform the installation and testing of Type MV cable. A qualified person(s) with documented training and experience in the installation of Type MV cable joints shall perform the installation of Type MV cable joints. A qualified person(s) with documented training and experience in the installation of Type MV cable terminations shall perform the installation of Type MV cable terminations.

Informational Note No. 1: See ANSI/NECA/NCSCB 600-2020, *Standard for Installing and Maintaining Medium-Voltage Cable*, and IEEE 576-2000 , *Recommended Practice for Installation, Termination, and Testing of Insulated Power Cables as Used in Industrial and Commercial Applications,* for information about accepted industry practices and installation procedures for medium-voltage cable.

Informational Note No. 2: Where medium-voltage cable is used for dc circuits, low frequency polarization can create hazardous voltages. When handling the cable these voltages could be present or could develop on dc stressed cable while the circuit is energized. Solidly grounding the cable prior to contacting, cutting or disconnecting cables in dc circuits is a method to discharge these voltages.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 15 13:37:44 EST 2024

Committee Statement

Committee Statement: This change to Informational Note#1 following 315.30 is being made to conform to 90.5(C) by adding the date to IEEE 576.

Response Message: FR-7569-NFPA 70-2024

Public Input No. 4456-NFPA 70-2023 [Section No. 315.30]

First Revision No. 7566-NFPA 70-2024 [Section No. 315.32(A)]

(A) Type MV Cable.

Type MV cable shall be permitted for use on power systems rated up to and including 35,000 volts, nominal, as follows:

(1) In wet or dry locations.

(2) In raceways.

(3) In cable trays, where identified for the use, in accordance with 392.10, 392.20(B), (C), and (D), 392.22(C), 392.30(B)(1), 392.46, 392.56, and 392.60. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as “MV or MC” shall be permitted to be installed in cable trays in accordance with 392.10(B)(2).

(4) In messenger-supported wiring in accordance with ~~Part II of~~ Article 396 , Part II .

(5) As exposed runs in accordance with 305.3. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as “MV or MC” shall be permitted to be installed as exposed runs of metal-clad cable in accordance with 305.3.

(6) Corrosive conditions where exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.

(7) Conductors in parallel in accordance with 310.10(G).

(8) Type MV cable used where exposed to direct sunlight shall be identified for the use.

(9) Direct buried in accordance with 315.36.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon Jan 15 13:33:37 EST 2024

Committee Statement

Committee Statement: The text is revised to comply with NEC Style Manual section 4.1.4 regarding references to specific parts of articles.
Response Message: FR-7566-NFPA 70-2024

Public Input No. 2660-NFPA 70-2023 [Section No. 315.32(A)]

First Revision No. 7560-NFPA 70-2024 [Section No. 315.60(D)(1)]

(1) Grounded Shields.

Ampacities shown in Table 315.60(C)(3), Table 315.60(C)(4), Table 315.60(C)(15), and Table 315.60(C)(16) shall apply for cables with shields grounded at one point only. Where shields for these cables are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents by multiplying by the shield current correction factor calculated per equation 315 .60(D)(1).

[315.60(D)(1)]

$$Shield\ Current\ Correction\ Factor = \sqrt{\frac{R_{ac}}{R_{ac} + R_s\left(\frac{X_M^2}{X_M^2 + R_S^2}\right)}}$$

R_{ac} = AC resistance of the conductor in mΩ/inch

R_s = Resistance of the conductor shield mΩ/inch

X_m = Mutual reactance between the conductor and cable shield in mΩ/inch

Exception: The shield current correction factor shall be permitted to be calculated by alternative means under engineering supervision.

Informational Note

~~: Tables~~

No.1: See Informative Annex B, section B.8, for background information on equation 315.60(D)(1) and calculation of X_m .

Informational Note No. 2: Tables other than those listed contain the ampacity of cables with shields grounded at multiple points.

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-7560_316.60_D_1_.docx		

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 15 13:20:32 EST 2024

Committee Statement

Committee Statement: This change provides a means of calculating the ampacity adjustment required by this section. The addition of an exception to allow for engineering supervision allows for another option and provides consistency with 315.60(B). Additional explanation of the material added in annex B as a proposed new B.8 is provided in FR 7601.

Response Message: FR-7560-NFPA 70-2024

Public Input No. 3076-NFPA 70-2023 [Section No. 315.60(D)(1)]

(1) Grounded Shields.

Ampacities shown in Table 315.60(C)(3), Table 315.60(C)(4), Table 315.60(C)(15), and Table 315.60(C)(16) shall apply for cables with shields grounded at one point only. Where shields for these cables are grounded at more than one point, ampacities shall be adjusted to take into consideration the heating due to shield currents by multiplying by the shield current correction factor calculated per equation 315.60(D)(1).

$$Shield\ Current\ Correction\ Factor = \sqrt{\frac{R_{ac}}{R_{ac} + R_s\left(\frac{X_M^2}{X_M^2 + R_S^2}\right)}}$$ **[315.60(D)(1)]**

R_{ac} = AC resistance of the conductor in mΩ/inch

R_s = Resistance of the conductor shield mΩ/inch

X_m = Mutual reactance between the conductor and cable shield in mΩ/inch

Exception: The shield current correction factor shall be permitted to be calculated by alternative means under engineering supervision.

Informational Note No.1: See Informative Annex B, section B.8, for background information on equation 315.60(D)(1) and calculation of X_m.

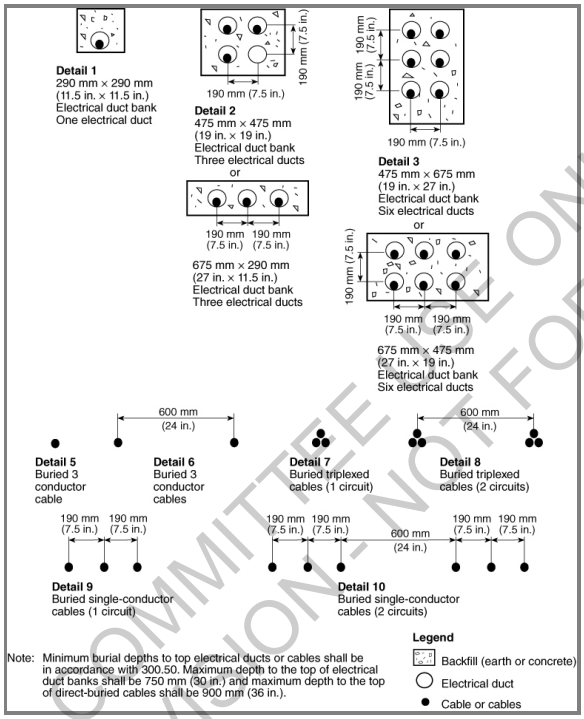
Informational Note No. 2: Tables other than those listed contain the ampacity of cables with shields grounded at multiple points.

First Revision No. 7554-NFPA 70-2024 [Section No. 315.60(D)(3)]

(3) Electrical Ducts Entering Equipment Enclosures.

At locations where electrical ducts enter equipment enclosures from underground, spacing between such ducts, as shown in Figure 315.60(D)(3), shall be permitted to be reduced without requiring the ampacity of conductors therein to be reduced.

Figure 315.60(D)(3) Cable Installation Dimensions for Use with Table 315.60(C)(11) Through Table 315.60(C)(20).



[Revision is to "Note" in Figure 315.60(D)(3):]

Note: Minimum burial depths to top electrical ducts or cables shall be in accordance with **305.15** . Maximum depth to the top of electrical duct banks shall be 750 mm (30 in.) and maximum depth to the top of direct-buried cables shall be 900 mm (36 in.) **, unless the ampacity de-rating factor from 315.60(D)(2) is applied** .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 15 13:01:22 EST 2024

Committee Statement

Committee Statement: The reference at the bottom of Figure 315.60(D)(3) was corrected to 305.15. In addition, a reference was added to the note to clarify that deeper depths are permitted if the derating factor in 315.60(D)(2) has been applied.

