Public Input No. 3085, Assigned to Code-Making Panel 1, Refer to Code-Making Panels 2 - 18

Public Input No. 3085-NFPA 70-2023 [Global Input]

This Global Public Input is for all Technical Committees and review their informational notes and the requirements in the NEC Style Manual Section 2.1.10 for informational notes.

Statement of Problem and Substantiation for Public Input

This Global Public Input is for all Technical Committees and review their informational notes and the requirements in the NEC Style Manual Section 2.1.10 for informational notes.
2.1.10.3 Format. Informational notes shall be structured as shown in the example, using the word “See” followed by the reference standard, the title of the standard and section if used, and an explanation for the reference.
Example:
"See" "Referenced Standard", "Standard Title", "Section Number", "Explanation of the reference"
Informational Note: See NFPA 101, Life Safety Code, 7.8, for illumination of means of egress.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Submittal Date: Tue Aug 29 11:15:17 EDT 2023
Committee: NEC-P01

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Public Input No. 3086, Assigned to Code-Making Panel 2, Refer to Code Making Panels 3 - 18

Public Input No. 3086-NFPA 70-2023 [Global Input]

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions.

Statement of Problem and Substantiation for Public Input

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions. The Changes in 2.2.1 are requirements that may need to be revised.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning
requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 4050, Assigned to Code-Making Panel 10, Refer to Code-Making Panels 1 - 9 and 11 - 18

Public Input No. 4050-NFPA 70-2023 [Global Input]

Review the terms regarding overcurrent protection and determine if the correct term is being used.

(1) Branch-Circuit Overcurrent Protective Device

(2) Current-Limiting Overcurrent Protective Device

(3) Current-Limiting

(4) Current-Limiting Overcurrent

(5) Overcurrent Protection

(6) Overcurrent Protection Device

(7) Overcurrent Protective Device

(8) Supplementary Overcurrent Protective Device

(9) Supplementary Overcurrent Protection

Statement of Problem and Substantiation for Public Input

The defined terms regarding overcurrent protection need to be reviewed by all code making panels and determine if the correct term is being used. The code has too many terms regarding overcurent protection, some that are defined and some that are not defined. These terms are often used interchangeably in the wrong context.

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Public Input No. 4287, Assigned to Code-Making Panel 1, Refer to Code-Making Panels 2 - 18

Public Input No. 4287-NFPA 70-2023 [Global Input]

Clearly identify any requirements which are not applicable to DC circuits by incorporating the recommended terminology as applicable:

“Applicable to…[ac][single-phase][three-phase][wye][delta] circuits only”.

“Not applicable to dc circuits”

“[Volts] ac only”

Other terminology that clearly applies to a specific ac (or dc) application, such as through a defined term or unique equipment.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee DC Task Group consisting of Danish Zia, Jason Fisher, Randy Dollar, Larry Wildermuth, Scott Higgins, Scott Harding, Mark Earley, Jason Hopkins, Christopher Vance, Chad Kennedy and Derrick Atkins. This Public Input, along with other Public Inputs, was developed with the goal of improving usability and accuracy on requirements associated with DC circuits.

DC residential and commercial installations are emerging in the electrical infrastructure and are expected to be a growing alternative to the traditional AC utility fed building. Examples include the US DOE Grid-interactive Efficient Buildings project (Note 1), the Purdue University RENEWW house (Note 2), and a DC Microgrid community in Vermont (Note 3). These installations may involve buildings that are distributed entirely with DC, or with an AC/DC hybrid distribution.

Although DC electrical distribution topics are covered by the NEC, the focus of most residential and commercial installations and the Code has historically been AC power. Many requirements are written using AC terminology or referencing only AC technology, but without distinction as to whether the requirement is also applicable to DC circuits or installations. Usage of terms such as “2-wire” and “3-wire”, or listing AC only voltages as informative references without appropriate mandatory language or further clarification may not provide sufficient clarity as to whether a requirement applies to DC circuits. This may leave the AHJ and other users of the Code confused. This public input recommends that such requirements be reviewed and clarified using the recommended terminology proposed.

Note 1 - https://www.energy.gov/sites/default/files/2020/09/f79/bto-geb-project-summary-093020.pdf
Note 2 - https://engineering.purdue.edu/ME/News/2022/purdue-house-runs-entirely-on-dc-power
Note 3 - https://www.efficiencyvermont.com/Media/Default/docs/white-papers/Energy_Resilience.pdf

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Committee: NEC-P01

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

See Attached File - Which Includes multiple related changes, all under the purview of CMP 9.

Additional Proposed Changes

File Name	Description	Approved
PI_For_CMP_9_Voltage_Demarcation_.docx	Global PI for CMP 9 (Consistent Voltage Demarcation)	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Changes related to the voltage demarcation have been grouped to assist the CMP with review and resolution, with each change, and it’s corresponding substantiation, noted in the table below: (table provided in attachment)

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Committee: NEC-P09

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth and Kyle Krueger.

Changes related to the voltage demarcation have been grouped to assist the CMP with review and resolution, with each change, and it's corresponding substantiation, noted in the table below:

Reference	Suggested Revision	Substantiation
Article 100 Definition for "Voltage, High"	Voltage, High. A potential difference ~~of more than~~ over 1000 volts ac, 1500 volts dc, nominal.	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~~IV 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. Reference to Part III is corrected to references Part IV.
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~~IV 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. Reference to Part III is corrected to references Part IV.
314.70(C)	**Handhole Enclosures.** Where handhole enclosures are used 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.
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, 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)	… materials, shall be provided for support of	With the identification in the title and scope of the Article that the

	overhead conductors ~~over 1000 volts nominal~~.	requirements apply to certain voltage ranges, the inclusion of this detail in this section is unnecessary.
495.33	**Guarding of Energized Parts Operating at** <u>**not over**</u> **1000 Volts** <u>**ac, 1500 volts dc**</u>**, 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 <u>**110.21(B)**</u> shall be installed on panels or doors that provide access to live parts over 1000 volts <u>ac, 1500 volts dc, nominal,</u> 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 <u>not over</u> 1000 volts <u>ac, 1500 volts dc</u>, 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 <u>ac, 1500 volts dc</u>, 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.

Public Input No. 3970-NFPA 70-2023 [Global Input]

Create a separate Chapter within the NEC to cover the requirements for "Wiring and Protection for Systems Over 1000 Vac, 1500 Vdc" (Refer to National Electrical Code® Correlating Committee White Paper: "Keeping the NEC® Relevant – Is Now the Time to Modernize?").

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

PI's submitted by this TG will propose the following Articles:

- Article 235 – Branch Circuits Over 1000 Volts ac, 1500 Volts dc, Nominal
- Article 236 – Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal
- Article 237 – Outside Branch Circuits and Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal
- Article 238 – Services Over 1000 Volts ac, 1500 Volts dc, Nominal

While these propose sequential numbering, it is recommended that the CMP consider the NEC CC Wire Paper "Keeping the NEC® Relevant – Is Now the Time to Modernize?", published earlier this year by NFPA. This White Paper provides a roadmap for a future Code structure where the Wiring and Protection for Systems Over 1000 Vac, 1500 Vdc (referred to as "Medium Voltage" (MV)) is consolidated into a single Chapter.

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Committee: NEC-P09

Public Input No. 462-NFPA 70-2023 [Definition: Transformer.]

Transformer.

Equipment, either single-phase or polyphase, that uses electromagnetic induction to convert current and voltage in a primary circuit into current and voltage in a secondary circuit; or in the case of an autotransformer, achieves the same purpose using a single winding with taps . (CMP-9)

Informational note: The output of an Autotransformer is not a Separately Derived System as the Neutral of the Primary is the same as the Neutral of the Secondary.

Statement of Problem and Substantiation for Public Input

Autotransformers are in Article 450 as well as Article 640 (Audio Autotransformer). The definition of "transformer" in Article 100 should account for autotransformers as well.

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Public Input No. 1528-NFPA 70-2023 [Definitions (100): Switch, Gen... to Switch, Iso...]

Definitions (100): Switch, Gen... to Switch, Iso...

Switch, General-Use. (General-Use Switch)

A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage. (CMP-~~9~~ 10)

Switch, General-Use Snap. (General-Use Snap Switch)

A ~~form of general-use switch constructed~~ type of wiring device constructed so that it can be installed in device boxes or on box covers, or otherwise used in conjunction with wiring systems recognized by this *Code*. (CMP-~~9~~ 18)

Switch, Isolating. (Isolating Switch)

A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means. (CMP-~~9~~ 10)

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee established Task Group consisting of Bryan Tatum (Co-Chair),Chuck Kurten (Co-Chair), Paul Costello, Frank Tse, Nick Malouf, Doug Smith, Diane Lynch, and Randy Dollar.

The present scope of Article 404 address all switches, switching devices and circuit breakers used as switches operating at 1000 volts and below unless specifically referenced elsewhere in this Code for higher voltages.

The intent of this Public Input is to modify the scope of Article 404 to only cover general-use switches, motor-circuit switches, isolating switches, circuit breakers used as switches, and molded case switches. Other types of switches that fit outside of the modified scope of Article 404, i.e., general-use snap switch, pendant switch, surface switch, dimmer, and electronic control switches, and lighting control switches are relocated to Article 406. This relocation is logical as these types of switches (also referred to as 'wiring devices') are installed similar to how receptacles are installed. It should also be noted that the Standard for Electrical Equipment Maintenance, NFPA 70B, currently has "Wiring Devices" in Chapter 24 and "Switches" in Chapter 17. This PI would create a similar alignment of requirements.

This Public Input, along with another companion Public Input, was developed with the goal of improving usability of Article 404 Switches and facilitate the reassignment of switches to CMP's with the right focus for the equipment (namely, CMP-18 for 'wiring devices' and CMP-10 for larger switches).

Additionally, operating at voltages not over 1000 volts ac, 1500 volts dc, nominal was introduced to clarify what is meant by unless specifically referenced elsewhere in this code for higher voltages and for consistency with other parts of the code where 1500 volts dc is used.

Related Public Input No. 1544-NFPA 70-2026 [Revised Article 406]
1543 -NFPA 70-2026 [Revised Article 404]
1529 - NFPA 70 -2026 [New Definition – Wiring Device]
1528 - NFPA 70 -2026 [Revised Definitions Switch, General-Use. (General-Use Switch); Switch, General-Use Snap. (General-Use Snap Switch); and Switch, Isolating. (Isolating

Switch)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1529-NFPA 70-2023 [New Definition after Definition: Wireways, Nonmetallic. (No...]	
Public Input No. 1543-NFPA 70-2023 [Article 404]	
Public Input No. 1544-NFPA 70-2023 [Article 406]	

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Public Input No. 1207-NFPA 70-2023 [New Definition after Definition: Voltage, High. (High Volta...]

TITLE OF NEW CONTENT

Voltage, Medium (Medium Voltage) - Voltages in the range from 1001 volts AC to 35,000 volts AC or 1501 volts DC to 50,000 volts DC. CMP 3

Statement of Problem and Substantiation for Public Input

The scope of Article 305 in the 2023 edition of the NEC states "This article covers wiring methods and materials for systems rated over 1000 volts ac, 1500 volts dc, nominal." The scope of Article 315 in the 2023 edition of the NEC states "This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors, cable, cable joints, and cable terminations. This article includes voltages from 2001 volts to 35,000 volts ac, nominal and 2001 volts to 2500 volts dc, nominal." It is necessary to have a clear definition of Medium Voltage in order for users and enforcers of the NEC to properly apply NEC requirements.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1210-NFPA 70-2023 [Definition: Voltage, Low. (Low Voltage).]	

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Public Input No. 1604-NFPA 70-2023 [New Article after 210]

Article 215 - Branch Circuits Over 1000 Volts AC, 1500 Volts DC, Nominal

215.1 Scope.

This article provides the general requirements for branch circuits over 1000 Volts ac or 1500 Volts dc, nominal.

Informational Note: See ANSI/IEEE C2, *National Electrical Safety Code*, for additional information on wiring ove r 1000 volts, nominal.

215.3 Other Articles for Specific-Purpose Branch Circuits.

Table 215. 3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 215. 3 References for Specific Equipment and Applica tions Not Located in Chapter 5, 6, and 7

Equipment	Article	Section(s)
Air-conditioning and refrigerating equipment		440.6, 440.31, 440.32
Busways		368.17
Central heating equipment other than fixed electric space-heating equipment .		422.12
Fixed electric space-heating equipment		424.4
Fixed outdoor electrical deicing and snow-melting equipment		426.4
Infrared lamp industrial heating equipment		422.48 and 424.3
Motors, motor ci rcuits, and controllers	430	

214 .5 Conductor Identification for Branch Circuits.

(1) **Grounded Conductor.**

The grounded conductor of a branch circuit shall be identified in accordance with 200.6.

(1) **Equipment Grounding Conductor.**

The equipment grounding conductor shall be identified in accordance with 250.119.