Response Message: FR-7554-NFPA 70-2024

Public Input No. 2420-NFPA 70-2023 [Section No. 315.60(D)(3)]

Public Input No. 957-NFPA 70-2023 [Section No. 315.60(D)(3)]

First Revision No. 7561-NFPA 70-2024 [Section No. 315.60(F)]

(F) Ampacity in Underground Electrical Ducts and Direct Buried in Earth.

Ampacities for conductors and cables in underground electrical ducts and direct buried in earth shall be as specified in Table 315.60(C)(11) through Table 315.60(C)(20). Ampacities shall be based on the following:

(1) Ambient earth temperature of 20°C (68°F)

(2) Arrangement in accordance with Figure 315.60(D)(3)

(3) 100 percent load factor

(4) Thermal resistance (Rho) of 90

(5) Conductor temperatures 90°C (194°F) and 105°C (221°F)

(6) Minimum burial depths to the top electrical ducts or cables shall be in accordance with 305.15.

(7) Maximum depth to the top of electrical duct banks shall be 750 mm (30 in.), and maximum depth to the top of direct-buried cables shall be 900 mm (36 in.) unless the ampacity de-rating factor from 315 .60(D)(2) is applied.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 15 13:24:19 EST 2024

Committee Statement

Committee Statement: This reference is needed to provide guidance for installations requiring deeper depths than 30 inches.

Response Message: FR-7561-NFPA 70-2024

Public Input No. 2421-NFPA 70-2023 [Section No. 315.60(F)]

First Revision No. 7862-NFPA 70-2024 [Section No. 404.8(A)]

[See attached word document "70_NEC_CMP9_A2025NEC_FD_404.8 (A) _FR_7862" for proposed revisions]

(A) Location.

All switches and circuit breakers used as switches shall be located so that they can 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, except as follows:

(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.

(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.

(3) Hookstick operable isolating switches shall be permitted at greater heights.

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_404.8_A_FR_7862.docx		
70_NEC_CMP9_A2025NEC_FD_404.8_A_FR_7862.docx	For prod use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 13:59:27 EST 2024

Committee Statement

Committee Statement: Wording was modified to recognize that switches may be installed in a location that does not have a defined floor or working platform. They may be installed in some other location that has some other finished grade, such as a grassy area. Subdivisions were added to improve readability and meet requirements of the NEC Style Manual section 3.5.1.2.

Response Message: FR-7862-NFPA 70-2024

Public Input No. 4104-NFPA 70-2023 [Section No. 404.8(A)]

Public Input No. 2693-NFPA 70-2023 [Section No. 404.8(A)]

Section 404.8(A) changes

(A) Location.
(1) Readily Accessible. All switches and circuit breakers used as switches shall be located so that they can be operated from a readily accessible place.
(2) Maximum Height. 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, finished grade, or working platform, except as follows:

(a) 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.

(b) 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.

(c) Hookstick operable isolating switches shall be permitted at greater heights.

First Revision No. 7852-NFPA 70-2024 [New Section after 404.9]

(D) Faceplates (Cover Plates) Incorporating Night Lights, USB Chargers, or Both.

For snap switches, dimmers, and control switches, faceplates (cover plates) that integrally incorporate night lights, Class 2 connections (USB chargers), or both, shall comply with all of the following:

(1) Faceplate (cover plate) assemblies shall be listed.

(2) During normal operation, night lights, and Class 2 connections (USB chargers) shall not introduce current to the bonding means or the equipment grounding conductor.

(3) Electrical power supply connections to night lights and Class 2 connections (USB chargers) shall not be connected across the line and load terminals of snap switches, dimmers, and control switches having a marked OFF position.

(4) Night lights and Class 2 connections (USB chargers), if relying on spring-tensioned contacts for electrical power, shall not be rated more than 1 watt and shall be connected to only unpainted or unenameled heads of switch terminal screws made of only copper alloy unless the faceplate (cover plate) is additionally listed and identified that the spring-tensioned contacts are suitable for connection to unpainted or unenameled heads of terminal screws made of steel.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 13:32:16 EST 2024

Committee Statement

Committee Statement: Added part (D) to provide requirements for faceplates incorporating night lights, USB chargers, or both, to align with the faceplate requirements in Article 406.6(D).
Response Message: FR-7852-NFPA 70-2024

Public Input No. 3095-NFPA 70-2023 [New Section after 404.9]

First Revision No. 7859-NFPA 70-2024 [Sections 404.9(A), 404.9(B), 404.9(C)]

Sections 404.9(A), 404.9(B), 404.9(C)

(A) ~~Faceplates~~ Faceplate (Cover Plate) Mounting .

Faceplates provided for snap switches, dimmers, and control 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.

Faceplates that are installed on receptacles mounted on the same box as snap switches, dimmers, and control switches shall additionally comply with 406.5 (C), 406.5(D), and 406.6, and as applicable, 406.9.

(B) Grounding.

Snap switches, dimmers, and 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 bonded to the equipment grounding conductor. Snap switches, dimmers, control switches, and metal faceplates shall be connected to an equipment grounding conductor using either of the following methods:

(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: Where no means exists within the enclosure for bonding 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: Listed kits or listed assemblies shall not be required to be bonded to an equipment grounding conductor if all of the following conditions are met:

(1) The device is provided with a nonmetallic faceplate, and the device is designed such that no metallic faceplate replaces the one provided.

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

(3) The device is equipped with a nonmetallic yoke.

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

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

(C)– **Faceplate (Cover Plate)** 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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 13:41:17 EST 2024

Committee Statement

Committee Statement: Modified the subsection titles of (A) and (C) to state the content of the section more clearly. The article title was not modified as item (B) does not apply to faceplates (cover plates). The existing requirements in (A) were not revised as the existing wording ensures the faceplate is installed flush to the finish surface. Added requirement in (A) for faceplates (cover plates) that are installed with other devices to also comply with the faceplate (cover plate) requirements for those devices.

Response Message: FR-7859-NFPA 70-2024

Public Input No. 3195-NFPA 70-2023 [Section No. 404.9]

Public Input No. 3091-NFPA 70-2023 [Section No. 404.9(A)]

First Revision No. 7883-NFPA 70-2024 [Section No. 404.12]

404.12 Grounding of Enclosures.

Metal enclosures for switches or circuit breakers shall be connected to an equipment grounding conductor as specified in Article 250, 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 , Part V . Where nonmetallic enclosures are used with metal raceways or metal-armored cables, they shall comply with 314.3, Exception No. 1 or No. 2.

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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 15:24:46 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4.

Response Message: FR-7883-NFPA 70-2024

Public Input No. 2678-NFPA 70-2023 [Section No. 404.12]

First Revision No. 7881-NFPA 70-2024 [Section No. 404.13(B)]

(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 ac , 1500 volts dc, nominal, a circuit breaker or a switch listed for such purpose shall be used.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 15:23:03 EST 2024

Committee Statement

Committee Statement: The text is revised to include the same ac voltage demarcation and dc voltage demarcations used in many places throughout the Code for consistency.

Response Message: FR-7881-NFPA 70-2024

Public Input No. 2434-NFPA 70-2023 [Section No. 404.13(B)]

First Revision No. 7839-NFPA 70-2024 [Section No. 404.14(C)]

~~**(C)** CO/ALR Snap Switches.~~

~~Snap switches directly connected to aluminum conductors and rated 20 amperes or less shall be marked CO/ALR.~~

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 11:51:37 EST 2024

Committee Statement

Committee Statement: Provides correlation with relocation of Article 404 content to Article 406 which contains the same requirement.