(1) **Ungrounded Conductors.**

Ungrounded conductors shall be identified in accordance with 211.(C)(1) or (C)(2), as applicable:

(1) **Branch Circuits Su pplied from More than One Nominal Voltage System.**

Where the premise wiring system has branch circuits supp lied by more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal voltage at all termination, connec tion, and splice points in accordance with 211.5(C)(1)(a) and (C)(1)(b). Different systems withing the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

(2) *Posting of Identification Means. The method used for conductors originating within each branch-circuit panelboard or similar or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.*

Exception. In existing installations where a voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified system shall not be required to be identified at each termination, connection, and splice point in accordance with 211.5(C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

(1) **Branch Circuits Supplied from Direct-Current Systems.**

Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 211.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(1) *Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:*

(1) A continuous red outer finish

(1) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black.

(1) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B).

(1) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black.

(1) *Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:*

(1) A continuous black outer finish

(1) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red.

(1) Imprinted minus signs (-) or the word NEGATIVE or NEG durably marked on insulation of a

color other than green, white, gray or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B).

(1) An approved permanent marking such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points , with imprinted minus signs (-) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red.

215 .6 Branch-Circuit Voltage Limitations Between Conductors.

Circuits exceeding 1000 volts ac or 1500 volts dc, nominal between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.

215 .9 Circuits Derived from Autotransformers.

Branch Circuits shall not be derived from autotransformers unless the circuit supplied has a g rounded conductor that is electricity connected to a grounded conductor of the system supplying the autotransformer.

215 .10 Ungrounded Conductors Tapped from Grounded Syste ms.

Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductor or circuits that have a grounded neutral conductor. Sw itching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switc h together where such switching devices also serve as a disconnecting means as required by the following sections:

(1) 410.93 for double-pole switched lampholders

(1) 410. 104(B) for electric-discharge lamp auxiliary equipment switching devices .

(1) 422.31(B) for an appliance .

(1) 424.20 for a fixed electric space -heating unit .

(1) 426.51 for electric deicing and snow-melting e quipment .

(1) 430.85 for a motor controller .

(1) 430.103 for a motor .

215 .11 Branch Circuits Required.

The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.

215 .18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rat ing or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the ci rcuit rating.

215 .19 Conductors – Minimum Ampacity and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Branch-circuit conductors shall be sized in accordance with 211 .19(A) or (B).

(1) **General.**

The ampacity of branch-circuit conductors shall not be less than 12 5 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(1) **Supervised Installations.**

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defi ned as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(1) Qual ified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.

215 .20 Overcurrent Protection.

Branch-circuit conductors and equipment shall be protected by overcurrent protection devices that have a rating or setting that complies with 211.20(A) through (C).

(1) **Continuous and Noncontinuous Loads.**

Where branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load.

Exception: Where the assembly, including the overcurrent devi ces protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.

(1) **Conductor Protection.**

Conductors shall be protected in accordance with the ampacities specified in 310.14 or 315.60, as applicable.

(1) **Equipment.**

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles references in Table 240.3 for equipment.

215 .22 Permissib le Loads, Individual Branch Circuits.

An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case sha ll the load exceed the branch-circuit ampere rating.

215 .23 Permissible Loads, Multiple-Outlet Branch Circuits.

A branch circuit supplying two or more outlets or receptacles shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24, and in no case shall the load exceed the branch-circuit ampere rating.

(1) **15- and 20- Ampere Branch Circuits .**

A 15- or 20- ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment , or any combination of them, and shall comply with 211. 23(A)(1) and (A)(2).

(1) **Cord-and-Plug Connected Equipment Not Fastened in Place.**

The rating of any one cord-and-plug connected utilization equipment not fastened in place shall not exceed 80 percent of the branch -circuit ampere rating.

(1) **Utilization Equipment Fastened in Place.**

The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug connected utilization equipment not fastened in place, or both, are also supplied.

(1) **30- Ampere Branch Circuits.**

A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.

(1) **40- and 50-Ampere Branch Circuits.**

A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilizations equipment.

(1) **Branch Circuits Larger Than 50 Amperes.**

Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.

215.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 210.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(1) **Heating, Air-Conditioning, and Refrigeration Equipment.**

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

Exception: A receptacle outlet shall not be required at one-and two-family dwellings for the service of evaporative coolers.

(1) **Other Electrical Equipment.**

In other than one- and two-family dwellings, a receptacle outlet shall be located as specified in 210.63(B)(1) and (B)(2).

(1) **Indoor Service Equipment.**

The required receptacle outlet shall be located within the same room or area as the service equipment.

(1) **Indoor Equipment Requiring Dedicated Equipment Spaces.**

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means.

Statement of Problem and Substantiation for Public Input

Last revision cycle Article 235 was created for the "Over 1000VAC/1500VDC" requirements for Branch-Circuits, Feeders, and Services. The NEC Style Manual Section 2.1.4.1 of the 2023 NEC Style Manual states: "Usage. Articles shall be the chapter subdivision that cover a specific subject." For compliance with the NEC Style Manaual this proposal moves the branch-circuit requirements out of Article 235 to a new Article 215 for Branch-Circuits Over 1000VAC/1500VDC. No technical content has been changed, just relocated for NEC Style Manual compliance.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	

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Public Input No. 4334-NFPA 70-2023 [Article 225]

~~**Article 225** Outside Branch Circuits and Feeders~~

~~**Part I.** General~~

~~**225.1** Scope.~~

~~This article covers requirements for outside branch circuits and feeders not over 1000 volts ac or 1500 volts dc, nominal, run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles.~~

~~Informational Note: See Part IV of Article 235 for outside branch circuits and~~

Article 2 25 Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal.

2 25 .1 General.

This article provides the general installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc

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~~**225.3** Other Articles.~~

~~Application of other articles, including additional requirements to specific cases of equipment and conductors, is shown in Table 225.3 .~~

~~Table 225.3 Other Articles~~

~~Equipment/Conductors Article Branch circuits 210 Class 1 power-limited circuits and Class 1 power-limited remote-control and signaling circuits 724 Class 2 and Class 3 remote-control, signaling, and power-limited circuits 725 Conductors for general wiring 310 Electrically driven or controlled irrigation machines 675 Electric signs and outline lighting 600 Feeders 215 Fire alarm systems 760 Fixed outdoor electric deicing and snow-melting equipment 426 Grounding and bonding 250 Hazardous (classified) locations 500 Marinas and boatyards 555 Medium-voltage conductors and cable 311 Messenger-supported wiring 396 Mobile homes, manufactured homes, and mobile home parks 550 Open wiring on insulators 398 Over 1000 volts, general 495 Overcurrent protection 240 Overcurrent protection for systems rated over 1000 volts ac, 1500 volts dc 245 Services 230 Services, feeders, and branch circuits over 1000 volts ac, 1500 volts dc 235 Solar photovoltaic systems 690 Swimming pools, fountains, and similar installations 680 Use and identification of grounded conductors 200~~

~~**225.4** Conductor Insulation.~~

~~Where within 3.0 m (10 ft) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated for the nominal voltage. The insulation of conductors in cables or raceways, except Type MI cable, shall be of thermoset or thermoplastic type and, in wet locations, shall comply with 310.10(C) . The insulation of conductors for festoon lighting shall be of the thermoset or thermoplastic type.~~

~~*Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.*~~

~~**225.6** Conductor Size and Support.~~

~~**(A)** Overhead Spans.~~

~~Open individual conductors shall not be smaller than 10 AWG copper or 8 AWG aluminum for spans up to 15 m (50 ft) in length, and 8 AWG copper or 6 AWG aluminum for a longer span unless supported by a messenger wire.~~

~~**(B)** Festoon Lighting.~~

~~Overhead conductors for festoon lighting shall not be smaller than 12 AWG unless the conductors are supported by messenger wires. In all spans exceeding 12 m (40 ft), the conductors shall be supported by messenger wire. The messenger wire shall be supported by strain insulators. Conductors or messenger wires shall not be attached to any fire escape, downspout, or plumbing equipment.~~

~~**225.10** Wiring on Buildings (or Other Structures).~~

~~The installation of outside wiring on surfaces of buildings (or other structures) shall be permitted for circuits not exceeding 1000 volts, nominal, as the following:~~

(1) ~~Auxiliary gutters~~

(2) ~~Busways~~

(3) ~~Cable trays~~

(4) ~~Cablebus~~

(5) ~~Electrical metallic tubing (EMT)~~

(6) ~~Flexible metal conduit (FMC)~~

(7) ~~Intermediate metal conduit (IMC)~~

(8) ~~Liquidtight flexible metal conduit (LFMC)~~

(9) ~~Liquidtight flexible nonmetallic conduit (LFNC)~~

(10) ~~Messenger-supported wiring~~

(11) ~~Open wiring on insulators~~

(12) ~~Reinforced thermosetting resin conduit (RTRC)~~

(13) ~~Rigid metal conduit (RMC)~~

(14) ~~Rigid polyvinyl chloride conduit (PVC)~~

(15) ~~Type MC cable~~

(16) ~~Type MI cable~~

(17) ~~Type SE cable~~

(18) ~~Type TC-ER cable~~

(19) ~~Type UF cable~~

(20) ~~Wireways~~

~~**225.11** Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures.~~

~~Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with 230.52 . Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with 230.54 .~~

~~**225.12** Open-Conductor Supports.~~

~~Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials.~~

~~**225.14** Open-Conductor Spacings.~~

~~Conductors shall comply with the spacings provided in Table 230.51(C) .~~

~~**(A)** Separation from Other Circuits.~~

~~Open conductors shall be separated from open conductors of other circuits or systems by not less than 100 mm (4 in.).~~

~~**(B)** Conductors on Poles.~~

~~Conductors on poles shall have a separation of not less than 300 mm (1 ft) where not placed on racks or brackets. Conductors supported on poles shall provide a horizontal climbing space not less than the following:~~

(1) ~~Power conductors below communications conductors — 750 mm (30 in.)~~

(2) ~~Power conductors alone or above communications conductors:~~

  (3) ~~300 volts or less — 600 mm (24 in.)~~

  (4) ~~Over 300 volts — 750 mm (30 in.)~~

(5) ~~Communications conductors below power conductors — same as power conductors~~

(6) ~~Communications conductors alone — no requirement~~

~~**225.15** Supports over Buildings.~~

~~Outside branch-circuit and feeder conductors passing over a building shall be securely supported.~~

~~**225.16** Attachment to Buildings.~~

~~**(A)** Point of Attachment.~~

~~The point of attachment to a building shall be in accordance with 230.26 .~~

~~**(B)** Means of Attachment.~~

~~The means of attachment to a building shall be in accordance with 230.27 .~~

~~**225.17** Masts as Supports.~~

~~Only feeder or branch-circuit conductors specified within this section shall be permitted to be attached to the feeder and/or branch-circuit mast. Masts used for the support of final spans of feeders or branch circuits shall be installed in accordance with 225.17(A) and (B).~~

~~**(A)** Strength.~~

~~The mast shall have adequate strength or be supported by braces or guy wires to safely withstand the strain imposed by the overhead feeder or branch-circuit conductors. Hubs intended for use with a conduit serving as a mast for support of feeder or branch-circuit conductors shall be identified for use with a mast.~~

~~**(B)** Attachment.~~

~~Feeder and/or branch-circuit conductors shall not be attached to a mast where the connection is between a weatherhead or the end of the conduit and a coupling where the coupling is located above the last point of securement to the building or other structure, or where the coupling is located above the building or other structure.~~

~~**225.18** Clearance for Overhead Conductors and Cables.~~

~~Overhead spans of open conductors and open multiconductor cables of not over 1000 volts, nominal, shall have a clearance of not less than the following:~~

(1) ~~3.0 m (10 ft) — above finished grade, sidewalks, or from any platform or projection that will permit personal contact where the voltage does not exceed 150 volts to ground and accessible to pedestrians only~~

(2) ~~3.7 m (12 ft) — over residential property and driveways, and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground~~

(3) ~~4.5 m (15 ft) — for those areas listed in the 3.7 m (12 ft) classification where the voltage exceeds 300 volts to ground~~

(4) ~~5.5 m (18 ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles, such as cultivated, grazing, forest, and orchard~~

(5) ~~7.5 m (24 1/2 ft) — over track rails of railroads~~

~~**225.19** Clearances from Buildings for Conductors of Not over 1000 Volts, Nominal.~~

~~Overhead spans of open conductors and open multiconductor cables shall comply with 225.19(A), (B), (C), and (D).~~

~~**(A)** Above Roofs.~~

~~Overhead spans of open conductors and open multiconductor cables shall have a vertical clearance of not less than 2.6 m (8 ft 6 in.) above the roof surface. The vertical clearance above the roof level shall be maintained for a distance not less than 900 mm (3 ft) in all directions from the edge of the roof.~~

~~*Exception No. 1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of 225.18.*~~

~~*Exception No. 2: Where the voltage between conductors does not exceed 300, and the roof has a slope of 100 mm in 300 mm (4 in. in 12 in.) or greater, a reduction in clearance to 900 mm (3 ft) shall be permitted.*~~

~~*Exception No. 3: Where the voltage between conductors does not exceed 300, a reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.8 m (6 ft) of the conductors, 1.2 m (4 ft) horizontally, pass above the roof overhang, and (2) they are terminated at a through-the-roof raceway or approved support.*~~

~~*Exception No. 4: The requirement for maintaining the vertical clearance 900 mm (3 ft) from the edge of the roof shall not apply to the final conductor span where the conductors are attached to the side of a building.*~~

~~**(B)** From Nonbuilding or Nonbridge Structures.~~

~~From signs, chimneys, radio and television antennas, tanks, and other nonbuilding or nonbridge structures, clearances — vertical, diagonal, and horizontal — shall not be less than 900 mm (3 ft).~~

~~**(C)** Horizontal Clearances.~~

~~Clearances shall not be less than 900 mm (3 ft).~~

~~**(D)** Final Spans.~~

~~Final spans of feeders or branch circuits shall comply with 225.19(D)(1), (D)(2), and (D)(3).~~

~~**(1)** Clearance from Windows.~~

~~Final spans to the building they supply, or from which they are fed, shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, and from doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.~~

~~*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900 mm (3 ft) requirement.*~~

~~**(2)** Vertical Clearance.~~

~~The vertical clearance of final spans above or within 900 mm (3 ft) measured horizontally of platforms, projections, or surfaces that will permit personal contact shall be maintained in accordance with 225.18 .~~

~~**(3)** Building Openings.~~

~~The overhead branch-circuit and feeder conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these openings.~~

~~**(E)** Zone for Fire Ladders.~~

~~Where buildings exceed three stories or 15 m (50 ft) in height, overhead lines shall be arranged, where practicable, so that a clear space (or zone) at least 1.8 m (6 ft) wide will be left either adjacent to the buildings or beginning not over 2.5 m (8 ft) from them to facilitate the raising of ladders when necessary for fire fighting.~~

~~**225.20** Protection Against Physical Damage.~~

~~Conductors installed on buildings, structures, or poles shall be protected against physical damage as provided for services in 230.50 .~~

~~**225.21** Multiconductor Cables on Exterior Surfaces of Buildings (or Other Structures).~~

~~Supports for multiconductor cables on exterior surfaces of buildings (or other structures) shall be as provided in 230.51 .~~

~~**225.22** Raceways on Exterior Surfaces of Buildings or Other Structures.~~

~~Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations.~~

~~**225.24** Outdoor Lampholders.~~

~~Where outdoor lampholders are attached as pendants, the connections to the circuit wires shall be staggered. Where such lampholders have terminals of a type that puncture the insulation and make contact with the conductors, they shall be attached only to conductors of the stranded type.~~

~~**225.25** Location of Outdoor Lamps.~~

~~Locations of lamps for outdoor lighting shall be below all energized conductors, transformers, or other electric utilization equipment, unless either of the following apply:~~

(1) ~~Clearances or other safeguards are provided for relamping operations.~~

(2) ~~Equipment is controlled by a disconnecting means that is lockable open in accordance with 110.25 .~~

~~**225.26** Vegetation as Support.~~

~~Vegetation such as trees shall not be used for support of overhead conductor spans.~~

~~**225.27** Raceway Seal.~~

~~Where a raceway enters a building or structure from outside, it shall be sealed in accordance with 300.5(G) and 300.7(A) . Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.~~

~~**Part II.** Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)~~

~~**225.30** Number of Supplies.~~

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

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

~~**(A)** Special Conditions.~~

~~Additional feeders or branch circuits shall be permitted to supply the following:~~

(1) ~~Fire pumps~~

(2) ~~Emergency systems~~

(3) ~~Legally required standby systems~~

(4) ~~Optional standby systems~~

(5) ~~Parallel power production systems~~

(6) ~~Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability~~

(7) ~~Electric vehicle power transfer systems listed, labeled, and identified for more than a single branch circuit or feeder~~

(8) ~~Docking facilities and piers~~

~~**(B)** Common Supply Equipment.~~

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

~~**(C)** Special Occupancies.~~

~~By special permission, additional feeders or branch circuits shall be permitted for either of the following:~~

(1) ~~Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants~~

(2) ~~A single building or other structure sufficiently large to make two or more supplies necessary~~

~~**(D)** Capacity Requirements.~~

~~Additional feeders or branch circuits shall be permitted where the capacity requirements are in excess of 2000 amperes at a supply voltage of 1000 volts or less.~~

~~**(E)** Different Characteristics.~~

~~Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses such as control of outside lighting from multiple locations.~~

~~**(F)** Documented Switching Procedures.~~

~~Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained.~~

~~**225.31** Disconnecting Means.~~

~~**(A)** General.~~

~~Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.~~

~~**(B)** Location.~~

~~The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. For the purposes of this section, the requirements in 230.6 shall apply.~~

~~*Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises.*~~

~~*Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.*~~

~~*Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.*~~

~~*Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.*~~

~~**225.33** Maximum Number of Disconnects.~~

~~**(A)** General.~~

~~The disconnecting means for each supply permitted by 225.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard or switchgear. There shall be no more than six disconnects per supply grouped in any one location.~~

~~*Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power-operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.*~~

~~**(B)** Single-Pole Units.~~

~~Two or three single-pole switches or breakers capable of individual operation shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with identified handle ties or a master handle to disconnect all ungrounded conductors with no more than six operations of the hand.~~

~~**225.34** Grouping of Disconnects.~~

~~**(A)** General.~~

~~The two to six disconnects as permitted in 225.33 shall be grouped. Each disconnect shall be marked to indicate the load served.~~

~~*Exception: One of the two to six disconnecting means permitted in 225.33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.*~~

~~**(B)** Additional Disconnecting Means.~~

~~The one or more additional disconnecting means for fire pumps or for emergency, legally required standby or optional standby system permitted by 225.30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.~~

~~**225.35** Access to Occupants.~~

~~In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.~~

~~*Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.*~~

~~**225.36** Type of Disconnecting Means.~~

~~The disconnecting means specified in 225.31 shall be a circuit breaker, molded case switch, general-use switch, snap switch, or other approved means. Where applied in accordance with 250.32(B)(1) , Exception No. 1, the disconnecting means shall be suitable for use as service equipment.~~

~~**225.37** Identification.~~

~~Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

~~*Exception No. 1: A plaque or directory shall not be required for large-capacity multibuilding industrial installations under single management, where it is ensured that disconnection can be accomplished by establishing and maintaining safe switching procedures.*~~

~~*Exception No. 2: This identification shall not be required for branch circuits installed from a dwelling unit to a second building or structure.*~~

~~**225.38** Disconnect Construction.~~

~~Disconnecting means shall meet the requirements of 225.38(A) through (D).~~

~~**(A)** Manually or Power Operable.~~

~~The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.~~

~~**(B)** Simultaneous Opening of Poles.~~

~~Each building or structure disconnecting means shall simultaneously disconnect all ungrounded supply conductors that it controls from the building or structure wiring system.~~

~~**(C)** Disconnection of Grounded Conductor.~~

~~Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.~~

~~In a multisection switchboard or switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard or switchgear, if the switchboard section or switchgear section is marked to indicate a grounded conductor disconnect is contained within the equipment.~~

~~**(D)** Indicating.~~

~~The building or structure disconnecting means shall plainly indicate whether it is in the open or closed position.~~

~~**225.39** Rating of Disconnect.~~

~~The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads. Where the branch circuit or feeder disconnecting means consists of more than one switch or circuit breaker, as permitted by 225.33, combining the ratings of all the switches or circuit breakers for determining the rating of the disconnecting means shall be permitted. In no case shall the rating be lower than specified in 225.39(A), (B), (C), or (D).~~

~~**(A)** One-Circuit Installation.~~

~~For installations to supply only limited loads of a single branch circuit, the branch circuit disconnecting means shall have a rating of not less than 15 amperes.~~

~~**(B)** Two-Circuit Installations.~~

~~For installations consisting of not more than two 2-wire branch circuits, the feeder or branch-circuit disconnecting means shall have a rating of not less than 30 amperes.~~

~~**(C)** One-Family Dwelling.~~

~~For a one-family dwelling, the feeder disconnecting means shall have a rating of not less than 100 amperes, 3-wire.~~

~~**(D)** All Others.~~

~~For all other installations, the feeder or branch-circuit disconnecting means shall have a rating of not less than 60 amperes.~~

~~**225.40** Access to Overcurrent Protective Devices.~~

~~Where a feeder overcurrent device is not readily accessible, branch-circuit overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of a lower ampere rating than the feeder overcurrent device.~~

~~**225.41** Emergency Disconnects.~~

~~For one-and two-family dwelling units, an emergency disconnecting means shall be installed.~~

~~**(A)** General.~~

~~**(1)** Location.~~

~~The disconnecting means shall be installed in a readily accessible outdoor location on or within sight of the dwelling unit.~~

~~**(2)** Rating.~~

~~The disconnecting means shall have a short-circuit current rating equal to or greater than the available fault current.~~

~~**(3)** Grouping.~~

~~If more than one disconnecting means is provided, they shall be grouped.~~

~~**(B)** Identification of Other Isolation Disconnects.~~

~~Where equipment for isolation of other energy source systems is not located adjacent to the emergency disconnect required by this section, a plaque or directory identifying the location of all equipment for isolation of other energy sources shall be located adjacent to the disconnecting means required by this section.~~

> ~~Informational Note: See 445.18, 480.7, 705.20, and 706.15 for examples of other energy source system isolation means.~~

~~**(C)** Marking.~~

~~The disconnecting means shall be marked as EMERGENCY DISCONNECT.~~

~~Markings shall comply with 110.21(B) and all of the following:~~

(1) ~~The marking or labels shall be located on the outside front of the disconnect enclosure with red background and white text.~~

(2) ~~The letters shall be least 13 mm (1/2 in.) high.~~

~~**225.42** Surge Protection.~~

~~**(A)** Surge-Protective Device.~~

~~Where a feeder supplies any of the following, a surge-protective device (SPD) shall be installed:~~

(1) ~~Dwelling units~~

(2) ~~Dormitory units~~

(3) ~~Guest rooms and guest suites of hotels and motels~~

(4) ~~Areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms~~

~~**(B)** Location.~~

~~The SPD shall be installed in or adjacent to the distribution equipment that is connected to the load side of the feeder and contains branch circuit overcurrent protective device(s) that supply the location specified in 225.42(A).~~

> ~~Informational Note: Surge protection is most effective when closest to the branch circuit. Surges can be generated from multiple sources including, but not limited to, lightning, the electric utility, or utilization equipment.~~

~~**(C)** Type.~~

~~The SPD shall be a Type 1 or Type 2 SPD.~~

~~**(D)** Replacement.~~

~~Where the distribution equipment supplied by the feeder is replaced, all of the requirements of this section shall apply.~~

~~**(E)** Ratings.~~

~~SPDs shall have a nominal discharge current rating~~ (I_n) ~~of not less than 10kA.~~

> ~~Informational Note: Lead lengths of conductors to the SPD should be kept as short as possible to reduce let-through voltages.~~

, nominal.

2 25 .2 Minimum Rating and Size.

The ampacity of conductors shall be in accordance wit h 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than that required b y 250.122 , except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors over 1000 volts shall be sized in accordance with 2.2(A) , (B), or (C).

(1) **Feeder Supplyin g Transformers.**

The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(1) **Feeders Supplyin g Transformers and Utilization Equipment .**

The ampacity of feeders supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 125 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(1) **Supervised Installations.**

For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those p ortions of a facility where all of the following conditions are met:

(1) Conditions of de sign and installation are provided under engineering supervision.

(1) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

2 25 .03 Overcurrent Protection.

Feeders shall be protected against overcurrent.

2 25 .05 Diagrams of Feeders.

If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.

2 25 .06 Feeder Equipment Grounding Conductors.

Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements o f 250.32 shall apply.

2 25 .12 Identification for Fe eders.

(1) **Grounded Conductor.**

The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6.

(1) **Equipment Grounding Conductor .**

The equipment grounding conductor shall be identified in accordance with 250.119.

(1) **Identification of Ungrounded Conductors.**

Ungrounded conductors shall be identified in accordance with 2 25 . 12(C)(1) or (C)(2), as applicable.

(1) **Feeders Supplied from More One Nominal Voltage System.**

Where the premises wiring system has feeders supplied from more than one nominal voltage system , each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 2 25 .12(C)(1)(a) and (C)(1)(b).

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

(2) *Posting of Identification Means . The method utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.*

(1) **Feeder Supplied form Direct-Current Systems.**

Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance wit h 2 25 .12(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment w ith 2 25 .12(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(1) *Positive Polarity, Sizes 6 A WG or Smaller. Where the positive polarity of a dc system does not service as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the follo wing means:*

(1) A continuous red outer finish

(1) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black.