Response Message: FR-7839-NFPA 70-2024

First Revision No. 7872-NFPA 70-2024 [Section No. 404.14(D)]

[See attached word document "70_NEC_CMP9_A2025NEC_FD_404.14 (D) _FR_7872" for clarification of proposed revisions]

(D) Snap Switch Terminations.

Snap switch terminations shall be in accordance with the following:

(1) ~~Terminals of 15-ampere and 20-ampere snap switches not~~ Copper, aluminum, and copper-clad aluminum conductors shall be permitted to terminate at the terminal of snap switches marked CO/ALR ~~shall be used with~~ .

(2) Only copper and copper-clad aluminum conductors ~~only.~~
~~Terminals marked CO/ALR~~

(3) shall be permitted to be
~~used with copper, aluminum, and copper-clad aluminum conductors~~

(4) terminated at the terminals of 15-ampere and 20-ampere snap switches not marked CO/ALR .

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

Informational Note: See UL 20-2018, *General-Use Snap Switches* , for information regarding screwless terminals of various voltage type constructions employed on snap switches. Screwless terminals of the separable-terminal assembly, spring-action clamp, and insulation-displacement type constructions are not classified in UL 20 as screwless terminals of the conductor push-in type construction (also known as push-in terminals).

Supplemental Information

File Name	Description	Approved
70_NEC_CMP9_A2025NEC_FD_404.14_D_FR_7872.docx	For staff use only	

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 14:51:00 EST 2024

Committee Statement

Committee Statement: The order of the list was changed to have the permitted connections first and the non-permitted connections second for better readability.

The sentence structure was changed to improve readability.

The informational note was added to provide reference to UL 20 to provide guidance to the reader where to find additional information on general use snap switches.

Information was not added concerning mixing of conductor types as no technical justification was provided for the basis of a new requirement.

Response Message: FR-7872-NFPA 70-2024

Public Input No. 442-NFPA 70-2023 [Section No. 404.14(D)]

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

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

~~(2)~~(1) ~~Terminals marked CO/ALR shall be permitted to be used with c~~Copper, aluminum, and copper-clad aluminum conductors shall be permitted to terminate at the terminal of snap switches marked CO/ALR.

~~(3)~~(2) Only copper and copper-clad aluminum conductors shall be permitted to be terminated at the terminals of 15-ampere and 20-ampere snap switches not marked CO/ALR.

~~(4)~~(3) Snap switches connected using screwless terminals of the conductor push-in type construction (also known as conductor push-in terminals) shall be installed on not greater than 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only unless listed and marked for other types of conductors. [Item (3) is existing]

Informational Note: See UL 20-2018, *General-Use Snap Switches*, for information regarding screwless terminals of various voltage type constructions employed on snap switches. Screwless terminals of the separable-terminal assembly, spring-action clamp, and insulation-displacement type constructions are not classified in UL 20 as screwless terminals of the conductor push-in type construction (also known as push-in terminals).

First Revision No. 7878-NFPA 70-2024 [Section No. 404.14 [Excluding any Sub-Sections]]

Switches shall ~~be listed and marked~~ be marked with their ratings. Switches of the types covered in 404.14(A) through (F) shall be limited to the control of loads as specified accordingly. Switches used to control cord-and-plug-connected loads shall be limited as covered in 404.14(G).

Informational Note No. 1: See 600.6 for switches for signs and outline lighting.

Informational Note No. 2: See 430.83, 430.109, and 430.110 for switches controlling motors.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 15:19:13 EST 2024

Committee Statement

Committee Statement: The requirement for Listing should be relocated to 404.2 for compliance with the NEC Style Manual Section 2.2.1.

Response Message: FR-7878-NFPA 70-2024

Public Input No. 3698-NFPA 70-2023 [Section No. 404.14 [Excluding any Sub-Sections]]

First Revision No. 7868-NFPA 70-2024 [Section No. 404.16]

~~(C) Knife Switches, Switches with Butt Contacts, and Bolted Pressure Contact Switches.~~

~~404.16~~ 3 Reconditioned Equipment.

~~(A) Lighting, Dimmer, and Electronic Control Switches.~~

~~Reconditioned lighting, dimmer, and electronic control switches shall not be permitted.~~

~~(B) Snap Switches.~~

~~Reconditioned snap switches of any type shall not be permitted.~~

[Relocate to 404.3, renumber subsequent sections]

(A) Permitted to be Installed.

Reconditioned knife switches, switches with butt contacts, and bolted pressure contact switches shall be permitted to be installed . If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

(

~~D) Molded-Case Switches.~~

~~Reconditioned molded-case switches shall not be permitted.~~

~~**B) Not Permitted to be Installed.**~~

~~The following reconditioned equipment shall not be installed:~~

(1) ~~Lighting, dimmer, and electronics control switches~~

(2) ~~Snap switches of any type~~

(3) ~~Molded-case switches~~

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-7868_404.16.docx		

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 14:37:17 EST 2024

Committee Statement

Committee Statement: Renumbered 404.16 – Reconditioned Equipment, to 404.3 and moved to the correct location in the article. Revised reconditioned equipment section formatting to match the NEC Style Manual.

Response Message: FR-7868-NFPA 70-2024

Public Input No. 2606-NFPA 70-2023 [Section No. 404.16]

Public Input No. 3696-NFPA 70-2023 [Section No. 404.16]

Public Input No. 1126-NFPA 70-2023 [Section No. 404.16]

404.16 Reconditioned Equipment. [Move to 404.3]

~~**(A) Lighting, Dimmer, and Electronic Control Switches.**~~
~~Reconditioned lighting, dimmer, and electronic control switches shall not be permitted.~~

~~**(B) Snap Switches.**~~
~~Reconditioned snap switches of any type shall not be permitted.~~

(C) ~~**Knife Switches, Switches with Butt Contacts, and Bolted Pressure Contact Switches**~~**Permitted to be Installed.**
Reconditioned knife switches, switches with butt contacts, and bolted pressure contact switches shall be permitted to be installed. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

~~**(D) Molded-Case Switches.**~~
~~Reconditioned molded-case switches shall not be permitted.~~

(D) Not Permitted to be Installed.

The following reconditioned equipment shall not be installed:

1. Lighting, dimmer, and electronics control switches
2. Snap switches of any type
3. Molded-case switches

First Revision No. 7875-NFPA 70-2024 [Section No. 404.22]

404.22 Electronic Control Switches.

Electronic control switches shall ~~be listed. Electronic control switches shall~~ not introduce current on the equipment grounding conductor during normal operation.

Exception: Electronic control switches that introduce current on the equipment grounding conductor shall be permitted for applications covered by ~~404~~ 406 .~~2~~ 30 (C), Exception. Electronic control switches that introduce current on the equipment grounding conductor shall be listed and marked for use in replacement or retrofit applications only.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 15:07:56 EST 2024

Committee Statement

Committee Statement: The Listing requirement should be relocated to 404.2 for compliance with the NEC Style Manual Section 2.2.1.

Response Message: FR-7875-NFPA 70-2024

Public Input No. 3699-NFPA 70-2023 [Section No. 404.22]

First Revision No. 7684-NFPA 70-2024 [Section No. 450.2]

450.2 ~~–~~ **4** Interconnection of Transformers.

Transformers shall individually comply with the requirements of this article unless specific provisions allow for interconnection and operation as a single unit.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 11:22:51 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual. Changed 450.2 to 450.4 and renumbered the sections through 450.14. Updated all article references to 450 to have the correct updated article number.

Response Message: FR-7684-NFPA 70-2024

Public Input No. 3750-NFPA 70-2023 [Section No. 450.2]

First Revision No. 7895-NFPA 70-2024 [Section No. 450.3]

450.3~~–~~ 5 Overcurrent Protection.

Overcurrent protection of transformers shall comply with 450.3~~–~~ 5 (A), (B), or (C). As used in this section, the word *transformer* shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4, 240.21, 245.26, and 245.27 for overcurrent protection of conductors.

Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device. See IEEE 3002.8-2018 , *Recommended Practice for Conducting Harmonic Studies and Analysis of Industrial and Commercial Power Systems*, for additional information.

(A) Transformers Over 1000 Volts, Nominal.

Overcurrent protection shall be provided in accordance with Table 450.3~~–~~ 5 (A).

(B) Transformers 1000 Volts, Nominal, or Less.

Overcurrent protection shall be provided in accordance with Table 450.3 5 (B) unless the transformer is installed as a motor control circuit transformer in accordance with 430.72(C)(1) through (C)(5).

Table 450.3 5 (A) Maximum Rating or Setting of Overcurrent Protection for Transformers Over 1000 Volts (as a Percentage of Transformer-Rated Current)

Location Limitations	Transformer Rated Impedance	Primary Protection over 1000 Volts		Secondary Protection[2]		
				Over 1000 Volts		1000 Volts or Less
		Circuit Breaker[4]	Fuse Rating	Circuit Breaker[4]	Fuse Rating	Circuit Breaker or Fuse Rating
Any location	Not more than 6%	600%[1]	300%[1]	300%[1]	250%[1]	125%[1]
	More than 6% and not more than 10%	400%[1]	300%[1]	250%[1]	225%[1]	125%[1]
Supervised locations only[3]	Any	300%[1]	250%[1]	Not required	Not required	Not required
	Not more than 6%	600%	300%	300%[5]	250%[5]	250%[5]
	More than 6% and not more than 10%	400%	300%	250%[5]	225%[5]	250%[5]

[1]Where the required fuse rating or circuit breaker setting does not correspond to a standard rating or setting, a higher rating or setting that does not exceed the following shall be permitted:

(1) The next higher standard rating or setting for fuses and circuit breakers in accordance with 240.6 for 1000 volts and below, or

(2) The next higher commercially available rating or setting for fuses and circuit breakers above 1000 volts.

[2]Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device. If both circuit breakers and fuses are used as the overcurrent device, the total of the device ratings shall not exceed that allowed for fuses.

[3]A supervised location is a location where conditions of maintenance and supervision ensure that only qualified persons monitor and service the transformer installation.

[4]Electronically actuated fuses that may be set to open at a specific current shall be set in accordance with settings for circuit breakers.

[5]A transformer equipped with a coordinated thermal overload protection by the manufacturer shall be permitted to have separate secondary protection omitted.

Table 450.3 5 (B) Maximum Rating or Setting of Overcurrent Protection for Transformers 1000 Volts and Less (as a Percentage of Transformer-Rated Current)

Protection Method	Primary Protection			Secondary Protection[2]	
	Currents of 9 Amperes or More	Currents Less Than 9 Amperes	Currents Less Than 2 Amperes	Currents of 9 Amperes or More	Currents Less Than 9 Amperes
Primary only	125%[1]	167%	300%	Not required	Not required

Protection Method	Primary Protection			Secondary Protection[2]	
	Currents of 9 Amperes or More	Currents Less Than 9 Amperes	Currents Less Than 2 Amperes	Currents of 9 Amperes or More	Currents Less Than 9 Amperes
protection					
Primary and secondary protection	250%[3]	250%[3]	250%[3]	125%[1]	167%

[1]Where 125 percent of this current does not correspond to a standard rating of a fuse or nonadjustable circuit breaker, in accordance with 240.6, a higher rating that does not exceed the next higher standard rating shall be permitted.

[2]Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device.

[3]A transformer equipped with coordinated thermal overload protection by the manufacturer and arranged to interrupt the primary current shall be permitted to have primary overcurrent protection rated or set at a current value that is not more than six times the rated current of the transformer for transformers having not more than 6 percent impedance and not more than four times the rated current of the transformer for transformers having more than 6 percent but not more than 10 percent impedance.

(C) Voltage (Potential) Transformers.

Voltage (potential) transformers installed indoors or enclosed shall be protected with primary fuses.

Informational Note: See 408.52 for protection of instrument circuits, including voltage transformers.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 16:10:20 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual. Changed 450.2 to 450.4 and renumbered the sections through 450.14. Updated all article references to 450 to have the correct updated article number.

Response Message: FR-7895-NFPA 70-2024

Public Input No. 3751-NFPA 70-2023 [Section No. 450.3]

Public Input No. 344-NFPA 70-2023 [Section No. 450.3(B)]

Public Input No. 1296-NFPA 70-2023 [Section No. 450.3(B)]

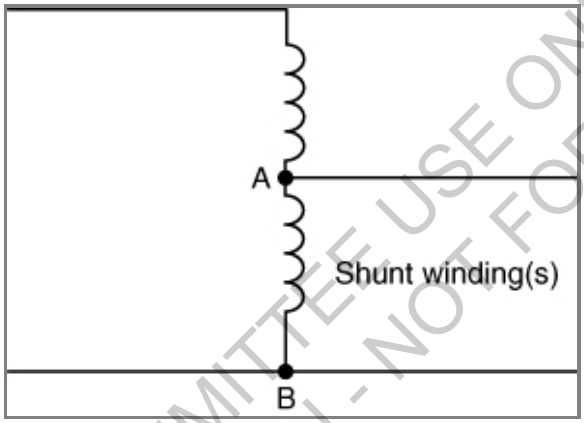
First Revision No. 7900-NFPA 70-2024 [Section No. 450.4]

450.4 – **6** Autotransformers 1000 Volts, Nominal, or Less.

(A) Overcurrent Protection.

Each autotransformer 1000 volts, nominal, or less shall be protected by an individual overcurrent device installed in series with each ungrounded input conductor. Such overcurrent device shall be rated or set at not more than 125 percent of the rated full-load input current of the autotransformer. Where this calculation does not correspond to a standard rating of a fuse or nonadjustable circuit breaker and the rated input current is 9 amperes or more, the next higher standard rating described in 240.6 shall be permitted. An overcurrent device shall not be installed in series with the shunt winding (the winding common to both the input and the output circuits) of the autotransformer between Points A and B as shown in Figure 450.4 6 (A).

Figure 450.4 6 (A) Autotransformer.



Exception: Where the rated input current of the autotransformer is less than 9 amperes, an overcurrent device rated or set at not more than 167 percent of the input current shall be permitted.

(B) Transformer Field-Connected as an Autotransformer.

A transformer field-connected as an autotransformer shall be identified for use at elevated voltage.

Informational Note: See 210.9 and 215.11 for information on permitted uses of autotransformers.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:24:15 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7900-NFPA 70-2024

First Revision No. 7897-NFPA 70-2024 [Section No. 450.5]

450.~~5~~ 7 Grounding Autotransformers.

Grounding autotransformers covered in this section are zigzag or T-connected transformers connected to 3-phase, 3-wire ungrounded systems for the purpose of creating a 3-phase, 4-wire distribution system or providing a neutral point for grounding purposes. Such transformers shall have a continuous per-phase current rating and a continuous neutral current rating. Zigzag-connected transformers shall not be installed on the load side of any system grounding connection, including those made in accordance with 250.24(C), 250.30(A)(1), or 250.32(B), Exception No. 1.

Informational Note: The ~~phase~~ neutral current in a grounding autotransformer is ~~one-third the neutral current~~ three times the phase current .

(A) Three-Phase, 4-Wire System.

A grounding autotransformer used to create a 3-phase, 4-wire distribution system from a 3-phase, 3-wire ungrounded system shall conform to 450.~~5~~ 7 (A)(1) through (A)(4).

(1) Connections.

The transformer shall be directly connected to the ungrounded phase conductors and shall not be switched or provided with overcurrent protection that is independent of the main switch and common-trip overcurrent protection for the 3-phase, 4-wire system.

(2) Overcurrent Protection.