(1) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B).

(1) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black .

(1) *Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:*

(1) A continuous black outer finish.

(1) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red.

(1) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B).

(1) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red.

Statement of Problem and Substantiation for Public Input

With a new Article 220 for Outside Branch-Circuits and Feeders Not Over 1000VAC/1500VDC, the existing requirements found in the 2023 edition Article 225 will need to be relocated to new Article 220. See companion PIs: for submitted proposing the following reorganization:

PI 1604 – NEW Art.215 Branch Circuits Over 1000VAC/1500VDC
PI 4294 - Deleting Art 220 Load Calcs
PI 4311 - NEW Art. 120 for Load Calcs.
PI 4329 - NEW Art. 220 Feeders Not Over 1000VAC/1500VDC
PI - NEW Article 221 Outside Branch-Circuits & Feeders < 1000VAC/1500VDC
PI - Deleting 2023 Art. 225 Outside Branch Circuit and Feeders < 1000VAC/1500VDC
PI – NEW Art 225 Feeders > 1000VSC/1500VDC
PI – NEW Art. 226 Outside Branch-Circuit and Feeder >1000VAC/1500VDC

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	

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Public Input No. 1611-NFPA 70-2023 [New Article after 225]

Article 2 26 Outside Branch Circu its and Feeders Over 1000 Volts ac and 1500 Volts dc, Nominal.

2 26 .1 General.

This article covers the general requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements of Art icle 21 5 and Article 2 25 . This Article 226 supplements or modifies those requirements found in Article 21 5 and Article 2 25 .

2 26 .6 Conductor Size and Support.

For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.

2 26 .10 Wiring on Buildings (or Other Structures).

The installation of outside wiring on surfaces of buildings (or other structures) shall be installed as provided in 305.3 .

2 26 .14 Open-Conductor Spacings.

Conductors shall comply with the spacings provided in 110.36 and 495.24.

2 26 .39 Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.

2 26 .50 Sizing of Conductors.

The sizing of conductors over 1000 volts shall be in accordance with 2 11.19(A) for branch circuits and 211.19(B) for feeders.

2 26 .51 Isolating Switches.

Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.4(B), (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected an d that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.

2 26 .52 Disconnecting Means.

(1) Location.

A building or structure disconnecting means shall be located in accordance with 225.31(B) , or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.

(1) Type.

Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.

Exception: Where the individual disconnecting means co nsists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutou ts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.

(1) Locking.

Disconnecting means shall be lockable open in accordance with 110.25.

Exception : Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installe d at a convenient location to the fused cutouts.

(1) Indicating.

Disconnecting means shall clearly indicate whether they are in the open “off” or closed “on” position.

(1) Uniform Position.

Where disconnecting means handles are operated vertically, the “up” position of the handle shall be the “on” position.

Exception: A switching device having more than one “on” position, such as a double throw switch, shall not be required to comply with this requirement.

(1) Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

2 26 .56 Inspections and Tests.

(1) Pre-Energization and Operating Tests.

The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.

(1) Instrument Transformers.

All instrument transformers shall be tested to verify correct polarity and burden.

(1) Protective Relays.

Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.

(1) Switching Circuits.

Each switching circuit shall be observed to operate the associated equipment being switched.

(1) Control and Signal Circuits.

Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

(1) Metering Circuits.

All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.

(1) Acceptance Tests.

Complete acceptance tests shall be performed, after the substation installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

(1) Relays and Metering Utilizing Phase Differences.

All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.

(1) Test Report.

A test report covering the results of the tests required in 226.56(A) shall be delivered to the authority having jurisdiction prior to energization.

Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*, *for an example of acceptance specifications.*

2 26 .60 Clearances over Roadways, Walkways, Rail, Water, and Open Land.

(1) 22 kV or Less to Ground.

The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown Ta ble 226.60(A).

Table 2 26 .60(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land.

Location	Clearance	
	m	ft.

Open land subject to vehicles, cultivation, or grazing.	5.6	18.5
Roadways, d riveways, parking lots, and alleys	5.6	18.5
Walkways	4.1	13.5
Rails	8.1	26.5
Spaces and ways for pedestrians and restricted traffic	4.4	14.5
Water areas not suitable for boating	5.2	17.0

(1) More Than 22 kV to Ground.

Clearances for the categories shown in Table 226.60(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

(1) Special Cases.

For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.

Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , *for additional information.*

2 26 .61 Clearances over Buildings and Other Structures .

(1) 22 kV or Less to Ground.

The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 226.61(A).

Table 2 26 .6 1 (A) Clearances over Buildings and Other Structures

	Horizontal		Vertical	
Clearance from Conductors or Live Parts from:	m	ft.	m	ft.
Building walls, projections, and windows	2.3	7.5	-	-
Balconies, catwalks, and similar areas accessible to people	2.3	7.5	4.1	13.5
Over or under roofs or projections not readily accessible to people	-	-	3.8	12.5
Over roo fs accessible to vehicles but not trucks	-	-	4.1	13.5

Over roofs accessible to trucks	-	-	5.6	18.5
Other structures	2.3	7.5	-	-

(1) More Than 22 kV to Gro und.

Clearances for the categories shown in Table 226.61(A) shall be increased by 10 mm (0.4 in.) per kV , or major fraction thereof, more than 22kV.

Information Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, *for additional information.*

Statement of Problem and Substantiation for Public Input

Delete Outside Feeder requirements from Article 235 (Move to separate article for compliance with 2023 NEC Style Manual).
NEW Article 235 has 3 separate subjects/topics and should be reverted separate Articles as appropriate.

Section 2.1.4.1 of the 2023 NEC Style Manual states: Usage. Articles shall be the chapter subdivision that cover a specific subject.

Creating a new Article 226 for Outside Branch-Circuits and Feeders Over 1000VAC/1500VDC, See companion PIs: for submitted proposing the following reorganization:

PI 1604 – NEW Art.215 Branch Circuits Over 1000VAC/1500VDC
PI 4294 - Deleting Art 220 Load Calcs
PI 4311 - NEW Art. 120 for Load Calcs.
PI 4329 - NEW Art. 220 Feeders Not Over 1000VAC/1500VDC
PI - NEW Article 221 Outside Branch-Circuits & Feeders < 1000VAC/1500VDC
PI 4334 - Deleting 2023 Art. 225 Outside Branch Circuit and Feeders < 1000VAC/1500VDC & adding NEW Art 225 Feeders > 1000VSC/1500VDC

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 1613-NFPA 70-2023 [Article 235]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	

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Committee:	NEC-P09

Public Input No. 1613-NFPA 70-2023 [Article 235]

~~**Article 235** Branch Circuits, Feeders, and~~ Article 235 **Services Over 1000 Volts ac, 1500 Volts dc, Nominal**

~~Part I~~

~~.~~

~~General~~

235.1

~~Scope.~~

~~This article provides the general requirements for branch circuits, feeders, and services over 1000 volts ac or 1500 volts dc, nominal.~~

> ~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information on wiring over 1000 volts, nominal.~~

~~**Part II.** Branch Circuits~~

~~**235.3** Other Articles for Specific-Purpose Branch Circuits.~~

~~Table 235.3 lists references for specific equipment and applications not located in Chapters 5 , 6 , and 7 that amend or supplement the requirements of this article.~~

~~Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7~~

~~Equipment Article Section Air-conditioning and refrigerating equipment - 440.6, 440.31, and 440.32 Busways - 368.17 Central heating equipment other than fixed electric space-heating equipment - 422.12 Fixed electric heating equipment for pipelines and vessels - 427.4 Fixed electric space-heating equipment - 424.4 Fixed outdoor electrical deicing and snow-melting equipment - 426.4 Infrared lamp industrial heating equipment - 422.48 and 424.3 Motors, motor circuits, and controllers 430 -~~

~~**235.5** Conductor Identification for Branch Circuits.~~

~~**(A)** Grounded Conductor.~~

~~The grounded conductor of a branch circuit shall be identified in accordance with 200.6 .~~

~~**(B)** Equipment Grounding Conductor.~~

~~The equipment grounding conductor shall be identified in accordance with 250.119 .~~

~~**(C)** Ungrounded Conductors.~~

~~Ungrounded conductors shall be identified in accordance with 235.5(C)(1) or (C)(2), as applicable.~~

~~**(1)** Branch Circuits Supplied from More Than One Nominal Voltage System.~~

~~Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.~~

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

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

~~*Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."*~~

~~**(2)** Branch Circuits Supplied from Direct-Current Systems.~~

~~Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.~~

(1) ~~*Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:~~

  (2) ~~A continuous red outer finish~~

  (3) ~~A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black~~

  (4) ~~Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (5) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black~~

(6) ~~*Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:~~

  (7) ~~A continuous black outer finish~~

  (8) ~~A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red~~

  (9) ~~Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (10) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red~~

~~**235.6** Branch-Circuit Voltage Limitations Over 1000 volts ac or 1500 volts dc, Nominal, Between Conductors.~~

~~Circuits exceeding 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.~~

~~**235.9** Circuits Derived from Autotransformers.~~

~~Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer.~~

~~**235.10** Ungrounded Conductors Tapped from Grounded Systems.~~

~~Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductors of circuits that have a grounded neutral conductor. Switching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switch together where such switching devices also serve as a disconnecting means as required by the following sections:~~

(1) ~~410.93 for double-pole switched lampholders~~

(2) ~~410.104(B) for electric-discharge lamp auxiliary equipment switching devices~~

(3) ~~422.31(B) for an appliance~~

(4) ~~424.20 for a fixed electric space-heating unit~~

(5) ~~426.51 for electric deicing and snow-melting equipment~~

(6) ~~430.85 for a motor controller~~

(7) ~~430.103 for a motor~~

~~**235.11** Branch Circuits Required.~~

~~The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.~~

~~**235.18** Rating.~~

~~Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.~~

~~**235.19** Conductors — Minimum Ampacity and Size.~~

~~The ampacity of conductors shall be in accordance with 310.14 and 315.60 , as applicable. Branch-circuit conductors shall be sized in accordance with 235.19(A) or (B).~~

~~**(A)**~~

General.

~~The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.~~

~~**(B)** Supervised Installations.~~

~~For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:~~

(1) ~~Conditions of design and installation are provided under engineering supervision.~~

(2) ~~Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.~~

~~**235.20** Overcurrent Protection.~~

~~Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with 235.20(A) through (C).~~

~~**(A)** Continuous and Noncontinuous Loads.~~

~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load.~~

~~*Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.*~~

~~**(B)** Conductor Protection.~~

~~Conductors shall be protected in accordance with the ampacities specified in 310.14 or 315.60 , as applicable.~~

~~**(C)** Equipment.~~

~~The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table 240.3 for equipment.~~

~~**235.22** Permissible Loads, Individual Branch Circuits.~~

~~An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.~~

~~**235.23** Permissible Loads, Multiple-Outlet Branch Circuits.~~

~~A branch circuit supplying two or more outlets or receptacles shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24 , and in no case shall the load exceed the branch-circuit ampere rating.~~

~~**(A)** 15- and 20-Ampere Branch Circuits.~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1)** Cord-and-Plug-Connected Equipment Not Fastened in Place.~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2)** Utilization Equipment Fastened in Place.~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B)** 30-Ampere Branch Circuits.~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(C)** 40- and 50-Ampere Branch Circuits.~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D)** Branch Circuits Larger Than 50 Amperes.~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

~~**235.63** Equipment Requiring Servicing.~~

~~A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 210.63(A) and (B).~~

~~Informational Note: See 210.8(E) for requirements on GFCI protection.~~

~~**(A)** Heating, Air-Conditioning, and Refrigeration Equipment.~~

~~The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.~~

~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

~~**(B)** Other Electrical Equipment.~~

~~In other than one- and two-family dwellings, a receptacle outlet shall be located as specified in 210.63(B)(1) and (B)(2).~~

~~**(1)** Indoor Service Equipment.~~

~~The required receptacle outlet shall be located within the same room or area as the service equipment.~~

~~**(2)** Indoor Equipment Requiring Dedicated Equipment Spaces.~~

~~Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means.~~

~~**Part III.** Feeders~~

~~**235.201** General.~~

~~Part III covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc, nominal.~~

~~**235.202** Minimum Rating and Size.~~

~~The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than that required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors over 1000 volts shall be sized in accordance with 235.202(A), (B), or (C).~~

~~**(A)** Feeders Supplying Transformers.~~

~~The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.~~

~~**(B)** Feeders Supplying Transformers and Utilization Equipment.~~

~~The ampacity of feeders supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 125 percent of the designed potential load of the utilization equipment that will be operated simultaneously.~~

~~**(C)** Supervised Installations.~~

~~For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:~~

(1) ~~Conditions of design and installation are provided under engineering supervision.~~

(2) ~~Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.~~

~~**235.203** Overcurrent Protection.~~

~~Feeders shall be protected against overcurrent.~~

~~**235.205** Diagrams of Feeders.~~

~~If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.~~

~~**235.206** Feeder Equipment Grounding Conductor.~~

~~Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of 250.32 shall apply.~~

~~**235.212** Identification for Feeders.~~

~~**(A)** Grounded Conductor.~~

~~The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6 .~~

~~**(B)** Equipment Grounding Conductor.~~

~~The equipment grounding conductor shall be identified in accordance with 250.119 .~~

~~**(C)** Identification of Ungrounded Conductors.~~

~~Ungrounded conductors shall be identified in accordance with 235.212(C)(1) or (C)(2), as applicable.~~

~~**(1)** Feeders Supplied from More Than One Nominal Voltage System.~~

~~Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 235.212(C)(1)(a) and (C)(1)(b).~~

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

(2) ~~*Posting of Identification Means.* The method utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.~~

~~**(2)** Feeders Supplied from Direct-Current Systems.~~

~~Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.212(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.~~

(1) ~~*Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:~~

  (2) ~~A continuous red outer finish~~

  (3) ~~A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black~~

  (4) ~~Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (5) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black~~

(6) ~~*Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:~~

  (7) ~~A continuous black outer finish~~

  (8) ~~A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red~~

  (9) ~~Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (10) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red~~

~~**Part IV.** Outside Branch Circuits and Feeders~~

~~**235.301** General.~~

~~Part IV covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Parts I and II of Article 225 and with Part IV of this article, which supplements or modifies those requirements.~~

~~**235.306** Conductor Size and Support.~~

~~For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.~~

~~**235.310** Wiring on Buildings (or Other Structures).~~

~~The installation of outside wiring on surfaces of buildings (or other structures) shall be installed as provided in 305.3 .~~

~~**235.314** Open-Conductor Spacings.~~

~~Conductors shall comply with the spacings provided in 110.36 and 495.24 .~~

~~**235.339** Rating of Disconnect.~~

~~The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.~~

~~**235.350** Sizing of Conductors.~~

~~The sizing of conductors over 1000 volts shall be in accordance with 235.19(A) for branch circuits and 235.19(B) for feeders.~~

~~**235.351** Isolating Switches.~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.404(B) , (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.~~

~~*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*~~

~~**235.352** Disconnecting Means.~~

~~**(A)** Location.~~

~~A building or structure disconnecting means shall be located in accordance with 225.31(B) , or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~

~~**(B)** Type.~~

~~Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.~~

~~*Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.*~~

~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~**(C)** Locking.~~

~~Disconnecting means shall be lockable open in accordance with 110.25 .~~

~~*Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.*~~

~~**(D)** Indicating.~~

~~Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.~~

~~**(E)** Uniform Position.~~

~~Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.~~

~~*Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.*~~

~~**(F)** Identification.~~

~~Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

~~**235.356** Inspections and Tests.~~

~~**(A)** Pre-Energization and Operating Tests.~~

~~The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.~~

~~**(1)** Instrument Transformers.~~

~~All instrument transformers shall be tested to verify correct polarity and burden.~~

~~**(2)** Protective Relays.~~

~~Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.~~

~~**(3)** Switching Circuits.~~

~~Each switching circuit shall be observed to operate the associated equipment being switched.~~

~~**(4)** Control and Signal Circuits.~~

~~Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.~~

~~**(5)** Metering Circuits.~~

~~All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.~~

~~**(6)** Acceptance Tests.~~

~~Complete acceptance tests shall be performed, after the substation installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.~~

~~**(7)** Relays and Metering Utilizing Phase Differences.~~

~~All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.~~

~~**(B)** Test Report.~~

~~A test report covering the results of the tests required in 235.356(A) shall be delivered to the authority having jurisdiction prior to energization.~~

~~Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems* , for an example of acceptance specifications.~~

~~**235.360** Clearances over Roadways, Walkways, Rail, Water, and Open Land.~~

~~**(A)** 22 kV or Less to Ground.~~

~~The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.360(A) .~~

~~Table 235.360(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land~~

~~Clearance Location m ft Open land subject to vehicles, cultivation, or grazing 5.6 18.5 Roadways, driveways, parking lots, and alleys 5.6 18.5 Walkways 4.1 13.5 Rails 8.1 26.5 Spaces and ways for pedestrians and restricted traffic 4.4 14.5 Water areas not suitable for boating 5.2 17.0~~

~~**(B)** More Than 22 kV to Ground.~~

~~Clearances for the categories shown in Table 235.360(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~**(C)** Special Cases.~~

~~For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information.~~

~~**235.361** Clearances over Buildings and Other Structures.~~

~~**(A)** 22 kV or Less to Ground.~~

~~The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.361(A) .~~

~~Table 235.361(A) Clearances over Buildings and Other Structures~~

~~Clearance from Conductors or Live Parts from: Horizontal - Vertical m ft - m ft Building walls, projections, and windows 2.3 7.5 - — — Balconies, catwalks, and similar areas accessible to people 2.3 7.5 - 4.1 13.5 Over or under roofs or projections not readily accessible to people — — - 3.8 12.5 Over roofs accessible to vehicles but not trucks — — - 4.1 13.5 Over roofs accessible to trucks — — - 5.6 18.5 Other structures 2.3 7.5 - — —~~

~~**(B)** More Than 22 kV to Ground.~~

~~Clearances for the categories shown in Table 235.361(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information.~~

~~**Part V.** Services~~

~~**235.401** General.~~

~~Part V~~ covers requirements for service conductors and equipment used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Parts I through VII of Article 230 and with Part V of this article, which supplements or modifies those requirements. In no case shall the provisions of Part V apply to equipment on the supply side of the service point.

235.40~~2~~ 2 Service-Entrance Conductors.

Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).

(A) Conductor Size.

Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.

(B) Wiring Methods.

Service-entrance conductors shall be installed by one of the wiring methods covered in 305.3 and 305.15.

235.~~404~~ 4 Isolating Switches.

(A) Where Required.

Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means, an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment.

Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:

(1) Cannot be opened unless the circuit is disconnected

(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position

(B) Fuses as Isolating Switch.

Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.

(C) Accessible to Qualified Persons Only.

The isolating switch shall be accessible to qualified persons only.

(D) Connection to Ground.

Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.

A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.

235.~~405~~ 5 Disconnecting Means.

(A) Location.

The service disconnecting means shall be located in accordance with 230.70.

For either overhead or underground primary distribution systems on private property, the service disconnect shall be permitted to be located in a location that is not readily accessible, if the disconnecting means can be operated by mechanical linkage from a readily accessible point, or electronically in accordance with 235.405(C), where applicable.

(B) Type.

Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.

Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.

(C) Remote Control.

For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.

235.4~~06~~ 6 Overcurrent Devices as Disconnecting Means.

Where the circuit breaker or alternative for it, as specified in 235.408 for service overcurrent devices, meets the requirements specified in 235.405, it shall constitute the service disconnecting means.

235.4~~08~~ 8 Protection Requirements.

A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

Overcurrent devices shall conform to 235.408(A) and (B).

(A) Equipment Type.

Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.

(B) Enclosed Overcurrent Devices.

The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.

235.4~~09~~ 9 Surge Arresters.

Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.

Informational Note: Surge arresters may be referred to as lightning arresters in older documents.

235.4~~10~~ 10 Service Equipment — General.

Service equipment, including instrument transformers, shall conform to Part I of Article 495.

235.4~~11~~ 11 Switchgear.

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.

235.4~~12~~ 12 Over 35,000 Volts.

Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.

Statement of Problem and Substantiation for Public Input

Revise Article 235 to only include Service requirements for 1000v/1500v nominal or more.(Move to separate article for compliance with 2023 NEC Style Manual). Currently Article 235 has 3 separate subjects/topics and should be separated for style manual compliance.

Section 2.1.4.1 of the 2023 NEC Style Manual states: Usage. Articles shall be the chapter subdivision that cover a specific subject.

See companion PIs: for submitted proposing the following reorganization:

PI 1604 – NEW Art.215 Branch Circuits Over 1000VAC/1500VDC
PI 4294 - Deleting Art 220 Load Calcs
PI 4311 - NEW Art. 120 for Load Calcs.
PI 4329 - NEW Art. 220 Feeders Not Over 1000VAC/1500VDC
PI - NEW Article 221 Outside Branch-Circuits & Feeders < 1000VAC/1500VDC
PI 4334 - Deleting 2023 Art. 225 Outside Branch Circuit and Feeders < 1000VAC/1500VDC & adding NEW Art 225 Feeders > 1000VSC/1500VDC
PI 1611 – NEW Art. 226 Outside Branch-Circuit and Feeder >1000VAC/1500VDC

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 1604-NFPA 70-2023 [New Article after 210]	
Public Input No. 1611-NFPA 70-2023 [New Article after 225]	
Public Input No. 4294-NFPA 70-2023 [Article 220]	
Public Input No. 4311-NFPA 70-2023 [New Section after 110.79]	
Public Input No. 4329-NFPA 70-2023 [New Article after 220]	
Public Input No. 4334-NFPA 70-2023 [Article 225]	

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Committee:	NEC-P09

Public Input No. 3215-NFPA 70-2023 [Article 235]

Article 235 Branch Circuits ~~, Feeders, and Services~~ Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

235.1 Scope.

This article provides the general requirements for branch ~~circuits, feeders, and services over~~ circuits over 1000 volts ac or 1500 volts dc, nominal.

Informational Note: See ANSI/IEEE C2-~~2017~~ 2022 , *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

~~**Part II.** Branch Circuits~~

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment	-	440.6, 440.31, and 440.32
Busways	-	368.17
Central heating equipment other than fixed electric space-heating equipment	-	422.12
Fixed electric heating equipment for pipelines and vessels	-	427.4
Fixed electric space-heating equipment	-	424.4
Fixed outdoor electrical deicing and snow-melting equipment	-	426.4
Infrared lamp industrial heating equipment	-	422.48 and 424.3
Motors, motor circuits, and controllers	430	-

235.5 Conductor Identification for Branch Circuits.

(A) Grounded Conductor.

The grounded conductor of a branch circuit shall be identified in accordance with 200.6.

(B) Equipment Grounding Conductor.

The equipment grounding conductor shall be identified in accordance with 250.119.

(C) Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 235.5(C)(1) or (C)(2), as applicable.

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

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

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each branch-circuit ~~panelboard or similar branch-circuit~~ distribution equipment shall be documented in a manner that is readily available or be permanently posted at each branch-circuit ~~panelboard or similar branch-circuit~~ distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) <u>A continuous red outer finish</u>

(3) <u>A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black</u>

(4) <u>Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)</u>

(5) <u>An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black</u>

(f) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(7) <u>A continuous black outer finish</u>

(8) <u>A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red</u>

(9) <u>Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)</u>

(10) <u>An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red</u>

235.6 Branch-Circuit Voltage Limitations Over 1000 volts ac or 1500 volts dc, Nominal, Between Conductors.

Circuits exceeding 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.

235.9 Circuits Derived from Autotransformers.

Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer.

235.10 Ungrounded Conductors Tapped from Grounded Systems.

Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductors of circuits that have a grounded neutral conductor. Switching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switch together where such switching devices also serve as a disconnecting means as required by the following sections:

(1) 410.93 for double-pole switched lampholders

(2) 410.104(B) for electric-discharge lamp auxiliary equipment switching devices

(3) 422.31(B) for an appliance

(4) 424.20 for a fixed electric space-heating unit

(5) 426.51 for electric deicing and snow-melting equipment

(6) 430.85 for a motor controller

(7) 430.103 for a motor

235.11 Branch Circuits Required.

The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.

Part II. Branch-Circuit Ratings

235.18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.

235.19 Conductors — Minimum Ampacity and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Branch-circuit conductors shall be sized in accordance with 235.19(A) or (B).

(A) General.

The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(B) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.

235.20 Overcurrent Protection.

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with 235.20(A) through (C).

(A) ~~Continuous and Noncontinuous Loads.~~

~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the~~

Simultaneous Loads.

The rating or setting of the overcurrent device shall not be less than ~~the noncontinuous load plus 125 percent of the continuous load.~~

~~Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load~~

100 percent of the sum of all loads on the branch circuit that will be operated simultaneously .

(B) *Conductor Protection.*

Conductors shall be protected in accordance with the ampacities specified in 310.14 or 315.60, as applicable.

(C) Equipment.

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table 240.3 for equipment.

235.22 Permissible Loads, Individual Branch Circuits.

An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.

235.23 Permissible Loads, Multiple-Outlet Branch Circuits.

A branch circuit ~~supplying two~~ shall be permitted to supply two or more outlets or receptacles ~~shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24 , and in no case shall the load exceed the branch-circuit ampere rating.~~

~~**(A)** 15- and 20-Ampere Branch Circuits.~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1)** Cord-and-Plug-Connected Equipment Not Fastened in Place.~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2)** Utilization Equipment Fastened in Place.~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B)** 30-Ampere Branch Circuits.~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of~~

. The sum of all loads that will be operated simultaneously shall not exceed the branch-circuit ampere rating.