An overcurrent sensing device shall be provided that will cause the main switch or common-trip overcurrent protection referred to in 450.~~5~~ 7 (A)(1) to open if the load on the autotransformer reaches or exceeds 125 percent of its continuous current per-phase or neutral rating. Delayed tripping for temporary overcurrents sensed at the autotransformer overcurrent device shall be permitted for the purpose of allowing proper operation of branch or feeder protective devices on the 4-wire system.

(3) Transformer Fault Sensing.

A fault-sensing system that causes the opening of a main switch or common-trip overcurrent device for the 3-phase, 4-wire system shall be provided to guard against single-phasing or internal faults.

Informational Note: This can be accomplished by the use of two subtractive-connected donut-type current transformers installed to sense and signal when an unbalance occurs in the line current to the autotransformer of 50 percent or more of rated current.

(4) Rating.

The autotransformer shall have a continuous neutral-current rating that is not less than the maximum possible neutral unbalanced load current of the 4-wire system.

(B) Ground Reference for Fault Protection Devices.

A grounding autotransformer used to make available a specified magnitude of ground-fault current for operation of a ground-responsive protective device on a 3-phase, 3-wire ungrounded system shall conform to 450.~~5~~ 7 (B)(1) and (B)(2).

(1) Rating.

The autotransformer shall have a continuous neutral-current rating not less than the specified ground-fault current.

(2) Overcurrent Protection.

Overcurrent protection shall comply with 450.~~5~~ 7 (B)(2)(a) and (B)(2)(b).

(a) *Operation and Interrupting Rating.* An overcurrent protective device having an interrupting rating in compliance with 110.9 and that will open simultaneously all ungrounded conductors when it operates shall be applied in the grounding autotransformer branch circuit.

(b) *Ampere Rating.* The overcurrent protection shall be rated or set at a current not exceeding 125 percent of the autotransformer continuous per-phase current rating or 42 percent of the continuous-current rating of any series-connected devices in the autotransformer neutral connection. Delayed tripping for temporary overcurrents to permit the proper operation of ground-responsive tripping devices on the main system shall be permitted but shall not exceed values that would be more than the short-time current rating of the grounding autotransformer or any series connected devices in the neutral connection thereto.

Exception: For high-impedance grounded systems covered in 250.36, where the maximum ground-fault current is designed to be not more than 10 amperes, and where the grounding autotransformer and the grounding impedance are rated for continuous duty, an overcurrent device rated not more than 20 amperes that will simultaneously open all ungrounded conductors shall be permitted to be installed on the line side of the grounding autotransformer.

(C) Ground Reference for Damping Transitory Overvoltages.

A grounding autotransformer used to limit transitory overvoltages shall be of suitable rating and connected in accordance with 450.~~5~~ 7 (A)(1).

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 16:33:59 EST 2024

Committee Statement

Committee Statement: The Informational Note was restructured to provide greater emphasis on the sizing of the neutral conductor as compared to the phase conductor.

Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual. Changed 450.2 to 450.4 and renumbered the sections through 450.14. Updated all article references to 450 to have the correct updated article number.

Response Message: FR-7897-NFPA 70-2024

Public Input No. 1100-NFPA 70-2023 [Section No. 450.5 [Excluding any Sub-Sections]]

First Revision No. 7898-NFPA 70-2024 [Section No. 450.6]

450.~~6~~ 8 Secondary Ties.

As used in this article, a secondary tie is a circuit operating at 1000 volts, nominal, or less between phases that connects two power sources or power supply points, such as the secondaries of two transformers. The tie shall be permitted to consist of one or more conductors per phase or neutral. Conductors connecting the secondaries of transformers in accordance with 450.~~7~~ ~~shall~~ 9 shall not be considered secondary ties.

As used in this section, the word *transformer* means a transformer or a bank of transformers operating as a unit.

(A) Tie Circuits.

Tie circuits shall be provided with overcurrent protection at each end as required in Article 240, Parts I, II, and VIII ~~of Article 240~~ .

Under the conditions described in 450.~~6~~ 8 (A)(1) and 450.~~6~~ 8 (A)(2), the overcurrent protection shall be permitted to be in accordance with 450.~~6~~ 8 (A)(3).

(1) Loads at Transformer Supply Points Only.

Where all loads are connected at the transformer supply points at each end of the tie and overcurrent protection is not provided in accordance with Article 240, Parts I, II, and VIII ~~of Article 240~~ , the ampacity of the tie shall not be less than 67 percent of the rated secondary current of the highest rated transformer supplying the secondary tie system.

(2) Loads Connected Between Transformer Supply Points.

Where load is connected to the tie at any point between transformer supply points and overcurrent protection is not provided in accordance with Article 240, Parts I, II, and VIII ~~of Article 240~~ , the ampacity of the tie shall not be less than 100 percent of the rated secondary current of the highest rated transformer supplying the secondary tie system.

Exception: Tie circuits comprised of multiple conductors per phase shall be permitted to be sized and protected in accordance with 450.~~6~~ 8 (A)(4).

(3) Tie Circuit Protection.

Under the conditions described in 450.~~6~~ 8 (A)(1) and (A)(2), both supply ends of each ungrounded tie conductor shall be equipped with a protective device that opens at a predetermined temperature of the tie conductor under short-circuit conditions. This protection shall consist of one of the following: (1) a fusible link cable connector, terminal, or lug, commonly known as a limiter, each being of a size corresponding with that of the conductor and of construction and characteristics according to the operating voltage and the type of insulation on the tie conductors or (2) automatic circuit breakers actuated by devices having comparable time–current characteristics.

(4) Interconnection of Phase Conductors Between Transformer Supply Points.

Where the tie consists of more than one conductor per phase or neutral, the conductors of each phase or neutral shall comply with 450.~~6~~ 8 (A)(4)(a) or (A)(4)(b).

(a) *Interconnected.* The conductors shall be interconnected in order to establish a load supply point, and the protective device specified in 450.~~6~~ 8 (A)(3) shall be provided in each ungrounded tie conductor at this point on both sides of the interconnection. The means of interconnection shall have an ampacity not less than the load to be served.

(b) *Not Interconnected.* The loads shall be connected to one or more individual conductors of a paralleled conductor tie without interconnecting the conductors of each phase or neutral and without the protection specified in 450.~~6~~ 8 (A)(3) at load connection points. Where this is done, the tie conductors of each phase or neutral shall have a combined capacity ampacity of not less than 133 percent of the rated secondary current of the highest rated transformer supplying the secondary tie system, the total load of such taps shall not exceed the rated secondary current of the highest rated transformer, and the loads shall be equally divided on each phase and on the individual conductors of each phase as far as practicable.

(5) Tie Circuit Control.

Where the operating voltage exceeds 150 volts to ground, secondary ties provided with limiters shall have a switch at each end that, when open, de-energizes the associated tie conductors and limiters. The current rating of the switch shall not be less than the rated current ampacity of the conductors connected to the switch. It shall be capable of interrupting its rated current, and it shall be constructed so that it will not open under the magnetic forces resulting from short-circuit current.

(B) Overcurrent Protection for Secondary Connections.

Where secondary ties are used, an overcurrent device rated or set at not more than 250 percent of the rated secondary current of the transformers shall be provided in the secondary connections of each transformer supplying the tie system. In addition, an automatic circuit breaker actuated by a reverse-current relay set to open the circuit at not more than the rated secondary current of the transformer shall be provided in the secondary connection of each transformer.

(C) Grounding.

Where the secondary tie system is grounded, each transformer secondary supplying the tie system shall be grounded in accordance with 250.30 for separately derived systems.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 16:41:22 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4.
Response Message: FR-7898-NFPA 70-2024

Public Input No. 2712-NFPA 70-2023 [Section No. 450.6]

First Revision No. 7901-NFPA 70-2024 [Section No. 450.7]

450.~~7~~ 9 Parallel Operation.