~~**(C)** 40- and 50-Ampere Branch Circuits.~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D)** Branch Circuits Larger Than 50 Amperes.~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

Part III. Required Outlets

235.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in ~~210~~ 235 .63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

(B) Other Indoor Electrical Equipment.

~~In other than one- and two-family dwellings, a~~ A receptacle outlet shall be ~~located as specified in 210.63(B)(1) and (B)(2).~~

~~**(1)** Indoor Service Equipment.~~

~~The required receptacle outlet shall be located within~~

located within the same room or area as

~~the service~~

indoor equipment

~~.~~

~~**(2)** Indoor Equipment Requiring Dedicated Equipment Spaces.~~

~~Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E) , the~~

requiring servicing. The required receptacle outlet shall

~~be located within the same room or area as the electrical equipment and shall~~

not be connected to the load side of the

~~equipment's disconnecting means.~~

~~**Part III.** Feeders~~

~~**235.201** General.~~

~~Part III covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc, nominal.~~

~~**235.202** Minimum Rating and Size.~~

~~The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than that required by 250.122 , except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors over 1000 volts shall be sized in accordance with 235.202(A) , (B), or (C).~~

~~**(A)** Feeders Supplying Transformers.~~

~~The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.~~

~~**(B)** Feeders Supplying Transformers and Utilization Equipment.~~

~~The ampacity of feeders supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 125 percent of the designed potential load of the utilization equipment that will be operated simultaneously.~~

~~**(C)** Supervised Installations.~~

~~For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B) . Supervised installations are defined as those portions of a facility where all of the following conditions are met:~~

(1) ~~Conditions of design and installation are provided under engineering supervision.~~

(2) ~~Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.~~

~~**235.203** Overcurrent Protection.~~

~~Feeders shall be protected against overcurrent.~~

~~**235.205** Diagrams of Feeders.~~

~~If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.~~

~~**235.206** Feeder Equipment Grounding Conductor.~~

~~Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of 250.32 shall apply.~~

~~**235.212** Identification for Feeders.~~

~~**(A)** Grounded Conductor.~~

~~The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6 .~~

~~**(B)** Equipment Grounding Conductor.~~

~~The equipment grounding conductor shall be identified in accordance with 250.119 .~~

~~**(C)** Identification of Ungrounded Conductors.~~

~~Ungrounded conductors shall be identified in accordance with 235.212(C)(1) or (C)(2), as applicable.~~

~~**(1)** Feeders Supplied from More Than One Nominal Voltage System.~~

~~Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 235.212(C)(1)(a) and (C)(1)(b).~~

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

(2) ~~*Posting of Identification Means.* The method utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.~~

~~**(2)** Feeders Supplied from Direct-Current Systems.~~

~~Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.212(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.~~

(1) ~~*Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:~~

  (2) ~~A continuous red outer finish~~

  (3) ~~A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black~~

  (4) ~~Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (5) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black~~

(6) ~~*Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:~~

  (7) ~~A continuous black outer finish~~

  (8) ~~A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red~~

  (9) ~~Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)~~

  (10) ~~An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red~~

~~**Part IV.** Outside Branch Circuits and Feeders~~

~~**235.301** General.~~

~~Part IV covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Parts I and II of Article 225 and with Part IV of this article, which supplements or modifies those requirements.~~

~~**235.306** Conductor Size and Support.~~

~~For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.~~

~~**235.310** Wiring on Buildings (or Other Structures).~~

~~The installation of outside wiring on surfaces of buildings (or other structures) shall be installed as provided in 305.3 .~~

~~**235.314** Open-Conductor Spacings.~~

~~Conductors shall comply with the spacings provided in 110.36 and 495.24 .~~

~~**235.339** Rating of Disconnect.~~

~~The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.~~

~~**235.350** Sizing of Conductors.~~

~~The sizing of conductors over 1000 volts shall be in accordance with 235.19(A) for branch circuits and 235.19(B) for feeders.~~

~~**235.351** Isolating Switches.~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.404(B) , (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.~~

~~*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*~~

~~**235.352** Disconnecting Means.~~

~~**(A)** Location.~~

~~A building or structure disconnecting means shall be located in accordance with 225.31(B) , or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~

~~**(B)** Type.~~

~~Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.~~

~~*Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.*~~

~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~**(C)** Locking.~~

~~Disconnecting means shall be lockable open in accordance with 110.25 .~~

~~*Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.*~~

~~**(D)** Indicating.~~

~~Disconnecting means shall clearly indicate whether they are in the open “off” or closed “on” position.~~

~~**(E)** Uniform Position.~~

~~Where disconnecting means handles are operated vertically, the “up” position of the handle shall be the “on” position.~~

~~*Exception: A switching device having more than one “on” position, such as a double throw switch, shall not be required to comply with this requirement.*~~

~~**(F)** Identification.~~

~~Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

~~**235.356** Inspections and Tests.~~

~~**(A)** Pre-Energization and Operating Tests.~~

~~The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.~~

~~**(1)** Instrument Transformers.~~

~~All instrument transformers shall be tested to verify correct polarity and burden.~~

~~**(2)** Protective Relays.~~

~~Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.~~

~~**(3)** Switching Circuits.~~

~~Each switching circuit shall be observed to operate the associated equipment being switched.~~

~~**(4)** Control and Signal Circuits.~~

~~Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.~~

~~**(5)** Metering Circuits.~~

~~All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.~~

~~**(6)** Acceptance Tests.~~

~~Complete acceptance tests shall be performed, after the substation installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.~~

~~**(7)** Relays and Metering Utilizing Phase Differences.~~

~~All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.~~

~~**(B)** Test Report.~~

~~A test report covering the results of the tests required in 235.356(A) shall be delivered to the authority having jurisdiction prior to energization.~~

> ~~Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems* , for an example of acceptance specifications.~~

~~**235.360** Clearances over Roadways, Walkways, Rail, Water, and Open Land.~~

~~**(A)** 22 kV or Less to Ground.~~

~~The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.360(A) .~~

~~Table 235.360(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land~~

~~- Clearance Location m ft Open land subject to vehicles, cultivation, or grazing 5.6 18.5 Roadways, driveways, parking lots, and alleys 5.6 18.5 Walkways 4.1 13.5 Rails 8.1 26.5 Spaces and ways for pedestrians and restricted traffic 4.4 14.5 Water areas not suitable for boating 5.2 17.0~~

~~**(B)** More Than 22 kV to Ground.~~

~~Clearances for the categories shown in Table 235.360(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~**(C)** Special Cases.~~

~~For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.~~

> ~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information.~~

~~**235.361** Clearances over Buildings and Other Structures.~~

~~**(A)** 22 kV or Less to Ground.~~

~~The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.361(A) .~~

~~Table 235.361(A) Clearances over Buildings and Other Structures~~

~~Clearance from Conductors or Live Parts from: Horizontal - Vertical m ft - m ft Building walls, projections, and windows 2.3 7.5 - — — Balconies, catwalks, and similar areas accessible to people 2.3 7.5 - 4.1 13.5 Over or under roofs or projections not readily accessible to people — — - 3.8 12.5 Over roofs accessible to vehicles but not trucks — — - 4.1 13.5 Over roofs accessible to trucks — — - 5.6 18.5 Other structures 2.3 7.5 - — —~~

~~**(B)** More Than 22 kV to Ground.~~

~~Clearances for the categories shown in Table 235.361(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

> ~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information.~~

~~**Part V.** Services~~

~~**235.401** General.~~

~~Part V covers requirements for service conductors and equipment used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Parts I through VII of Article 230 and with Part V of this article, which supplements or modifies those requirements. In no case shall the provisions of Part V apply to equipment on the supply side of the service point.~~

~~**235.402** Service-Entrance Conductors.~~

~~Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).~~

~~**(A)** Conductor Size.~~

~~Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.~~

~~**(B)** Wiring Methods.~~

~~Service-entrance conductors shall be installed by one of the wiring methods covered in 305.3 and 305.15 .~~

~~**235.404** Isolating Switches.~~

~~**(A)** Where Required.~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means, an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment.~~

~~*Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:*~~

(1) ~~*Cannot be opened unless the circuit is disconnected*~~

(2) ~~*Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position*~~

~~**(B)** Fuses as Isolating Switch.~~

~~Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.~~

~~**(C)** Accessible to Qualified Persons Only.~~

~~The isolating switch shall be accessible to qualified persons only.~~

~~**(D)** Connection to Ground.~~

~~Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.~~

~~A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.~~

~~**235.405** Disconnecting Means.~~

~~**(A)** Location.~~

~~The service disconnecting means shall be located in accordance with 230.70 .~~

~~For either overhead or underground primary distribution systems on private property, the service disconnect shall be permitted to be located in a location that is not readily accessible, if the disconnecting means can be operated by mechanical linkage from a readily accessible point, or electronically in accordance with 235.405(C) , where applicable.~~

~~**(B)** Type.~~

~~Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.~~

~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~**(C)** Remote Control.~~

~~For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.~~

~~**235.406** Overcurrent Devices as Disconnecting Means.~~

~~Where the circuit breaker or alternative for it, as specified in 235.408 for service overcurrent devices, meets the requirements specified in 235.405 , it shall constitute the service disconnecting means.~~

~~**235.408** Protection Requirements.~~

~~A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.~~

> ~~Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.~~

~~Overcurrent devices shall conform to 235.408(A) and (B).~~

~~**(A)** Equipment Type.~~

~~Equipment used to protect service-entrance conductors shall meet the requirements of Article 495 , Part II.~~

~~**(B)** Enclosed Overcurrent Devices.~~

~~The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.~~

~~**235.409** Surge Arresters.~~

~~Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.~~

> ~~Informational Note: Surge arresters may be referred to as lightning arresters in older documents.~~

~~**235.410** Service Equipment — General.~~

~~Service equipment, including instrument transformers, shall conform to Part I of Article 495 .~~

~~**235.411** Switchgear.~~

~~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.~~

~~**235.412** Over 35,000 Volts.~~

~~Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48 .~~

equipment's disconnecting means.

Exception: Where there is no branch circuit available from another source, the receptacle outlet shall be permitted to be connected to the load side of the equipment's disconnecting means.

Additional Proposed Changes

File Name	Description	Approved

Article_235_-_FINAL.docx Word Document with Changes for Article 235

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Article 235 is new to the 2023 NEC® and was created to locate requirements for systems operating at over 1000 Vac, 1500 Vdc (referred to as “Medium Voltage” (MV)) from Articles 210, 215, 225, and 230 into one location. This restructuring allows for an improved focus on MV requirements. With this improved focus, it is clear that additional work is needed to ensure requirements are written to address the needs specific to MV installations. With the newly created Article 235, requirements for MV branch circuits (in Part II) and feeders (in Part III) are ‘standalone’ – i.e., do not require a reference back to Articles 210 and 215. However, requirements for MV Outside Branch Circuits and Feeders (Part IV) and Services (Part V) still require the user of the Code to apply “applicable requirements” from the LV Articles of 225 and 230.

The TG recommendation is to make all MV requirements in 235 ‘standalone’, so the user does not have to determine what LV requirements are applicable. To accomplish this, it is necessary to separate the requirements into Articles, just as the requirements are separated for LV circuits. Requirements for Services are the best example of why this is needed, as those requirements are best covered when structured into Parts; however, this type of structure is not possible if all MV circuit requirements are consolidated into a single Article.

This PI is part of a series of 4 PI’s that were developed to make the MV requirements ‘standalone’ from the LV requirements, and to structure those requirements using a similar approach. The 4 PIs would result in the following 4 Articles:

235 - Branch Circuits Over 1000 Volts ac, 1500 V dc, Nominal
236 - Feeders over 1000 V ac, 1500 V dc, Nominal
237 - Outside Feeders and Branch Circuits Over 1000 Volt ac, 1500 V dc, Nominal
238 - Services Over 1000 Volt ac, 1500 V dc, Nominal

This series of PI’s were also developed to ensure that requirements are written for MV, as opposed to being written for LV, then assumed to apply to MV.

The focus of this PI is to revise Article 235 to apply only to “Branch Circuits Over 1000 Volts ac, 1500 Volts dc, Nominal”. Below is a summary of the changes:

- The Article is restructured with Part I as General for branch circuits, Part II for “Branch-Circuit Ratings”, and Part III for “Required Outlets”.
- References to “panelboards” are removed, as there aren’t MV panelboards.
- Requirements for overcurrent protection are revised to address the fact that MV equipment is rated for operation at 100% of their rating (as opposed to LV equipment, where the default is 80%). The load criteria for selecting the minimum overcurrent device rating or setting was also changed from “Continuous and Non-Continuous” criteria to “Simultaneous Loads” criteria to reflect MV practices. The new criteria is also in line with the criteria for sizing of branch circuit conductors in 235.19.
- Requirements for branch circuit outlets are updated to reflect appropriate requirements for MV circuits.

Related Public Inputs for This Document

Related Input	Relationship

Public Input No. 3223-NFPA 70-2023 [New Article after 235]	New Article for Feeders
Public Input No. 3224-NFPA 70-2023 [New Article after 235]	New Article for Outside Branch Circuits and Feeders
Public Input No. 3225-NFPA 70-2023 [New Article after 235]	New Article for Services
Public Input No. 3223-NFPA 70-2023 [New Article after 235]	
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Article 235 Branch Circuits~~, Feeders, and Services~~ Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

235.1 Scope.

This article provides the general requirements for branch circuits~~, feeders, and services~~ over 1000 volts ac or 1500 volts dc, nominal.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

~~Part II. Branch Circuits~~

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment		440.6, 440.31, and 440.32
Busways		368.17
Central heating equipment other than fixed electric space-heating equipment		422.12
Fixed electric heating equipment for pipelines and vessels		427.4
Fixed electric space-heating equipment		424.4
Fixed outdoor electrical deicing and snow-melting equipment		426.4
Infrared lamp industrial heating equipment		422.48 and 424.3
Motors, motor circuits, and controllers	430	

235.5 Conductor Identification for Branch Circuits.

(A) Grounded Conductor.

The grounded conductor of a branch circuit shall be identified in accordance with 200.6.

(B) Equipment Grounding Conductor.

The equipment grounding conductor shall be identified in accordance with 250.119.

(C) Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 235.5(C)(1) or (C)(2), as applicable.

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

(b) *Posting of Identification Means.* The method used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment. The label shall

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be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

235.6 Branch-Circuit Voltage Limitations Over 1000 volts ac or 1500 volts dc, Nominal, Between Conductors.

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Circuits exceeding 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.

235.9 Circuits Derived from Autotransformers.

Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer.

235.10 Ungrounded Conductors Tapped from Grounded Systems.

Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductors of circuits that have a grounded neutral conductor. Switching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switch together where such switching devices also serve as a disconnecting means as required by the following sections:

(1) 410.93 for double-pole switched lampholders

(2) 410.104(B) for electric-discharge lamp auxiliary equipment switching devices

(3) 422.31(B) for an appliance

(4) 424.20 for a fixed electric space-heating unit

(5) 426.51 for electric deicing and snow-melting equipment

(6) 430.85 for a motor controller

(7) 430.103 for a motor

235.11 Branch Circuits Required.

The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.

Part II. Branch-Circuit Ratings

235.18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.

235.19 Conductors — Minimum Ampacity and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Branch-circuit conductors shall be sized in accordance with 235.19(A) or (B).

(A) General.

The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(B) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.

235.20 Overcurrent Protection.

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with 245.26 and 235.20(A) through (C).

(A) ~~Continuous and Noncontinuous~~Simultaneous Loads.

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The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads on the branch circuit that will be operated simultaneously. ~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load.~~

~~*Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.*~~

(B) Conductor Protection.

Conductors shall be protected in accordance with the ampacities specified in 235.19~~310.14 or 315.60, as applicable~~.

(C) Equipment.

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table 240.3 for equipment.

235.22 Permissible Loads, Individual Branch Circuits.

An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.

235.23 Permissible Loads, Multiple-Outlet Branch Circuits. A branch circuit shall be permitted to supply~~ing~~ two or more outlets or receptacles. ~~shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24, and in no case shall the load~~ The sum of all loads that will be operated simultaneously shall not exceed the branch-circuit ampere rating.

~~**(A) 15- and 20-Ampere Branch Circuits.**~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1) Cord-and-Plug-Connected Equipment Not Fastened in Place.**~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2) Utilization Equipment Fastened in Place.**~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B) 30-Ampere Branch Circuits.**~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(C) 40- and 50-Ampere Branch Circuits.**~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D) Branch Circuits Larger Than 50 Amperes.**~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

Part III. Required Outlets

235.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 235~~10~~.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

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~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

(B) Other Indoor Electrical Equipment.

~~In other than one- and two-family dwellings, a~~A receptacle outlet shall be located within the same room or other area as indoor equipment requiring servicing~~ as specified in 235~~10.63(B)(1) and (B)(2)~~. The required receptacle outlet shall not be connected to the load side of the equipment's disconnecting means.

Exception: Where there is no branch circuit available from another source, the receptacle outlet shall be permitted to be connected to the load side of the equipment's disconnecting means.

~~**(1) Indoor Service Equipment.**~~

~~The required receptacle outlet shall be located within the same room or area as the service equipment.~~

~~**(2) Indoor, Other Than Service Equipment Requiring Dedicated Equipment Spaces.**~~

~~For switchgear, motor control centers, and other equipment requiring servicingWhere equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shouldshall not be connected to the load side of the equipment's disconnecting means, if practical.~~

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Article 236~~Part III.~~ Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal

236~~5~~.1~~201~~ Scope~~General~~.
~~Part III~~This article covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc, nominal.
Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

236~~5~~.~~20~~2 Minimum Ampacity~~Rating~~ and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than the equipment grounding conductor size ~~that~~ required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors ~~over 1000 volts~~ shall be sized in accordance with 236~~5~~.~~20~~2(A), (B), or (C).
(A) Feeders Supplying Transformers.
The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.
(B) Feeders Supplying Transformers and Utilization Equipment.
The ampacity of feeder conductors~~s~~ supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100~~25~~ percent of the designed potential load of the utilization equipment that will be operated simultaneously.
(C) Supervised Installations.
For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision~~ in accordance with 310.14(B) or 315.60(B)~~. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

236~~5~~.~~20~~3 Overcurrent Protection.
Feeders shall be protected against overcurrent in accordance with 245.26 and 245.27. The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads that will be operated simultaneously.

236~~5~~.~~20~~5 Diagrams of Feeders.
If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.
236~~5~~.~~20~~6 Feeder Equipment Grounding Conductor.
Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of 250.32 shall apply.
236~~5~~.~~2~~12 Identification for Feeders.

(A) Grounded Conductor.
The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6.
(B) Equipment Grounding Conductor.
The equipment grounding conductor shall be identified in accordance with 250.119.
(C) Identification of Ungrounded Conductors.
Ungrounded conductors shall be identified in accordance with 236~~5~~.~~2~~12(C)(1) or (C)(2), as applicable.
(1) Feeders Supplied from More Than One Nominal Voltage System.
Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(1)(a) and (C)(1)(b).

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

(b) *Posting of Identification Means.* The method utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

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(2) Feeders Supplied from Direct-Current Systems.
Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

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Article 237 Outside Branch Circuits and Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal~~Part IV. Outside Branch Circuits and Feeders~~

Part I. General

237~~5~~.~~30~~1 Scope~~General~~.
This article~~Part IV~~ covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. ~~Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Parts I and II of Article 225 and with Part IV of this article, which supplements or modifies those requirements.~~

237.4 Conductor Insulation.

Where within 3.0 m (10 ft) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated for the nominal voltage. The insulation of conductors in cables or raceways in wet locations, shall comply with 310.10(C) for systems rated up to 2000 volt, or be rated for wet locations for systems rated over 2000 volts.

Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.

237~~5~~.~~30~~6 Conductor Sizes for Overhead Spans~~ and Support~~.
For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.

237~~5~~.~~3~~10 Wiring on Buildings (or Other Structures).
The installation of outside wiring on surfaces of buildings (or other structures) shall be one of the methods permitted ~~installed as provided~~ in 305.3.

237.12 Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures.

Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with **238.52~~XX (230.52)~~**. Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with **238.54~~XX (230.54)~~**.

237.14 Open-Conductor Supports and Spacings.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

~~**235.314 Open-Conductor Spacings.**~~
~~Conductors shall comply with the spacings provided in 110.36 and 495.24.~~

237.15 Supports over Buildings.

Outside branch-circuit and feeder conductors passing over a building shall be securely supported.

237.16 Attachment to Buildings.

(A) Point of Attachment.

The point of attachment to a building shall be in accordance with 238~~0~~.26.

(B) Means of Attachment.

The means of attachment to a building shall be in accordance with 238~~0~~.27.

237~~5~~.18~~360~~ Clearances over Roadways, Walkways, Rail, Water, and Open Land.
(A) 22 kV or Less to Ground.
The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237.18~~5.360~~(A).

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Table 237~~5~~.18~~360~~(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land

Location	Clearance m	Clearance ft
Open land subject to vehicles, cultivation, or grazing	5.6	18.5
Roadways, driveways, parking lots, and alleys	5.6	18.5
Walkways	4.1	13.5
Rails	8.1	26.5
Spaces and ways for pedestrians and restricted traffic	4.4	14.5
Water areas not suitable for boating	5.2	17.0

(B) More Than 22 kV to Ground.

Clearances for the categories shown in Table 237.18~~5.360~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

(C) Special Cases.

For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

237~~5~~.19~~361~~ Clearances~~ over Buildings and Other Structures~~.

(A) Clearances over Buildings and Other Structures - -22 kV or Less to Ground.

The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237~~5~~.19~~361~~(A).

Table 237~~5~~.19~~361~~(A) Clearances over Buildings and Other Structures

Clearance from Conductors or Live Parts from:	Horizontal m	Horizontal ft	Vertical m	Vertical ft
Building walls, projections, and windows	2.3	7.5	—	—
Balconies, catwalks, roofs, and similar areas readily accessible to people	2.3	7.5	4.1	13.5
Over or under roofs or projections not readily accessible to people	—	—	3.8	12.5
Over roofs accessible to vehicles but not trucks	—	—	4.1	13.5
Over roofs accessible to trucks	—	—	5.6	18.5
Other structures	2.3	7.5	—	—

(B) Clearances over Buildings and Other Structures - More Than 22 kV to Ground.

Clearances for the categories shown in Table 237~~5~~.19~~361~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

(C) Clearance from Swimming Pools, Fountains, and Similar Installations.

Clearances from swimming pools, fountains, and similar installations shall comply with 680.9.

(D) Clearance from Communication Wires and Cables.

Conductors shall have adequate clearance from communication wires and cables.

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Informational Note: Adequate clearance from communication wires and cables may depend on both specific electrical and physical installation details. See ANSI/IEEE C2-2022, *National Electrical Safety Code*, for additional information.

237.20 Protection Against Physical Damage.

Conductors installed on buildings, structures, or poles shall be protected against physical damage as provided for services in 238.50.

237.21 Multiconductor Cables on Exterior Surfaces of Buildings (or Other Structures).

Supports for multiconductor cables on exterior surfaces of buildings (or other structures) shall be as provided in 238.51.

237.22 Raceways on Exterior Surfaces of Buildings or Other Structures.

Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations.

237.26 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead conductor spans.

237.27 Raceway Seal.

Where a raceway enters a building or structure from outside, it shall be sealed in accordance with 305.15(F) and 300.7(A). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

Part II. Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)

237.30 Number of Supplies.

A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 237.30(A) through (E).

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 237.30(A) through (E).

(A) Special Conditions.

Additional feeders or branch circuits shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Parallel power production systems

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(7) Electric vehicle power transfer systems listed, labeled, and identified for more than a single branch circuit or feeder

(8) Docking facilities and piers

(B) Common Supply Equipment.

Where feeder conductors originate in the same equipment, and each feeder terminates in a single disconnecting means, not more than six feeders shall be permitted. Where more than one feeder is installed in accordance with this section, all feeder disconnects supplying the building or structure shall be grouped in the same location, and the requirements of 237.33 shall not apply. Each disconnect shall be marked to indicate the load served.

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(C) Special Occupancies.

By special permission, additional feeders or branch circuits shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more supplies necessary

(D) Different Characteristics.

Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses.

(E) Documented Switching Procedures.

Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained.

237.31 Disconnecting Means.

(A) General.
Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

(B) Location.

The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(C) Type.

Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals. Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. If the disconnect does not have visible break contacts, an isolating switch in accordance with 237.31(J) shall be installed.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting

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means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(D) Locking.

Disconnecting means shall be lockable open in accordance with 110.25.

Exception: Where a disconnecting means consists of fused cutouts, it shall not be required to be lockable open.

(E) Indicating.

Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.

(F) Uniform Position.

Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.

Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.

(G) Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

(H) Manually or Power Operable.

The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.

(I) Disconnection of Grounded Conductor in a Grounded System.

Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multi-section ~~switchboard or~~ switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the ~~switchboard or~~ switchgear, if the ~~switchboard section or~~ switchgear section is marked to indicate a grounded conductor disconnect is contained within the equipment.

(J) Isolating Switches.

Where the building disconnecting means does not provide visible break contacts, an isolating switch with visible break contacts and meeting the requirements of 238.70(F)(2), (3),and (4)~~235.404(B), (C), and (D)~~ shall be installed on the supply side of the disconnecting means and all associated equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.

237.33 Maximum Number of Disconnects.

(A) General.

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The disconnecting means for each supply permitted by 237.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in a switchgear assembly. There shall be no more than six disconnects per supply grouped in any one location.

Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power-operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.

(B) Single-Pole Units.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. Where single-pole units are used on a multi-pole circuit, these units shall be considered as one switch, with respect to 237.33(A).

237.34 Grouping of Disconnects.

(A) General.