Transformers shall be permitted to be operated in parallel and switched as a unit, provided the overcurrent protection for each transformer meets the requirements of 450.~~3~~ 5 (A) for primary and secondary protective devices over 1000 volts, or 450.~~3~~ 5 (B) for primary and secondary protective devices 1000 volts or less.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 17:27:32 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.

Response Message: FR-7901-NFPA 70-2024

First Revision No. 7902-NFPA 70-2024 [Section No. 450.8]

450.8~~–~~ 10 Guarding.

Transformers shall be guarded as specified in 450.8 10 (A) through (D).

(A) Mechanical Protection.

Appropriate provisions shall be made to minimize the possibility of damage to transformers from external causes where the transformers are exposed to physical damage.

(B) Case or Enclosure.

Dry-type transformers shall be provided with a noncombustible moisture-resistant case or enclosure that provides protection against the accidental insertion of foreign objects.

(C) Exposed Energized Parts.

Switches or other equipment operating at 1000 volts, nominal, or less and serving only equipment within a transformer enclosure shall be permitted to be installed in the transformer enclosure if accessible to qualified persons only. All energized parts shall be guarded in accordance with 110.27 and 110.34.

(D) Voltage Warning.

The operating voltage of exposed live parts of transformer installations shall be indicated by signs or visible markings on the equipment or structures.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:29:21 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7902-NFPA 70-2024

First Revision No. 7891-NFPA 70-2024 [Section No. 450.9]

450.9 ~~–~~ **11** Ventilation.

(A) General.

The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.

(B) Ventilation Openings.

Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions.

(C) Marking.

The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.

Informational Note No. 1: See IEEE C57.12.00-2015, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, and IEEE C57.12.01-2020, *General Requirements for Dry-Type Distribution and Power Transformers*, for additional information.

Informational Note No. 2: See IEEE C57.110-2018, *Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents*, for more information where transformers are used with nonlinear loads that have nonsinusoidal currents that can result in additional losses and transformer heating.

~~Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.~~

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-7891_450.9.docx		

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 16:00:37 EST 2024

Committee Statement

Committee Statement: Article 450.9 was restructured to put into a list form per NEC Style Manual requirements and for better readability. No changes were made to the requirements.
Response Message: FR-7891-NFPA 70-2024

Public Input No. 4140-NFPA 70-2023 [Section No. 450.9]

450.9 Ventilation. [Renumber as 450.11] [Move text to (A)—(C)]

~~The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.~~

~~Informational Note No. 1: See IEEE C57.12.00-2015, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, and IEEE C57.12.01-2020, *General Requirements for Dry-Type Distribution and Power Transformers*, for additional information.~~

~~Informational Note No. 2: See IEEE C57.110-2018, *Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents*, for more information where transformers are used with nonlinear loads that have nonsinusoidal currents that can result in additional losses and transformer heating.~~

~~Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.~~

(A) General.

The ventilation shall dispose of the transformer full-load heat losses without creating a temperature rise that is in excess of the transformer rating.

(B) Ventilation Openings.

Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions.

(C) Marking.

The required clearances shall be clearly marked on the transformer. Transformer top surfaces that are horizontal and readily accessible shall be marked to prohibit storage.

Informational Note No. 1: See IEEE C57.12.00-2015, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, and IEEE C57.12.01-2020, *General Requirements for Dry-Type Distribution and Power Transformers*, for additional information.

Informational Note No. 2: See IEEE C57.110-2018, *Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents*, for more information where transformers are used with nonlinear loads that have nonsinusoidal currents that can result in additional losses and transformer heating.

First Revision No. 7903-NFPA 70-2024 [Section No. 450.10]

450.~~10~~ 12 Grounding and Bonding.

(A) Dry-Type Transformer Enclosures.

Where separate equipment grounding conductors and supply-side bonding jumpers are installed, a terminal bar for all grounding and bonding conductor connections shall be secured inside the transformer enclosure. The terminal bar shall be bonded to the enclosure in accordance with 250.12 and shall not be installed on or over any vented portion of the enclosure.

Exception: Where a dry-type transformer is equipped with wire-type connections (leads), the grounding and bonding connections shall be permitted to be connected together using any of the methods in 250.8 and shall be bonded to the enclosure if of metal.

(B) Other Metal Parts.

Exposed non-current-carrying metal parts of transformer installations, including fences, guards, and so forth, shall be grounded and bonded under the conditions and in the manner specified for electrical equipment and other exposed metal parts in Article 250, Parts V, VI, and VII ~~of Article 250~~.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:36:22 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7903-NFPA 70-2024

Public Input No. 2713-NFPA 70-2023 [Section No. 450.10(B)]

First Revision No. 7904-NFPA 70-2024 [Section No. 450.11]

450.~~11~~ 13 Marking.

(A) General.

Each transformer shall be provided with a nameplate giving the following information:

(1) Name of manufacturer
(2) Rated kilovolt-amperes
(3) Frequency
(4) Primary and secondary voltage
(5) Impedance of transformers 25 kVA and larger
(6) Required clearances for transformers with ventilating openings
(7) Amount and kind of insulating liquid where used
(8) For dry-type transformers, temperature class for the insulation system

(B) Source Marking.

A transformer shall be permitted to be supplied at the marked secondary voltage, provided that the installation is in accordance with the manufacturer's instructions.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:39:52 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7904-NFPA 70-2024

First Revision No. 7905-NFPA 70-2024 [Section No. 450.12]

450.~~12~~ 14 Terminal Wiring Space.

The minimum wire-bending space at fixed, 1000-volt and below terminals of transformer line and load connections shall be as required in 312.6. Wiring space for pigtail connections shall conform to Table 314.16(B)(1).

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:41:41 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7905-NFPA 70-2024

First Revision No. 7906-NFPA 70-2024 [Section No. 450.13]

450.~~13~~ 15 Accessibility.

All transformers and transformer vaults shall be readily accessible to qualified personnel for inspection and maintenance or shall meet the requirements of 450.~~13~~ 15 (A) or 450.~~13~~ 15 (B).

(A) Open Installations.

Dry-type transformers 1000 volts, nominal, or less, located in the open on walls, columns, or structures, shall not be required to be readily accessible.

(B) Hollow Space Installations.

Dry-type transformers 1000 volts, nominal, or less and not exceeding 50 kVA shall be permitted in hollow spaces of buildings not permanently closed in by structure, provided they meet the ventilation requirements of 450.~~9~~ ~~and~~ 11 and separation from combustible materials requirements of 450.~~21~~ 23 (A). Transformers so installed shall not be required to be readily accessible.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Wed Jan 17 17:43:31 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.
Response Message: FR-7906-NFPA 70-2024

First Revision No. 7907-NFPA 70-2024 [Section No. 450.14]

450.14 ~~–~~ **16** Disconnecting Means.

Transformers, other than Class 2 or Class 3 transformers, shall have a disconnecting means located either in sight of the transformer or in a remote location. Where located in a remote location, the disconnecting means shall be lockable open in accordance with 110.25, and its location shall be field marked on the transformer.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Jan 17 17:45:57 EST 2024

Committee Statement

Committee Statement: Renumbered the article to comply with the requirements of section 2.2.1.1 of the NEC Style Manual.

Response Message: FR-7907-NFPA 70-2024

First Revision No. 7703-NFPA 70-2024 [Section No. 460.27]

460.27 Grounding.

Capacitor cases shall be connected to the equipment grounding conductor. If the capacitor neutral point is connected to a grounding electrode conductor, the connection shall be made in accordance with ~~Part III of~~ Article 250 , Part III .

Exception: Capacitor cases shall not be connected to the equipment grounding conductor where the capacitor units are supported on a structure designed to operate at other than ground potential.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 13:39:58 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4.

Response Message: FR-7703-NFPA 70-2024

Public Input No. 2714-NFPA 70-2023 [Section No. 460.27]

First Revision No. 7708-NFPA 70-2024 [Section No. 470.22]

470.22 Oil-Filled Reactors.

Installation of oil-filled reactors, in addition to the above requirements, shall comply with applicable requirements of Article 450, Part II and Part III ~~of Article 450~~ .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 13:59:31 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4.

Response Message: FR-7708-NFPA 70-2024

Public Input No. 2715-NFPA 70-2023 [Section No. 470.22]

First Revision No. 8490-NFPA 70-2024 [New Section after 495.1]

495.2 Listing Requirements.

Switchgear and industrial control assemblies operating up to 15,000 volts ac shall be listed. The listing requirement for this equipment shall be effective January 1, 2029.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 22 14:18:19 EST 2024

Committee Statement

Committee Statement: Adding the listing requirement helps ensure switchgear and industrial control assemblies meets appropriate product standards. Having a future effective date provides manufacturers time to obtain listing. The 15,000 volt ac limit was chosen as this equipment is commonly available as listed equipment.

Response Message: FR-8490-NFPA 70-2024

Public Input No. 3474-NFPA 70-2023 [New Section after 495.3]

First Revision No. 8494-NFPA 70-2024 [Section No. 495.2]

495.~~2~~ 3 Reconditioned Equipment.

(A) Permitted to be Installed.

Reconditioned switchgear, or sections of switchgear, shall be permitted to be installed. If equipment has been damaged by fire, products of combustion, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

(B) Not Permitted to be Installed.

Except as modified within this article, reconditioned equipment shall not be ~~permitted~~ installed .

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-8494_495.2.docx		

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 22 14:22:19 EST 2024

Committee Statement

Committee Statement: The section was renumbered to meet the requirements of the NEC Style Manual. Information about reconditioning of equipment was relocated from 495.49 and the content was restructured to meet the NEC Style Manual requirements.

Response Message: FR-8494-NFPA 70-2024

Public Input No. 3783-NFPA 70-2023 [Section No. 495.2]

Public Input No. 2612-NFPA 70-2023 [Section No. 495.2]

495.2 Reconditioned Equipment. [Renumber as 495.3] [Move text to (B)]

~~Except as modified within this article, reconditioned equipment shall not be permitted.~~

(A) Permitted to be Installed.

Reconditioned switchgear, or sections of switchgear, shall be permitted to be installed. If equipment has been damaged by fire, products of combustion, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

(B) Not Permitted to be Installed.

Except as modified within this article, reconditioned equipment shall not be ~~permitted~~installed.

First Revision No. 8495-NFPA 70-2024 [Section No. 495.3]

~~(B)~~

495.3 ~~Other Articles.~~

~~(A) Oil-Filled Equipment.~~

~~Installation of electrical equipment containing more than 38 L (10 gal) of flammable oil per unit shall meet the requirements of Parts II and III of Article 450 .~~

4 Enclosures in Damp or Wet Locations.

Enclosures installed in damp or wet locations shall ~~meet the requirements of 312.2 .~~ be weatherproof. For enclosures in wet locations, raceways or cables entering above the level of uninsulated live parts shall use fittings listed for wet locations.

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-8495_495.3.docx		

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Mon Jan 22 14:26:34 EST 2024

Committee Statement

Committee Statement: The information concerning oil filled equipment was removed as the requirements are already in Article 450, Parts II and III. A task group has been formed to review if there is still a need for additional requirements for oil-filled equipment.

The section subdivision was removed since there remained only one section. The information concerning equipment installations in damp or wet locations was retained as it is not addressed in other sections of the NEC for this equipment.

The requirements were revised to closely match appropriate content in 312.2 for consistency in the wet location installation requirements. The section was retitled to match the revised content of the section.

The section was renumbered to allow for meeting NEC Style Manual requirements for 495.3.

Response Message: FR-8495-NFPA 70-2024

Public Input No. 3781-NFPA 70-2023 [Section No. 495.3]

Public Input No. 2716-NFPA 70-2023 [Section No. 495.3(A)]

495.3 ~~Other Articles~~Enclosures in Damp or Wet Locations. [Renumber as 495.4]
Enclosures installed in damp or wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables entering above the level of uninsulated live parts shall use fittings listed for wet locations.

~~**(A) Oil-Filled Equipment.**~~
~~Installation of electrical equipment containing more than 38 L (10 gal) of flammable oil per unit shall meet the requirements of Parts II and III of Article 450.~~

~~**(B) Enclosures in Damp or Wet Locations.**~~
~~Enclosures in damp or wet locations shall meet the requirements of 312.2.~~

First Revision No. 7731-NFPA 70-2024 [Section No. 495.22]

495.22 Isolating Means.

Means shall be provided to completely isolate an item of equipment from all ungrounded conductors other than service conductors connected to the service disconnect . The use of isolating switches shall not be required where there are other ways of de-energizing the equipment for inspection and repairs, such as draw-out-type switchgear units and removable truck panels.

~~Isolating switches not interlocked with an approved circuit-interrupting device shall be provided with a sign warning against opening them under load.~~ Non-load break isolating switches shall comply with one or both of the following:

(1) Non-load break isolating switches shall be interlocked with a circuit interrupting device in series with the isolating switch, such that the interrupting device must be open before the isolating switch is opened or closed; or

(2) Non-load break isolating switches shall be field marked with a warning against opening or closing the isolating switch under load. The warning sign(s) or label(s) shall comply with 110.21(B) .

~~An identified fuseholder~~ A fuseholder and fuse, where the fuseholder is identified for use as an isolating switch, shall be permitted as an isolating switch.

Supplemental Information

File Name	Description	Approved
NEC_CMP9_FR-7731_495.22.docx		

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Tue Jan 16 15:30:34 EST 2024

Committee Statement

Committee Statement: The requirement was modified to improve the clarity of the requirements for non-load break isolation switches. Requirements were modified to help improve safety by minimizing the opportunity to operate non-load break switches under load.

Response Message: FR-7731-NFPA 70-2024

Public Input No. 2419-NFPA 70-2023 [Section No. 495.22]

Public Input No. 3980-NFPA 70-2023 [Section No. 495.22]

495.22 Isolating Means.

Means shall be provided to completely isolate an item of equipment from all ungrounded conductors other than service conductors connected to the service disconnect. The use of isolating switches shall not be required where there are other ways of de-energizing the equipment for inspection and repairs, such as draw-out-type switchgear units and removable truck panels.

Non-load break isolating switches shall comply with one or both of the following:

a. Non-load break isolating switches shall be interlocked with a circuit interrupting device in series with the isolating switch, such that the interrupting device must be open before the isolating switch is opened or closed; or
b. Non-load break isolating switches shall be field marked with a warning against opening or closing the isolating switch under load. The warning sign(s) or label(s) shall comply with 110.21(B).

~~Isolating switches not interlocked with an approved circuit-interrupting device shall be provided with a sign warning against opening them under load. The warning sign(s) or label(s) shall comply with 110.21(B).~~

~~An identified~~A fuseholder and fuse, where the fuseholder is identified for use as an isolating switch, shall be permitted as an isolating switch.

First Revision No. 7733-NFPA 70-2024 [New Section after 495.25]

495.26 Grounding Switches.

Where grounding switches are installed, they shall comply with 495.26(A) and (B).

(A) Interlocking.

Grounding switches shall be interlocked with the disconnecting means for all sources of power to the location where the ground switch is applied, so that the disconnecting means must be open prior to moving the grounding switch to the grounded position and the disconnecting means cannot be closed while the grounding switch is in the grounded position.

Exception: Interlocking shall not be required for installations under single management where documented safe switching procedures are established and maintained.

(B) Sign.

A sign in accordance with 110.21(B) shall be installed at the grounding switch location indicating that a grounding switch is present and the designation and locations of all disconnecting means which must be opened prior to moving the grounding switch to the grounded position. This sign shall be permitted to be field- or factory-installed.

Exception: A sign shall not be required when a grounding switch is interlocked with a disconnecting means in accordance with 495.26(A), and there is no other source of power to the grounding switch location.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 15:34:28 EST 2024

Committee Statement

Committee Statement: Grounding switches are used in electrical equipment, but the NEC does not have any requirements for these switches. Basic requirements for the switches are added to enhance safety.

Response Message: FR-7733-NFPA 70-2024

Public Input No. 3068-NFPA 70-2023 [New Section after 495.25]

First Revision No. 7745-NFPA 70-2024 [New Section after 495.35]

495.36 Switchgear Enclosure and Mounting.

Switchgear shall consist of a substantial metal structure and a sheet metal enclosure. Where installed over a combustible floor, suitable protection thereto shall be provided.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 16:02:02 EST 2024

Committee Statement

Committee Statement: The requirements for the switchgear enclosure and mounting are added as these requirements should apply to all equipment, not only to service equipment as currently required in 235.411.

Response Message: FR-7745-NFPA 70-2024

Public Input No. 3070-NFPA 70-2023 [New Section after 495.35]

First Revision No. 7710-NFPA 70-2024 [Section No. 495.49]

~~**495.49** Reconditioned Switchgear.~~

~~Reconditioned switchgear, or sections of switchgear, shall be permitted. If equipment has been damaged by fire, products of combustion, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.~~

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 14:13:26 EST 2024

Committee Statement

Committee Statement: The information concerning reconditioning is moved to 450.3 to meet the NEC Style Manual requirements.

Response Message: FR-7710-NFPA 70-2024

Public Input No. 3782-NFPA 70-2023 [Section No. 495.49]

First Revision No. 7754-NFPA 70-2024 [Section No. 495.61]

495.61 General.

(A) Covered.

The provisions of this part shall apply to installations and use of high-voltage power distribution and utilization equipment that is portable, mobile, or both, and include but not be limited to the following:

(1) Substations and switch houses mounted on skids
(2) Trailers or cars
(3) Mobile shovels
(4) Draglines
(5) Cranes
(6) Hoists
(7) Drills
(8) Dredges
(9) Compressors
(10) Pumps
(11) Conveyors
(12) Underground excavators

(B) Grounding and Bonding.

Grounding and bonding shall be in accordance with ~~Part X of~~ Article 250 , Part X .

(C) Protection.

Approved enclosures or guarding, or both, shall be provided to protect portable and mobile equipment from physical damage.

(D) Disconnecting Means.

Disconnecting means shall be installed for mobile and portable high-voltage equipment according to the requirements of ~~Part VIII of~~ Article 230 , Part VIII, and shall disconnect all ungrounded conductors.

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Tue Jan 16 16:26:43 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4.
Response Message: FR-7754-NFPA 70-2024

Public Input No. 2717-NFPA 70-2023 [Section No. 495.61]

First Revision No. 7755-NFPA 70-2024 [Section No. 495.66]

495.66 High-Voltage Portable Cable for Main Power Supply.

Flexible high-voltage cable supplying power to portable or mobile equipment shall comply with the grounding and bonding requirements in Article 250, Parts V, VI, and X ~~of Article 250~~ , and the flexible cable requirements in ~~Part III of~~ Article 400 , Parts III and IV .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Tue Jan 16 16:31:09 EST 2024

Committee Statement

Committee Statement: The references have been revised to reference specific parts of articles to comply with the NEC Style Manual section 4.1.4. Added reference to part IV of Article 400, as it also applies.

Response Message: FR-7755-NFPA 70-2024

Public Input No. 2718-NFPA 70-2023 [Section No. 495.66]

First Revision No. 7601-NFPA 70-2024 [New Section after B.7]

B.8 Medium Voltage Cable Shield Current Correction Factor.

A conservative method for determining the correction to the table ampacity where the table ampacity does not include the effect of shield circulating current may be taken from the equation of 315.60(B). The ampacity without the shield current taken into account is:

$$I_1 = \sqrt{\frac{T_c - (T_a + \Delta T_d)}{R_{dc}(1 + Y_{c1})R_{ca}}} \times 10^3 \; amperes$$

With cable shield current present, the additional losses of the cable shield need to be taken into account:

$$I_2 = \sqrt{\frac{T_c - (T_a + \Delta T_d)}{R_{dc}(1 + Y_{c2})R_{ca}}} \times 10^3 \; amperes$$

$$Y_{c2} = Y_{c1} + Y_{sc}$$

The factor Y_{sc} takes into account the resistance of the cable shield.

If I_1 is the known ampacity of a cable configuration without cable shield current flow taken into account, and I_2 is the ampacity of the same cable configuration at the same conductor temperature and ambient temperature, then the ratio I_2 / I_1 is the ampacity correction factor for shield current flow. From above, this is:

$$Shield\ Current\ Correction\ Factor = \frac{I_2}{I_1} = \sqrt{\frac{1 + Y_{c1}}{1 + Y_{c2}}} = \sqrt{\frac{1 + Y_{c1}}{1 + Y_{c1} + Y_{sc}}} = \sqrt{\frac{1}{1 + \frac{Y_{sc}}{1 + Y_{c1}}}}$$

From IEEE 525-2016, Y_{sc} can be calculated as:

$$Y_{sc} = \frac{R_s}{R_{dc}}\left(\frac{X_M^2}{X_M^2 + R_S^2}\right)$$

Where

R_s is the dc resistance of the shield in mW/ft

S is the axial spacing of adjacent cables in inches

D_{SM} is the mean diameter of the shield in inches

D_P is the inside of the conduit wall (if applicable)

X_m is the mutual reactance of the conductor and cable shield in mW/ft:

Table B.8(1) Formulas for Mutual Reactance X_m

Condition	Description	Applies To Table	Formula for Xm (μΩ /ft.)
1	Flat configuration, equally spaced	315.60(C)(15) 315.60(C)(16)	$X_m = 52.92 \log_{10}\left(\frac{2S}{D_{SM}}\right)$
2	Equilateral Triangular Configuration	N/A	$X_m = 52.92 \log_{10}\left(\frac{S}{D_{SM}}\right)$
3	Cradled Configuration in Conduit	N/A	$X_m = 52.92 \log_{10}\left[\left(\frac{2.52S}{D_{SM}}\right)^6 \sqrt{1 - \left(\frac{S}{D_P - S}\right)^2}\right]$

Formulas for Conditions 1 and 3 were taken from Neher J.H. and McGrath, M.H., "The calculation of temperature rise and load capability of cable systems,", AIEE Transactions Part III, vol. 76, no.

3, pp. 752-772, Oct. 1957.

Substituting this value of Y_{sc} into the expression for the Shield Current Correction Factor yields:

$$Shield\ Current\ Correction\ Factor = \sqrt{\frac{1}{1 + \frac{R_s\left(\frac{X_M^2}{X_M^2 + R_S^2}\right)}{R_{dc}(1 + Y_{c1})}}}$$

The value $R_{dc}(1+Y_{c1})$ is the AC resistance of the conductor R_{ac} in μΩ /ft. The shield current correction factor therefore simplifies to:

$$Shield\ Current\ Correction\ Factor = \sqrt{\frac{R_{ac}}{R_{ac} + R_s\left(\frac{X_M^2}{X_M^2 + R_S^2}\right)}}$$

It should be noted that this same result may be obtained by considering the ratio of I^2R losses in the cable without shield current flowing to the sum of I^2R losses in the cable and shield with shield current flowing.

Submitter Information Verification

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Committee Statement

Committee Statement: This addition to Annex B is being placed to provide additional information for the Shield Current Correction Factor Calculation placed in 315.60(D)(1) for multi-point grounded shields.
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