The two to six disconnects as permitted in 237.33 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six disconnecting means permitted in 237.33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

(B) Additional Disconnecting Means.

The one or more additional disconnecting means for fire pumps or for emergency, legally required standby or optional standby system permitted by 237.30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.

237.35 Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.

Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

237~~5~~.~~3~~39 Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the ~~calculated~~ load as determined by both 237.39(A) and (B), or by 237.39(C):

(A) Branch Circuits and Feeders.
The rating of the disconnect shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Branch Circuits and Feeders Supplying Transformers and Utilization Equipment.
The rating of the disconnect supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, the rating of the disconnect shall be permitted to be determined by qualified persons under engineering supervision, but the determined rating shall not be less than size of the feeder or branch circuit supplying the disconnect. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

~~to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.~~

237~~5~~.40~~350~~ Sizing of Conductors.

The sizing of conductors ~~over 1000 volts~~ shall be in accordance with 235.19~~(A)~~ for branch circuits and 236.2~~235.19(B)~~ for feeders.

~~**235.351 Isolating Switches.**~~
~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.404(B), (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.~~
~~*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*~~
~~**235.352 Disconnecting Means.**~~
~~**(A) Location.**~~
~~or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~~~A building or structure disconnecting means shall be located in accordance with 225.31(B), or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~
~~**(B) Type.**~~
~~Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.~~
~~*Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.*~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~
~~**(C) Locking.**~~
~~Disconnecting means shall be lockable open in accordance with 110.25.~~
~~*Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.*~~
~~**(D) Indicating.**~~
~~Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.~~
~~**(E) Uniform Position.**~~
~~Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.~~
~~*Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.*~~
~~**(F) Identification.**~~
~~Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

237~~5~~.42~~356~~ Inspections and Tests.

(A) Pre-Energization and Operating Tests.

The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.

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(1) Instrument Transformers.

All instrument transformers shall be tested to verify correct polarity and burden.

(2) Protective Relays.

Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.

(3) Switching Circuits.

Each switching circuit shall be observed to operate the associated equipment being switched.

(4) Control and Signal Circuits.

Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

(5) Metering Circuits.

All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.

(6) Acceptance Tests.

Complete acceptance tests shall be performed, after the ~~substation~~ installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

(7) Relays and Metering Utilizing Phase Differences.

All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.

(B) Test Report.

A test report covering the results of the tests required in 237~~5~~.42~~356~~(A) shall be delivered to the authority having jurisdiction prior to energization.

Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*, for an example of acceptance specifications.

~~**235.360 Clearances over Roadways, Walkways, Rail, Water, and Open Land.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.360(A).~~

~~**Table 235.360(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land**~~

~~Location~~	~~Clearance~~	
	~~m~~	~~ft~~
~~Open land subject to vehicles, cultivation, or grazing~~	~~5.6~~	~~18.5~~
~~Roadways, driveways, parking lots, and alleys~~	~~5.6~~	~~18.5~~
~~Walkways~~	~~4.1~~	~~13.5~~
~~Rails~~	~~8.1~~	~~26.5~~
~~Spaces and ways for pedestrians and restricted traffic~~	~~4.4~~	~~14.5~~
~~Water areas not suitable for boating~~	~~5.2~~	~~17.0~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.360(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~**(C) Special Cases.**~~

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~~For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

~~**235.361 Clearances over Buildings and Other Structures.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.361(A).~~

~~**Table 235.361(A) Clearances over Buildings and Other Structures**~~

~~**Clearance from Conductors or Live Parts from:**~~	~~**Horizontal**~~		~~**Vertical**~~	
	~~**m**~~	~~**ft**~~	~~**m**~~	~~**ft**~~
~~Building walls, projections, and windows~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~
~~Balconies, catwalks, and similar areas accessible to people~~	~~2.3~~	~~7.5~~	~~4.1~~	~~13.5~~
~~Over or under roofs or projections not readily accessible to people~~	~~—~~	~~—~~	~~3.8~~	~~12.5~~
~~Over roofs accessible to vehicles but not trucks~~	~~—~~	~~—~~	~~4.1~~	~~13.5~~
~~Over roofs accessible to trucks~~	~~—~~	~~—~~	~~5.6~~	~~18.5~~
~~Other structures~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.361(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

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Article 238 Services Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

~~**Part V. Services**~~

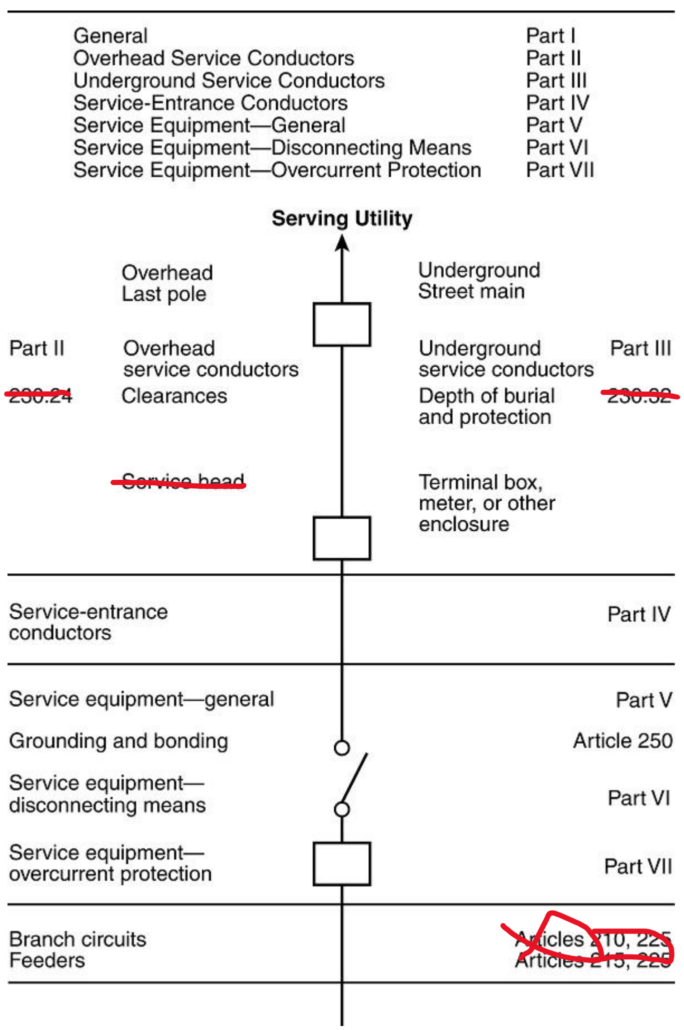
23~~5~~8.~~40~~1 Scope~~General~~.

This article ~~Part V~~ covers requirements for service conductors and equipment for control and protection of services over 1000 volts ac or 1500 volts dc, nominal, and their installation requirements. ~~used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Parts I through VII of Article 230 and with Part V of this article, which supplements or modifies those requirements~~. In no case shall ~~the provisions of~~ this article~~Part V~~ apply to equipment on the supply side of the service point.

Informational Note No. 1: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 2: See Informational Note Figure 238.1

Figure Informational Note Figure 238.1 Services.



238.2 Number of Services.

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A building or other structure served shall be supplied by only one service unless permitted in 238.2(A) through (D). For the purpose of 238.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.

(A) Special Conditions.

Additional services shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Interconnected electric power production sources

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(B) Special Occupancies.

By special permission, additional services shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more services necessary

(C) Capacity Requirements.

Additional services shall be permitted under any of the following:

(1) Where the capacity requirements are in excess of 2000 amperes

(2) Where the load requirements of an installation are greater than the serving agency normally supplies through one service

(3) By special permission

(D) Different Characteristics.

Additional services shall be permitted for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

(E) Identification.

Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders, and branch circuits supplying that building or structure and the area served by each.

238.3 One Building or Other Structure Not to Be Supplied Through Another.

Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure.

238.6 Conductors Considered Outside the Building.

Conductors shall be considered outside of a building or other structure under any of the following conditions:

(1) Where installed under not less than 50 mm (2 in.) of concrete beneath a building or other structure.

(2) Where installed within a building or other structure in a raceway that is encased in concrete or masonry structure not less than 50 mm (2 in.) thick

(3) Where installed in any vault that meets the construction requirements of Part III of Article 450

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(4) Where installed in conduit and under not less than 450 mm (18 in.) of earth beneath a building or other structure.

Informational Note: See 305.15 for cover requirements for underground installations.

238.7 Other Conductors.

Circuit conductors other than service conductors, shall not be installed in the same raceway, cable, handhole enclosure, underground box, cable tray, or cable bus as the service conductors.

Exception No. 1: Grounding electrode conductors or supply side bonding jumpers or conductors shall be permitted within service raceways.

Exception No. 2: Load management control conductors having overcurrent protection shall be permitted within service raceways.

Exception No. 3: Conductors associated with sump pumps, having overcurrent protection, shall be permitted within underground boxes.

238.8 Raceway Seal.

Where a service raceway enters a building or structure, it shall be sealed in accordance with 305.5(F) and 305.16(A), as applicable. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

238.9 Clearances.

Clearances for service conductors shall comply with 237.19.

238.10 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead service conductors or service equipment.

238~~5~~.15~~412~~ Over 35,000 Volts.

Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.

Part II. Overhead Service Conductors

238.23 Size and Ampacity.

Conductors shall have adequate mechanical strength and shall be sized in accordance with 238.23(A), (B), or (C).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.26 Point of Attachment.

The point of attachment of the overhead service conductors to a building or other structure shall provide the minimum clearances as specified in 237.19. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

238.27 Means of Attachment.

Conductors shall be attached to noncombustible, nonabsorbent insulators securely attached to the building or other structure.

238.28 Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.

238.29 Surge Arresters.

Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.

Informational Note: Surge arresters may be referred to as lightning arresters in older documents.

Part III. Underground Service Conductors

238.30 Installation.

(A) Insulation.

Underground service conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial

(B) Wiring Methods.

Underground service conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Rigid metal conduit (RMC)

(2) Intermediate metal conduit (IMC)

(3) Nonmetallic underground conduit with conductors (NUCC)

(4) High density polyethylene conduit (HDPE)

(5) Rigid polyvinyl chloride conduit (PVC)

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(6) Reinforced thermosetting resin conduit (RTRC)

(7) Type MV or Type MC cable identified for direct burial applications

(8) Type TC-ER cable where rated for the voltage and identified for service entrance use and direct burial applications

238.31 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Conductors shall be sized in accordance with 238.31(A), (B), or (C), and shall have a minimum size in accordance with 238.31(D) and (E).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

(D) Minimum Size.
The conductors shall not be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(E) Grounded Conductors.
The grounded conductor shall not be smaller than the minimum size required by 250.24(D) and Part X of Article 250.

238.32 Protection Against Damage.

Underground service conductors shall be protected against damage in accordance with 305.15. Service conductors entering a building or other structure shall be installed in accordance with 238.6 or protected by a raceway wiring method identified in 238.43.

238.33 Spliced Conductors.

Service conductors shall be permitted to be spliced or tapped in accordance with 110.14, 238.46, 305.15(D), 300.13, and 300.15.

Part IV. Service-Entrance Conductors

238.40 Number of Service-Entrance Conductor Sets.

Each service drop, set of overhead service conductors, set of underground service conductors, or service lateral shall supply only one set of service-entrance conductors.

Exception No. 1: A building with more than one occupancy shall be permitted to have one set of service-entrance conductors for each service, as permitted in 238.2, run to each occupancy or group of occupancies. If the number of service disconnect locations for any given classification of service does not exceed six, the requirements of 238.2(E) shall apply at each location. If the number of service disconnect locations exceeds six for any given supply classification, the following conditions shall apply:

(1) All service disconnect locations for all supply characteristics, together with any branch circuit or feeder supply sources, shall be clearly described using graphics or text, or both, on one or more plaques

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(2) The plaques shall be located in an approved, readily accessible location(s) on the building or structure served and as near as practicable to the point(s) of attachment or entry(ies) for each service drop or service lateral and for each set of overhead or underground service conductors.

Exception No. 2: Where two to six service disconnecting means in separate enclosures are grouped at one location and supply separate loads from one service drop, set of overhead service conductors, set of underground service conductors, or service lateral, one set of service-entrance conductors shall be permitted to supply each or several such service equipment enclosures.

Exception No. 3: One set of service-entrance conductors connected to the supply side of the normal service disconnecting means shall be permitted to supply each or several systems covered by 238.82(5) or 238.82(6).

238.41 Insulation of Service-Entrance Conductors.

Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial

238.42 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the service circuit grounded conductor shall not be smaller than the equipment grounding conductor size required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Service entrance conductors shall be sized in accordance with 238.42(A), (B), or (C), but shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.

(A) Services Supplying Transformers.
The ampacity of service entrance conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service entrance conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service entrance conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.43 Wiring Methods.

Service-entrance conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Open wiring on insulators

(2) Rigid metal conduit (RMC)

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(3) Intermediate metal conduit (IMC)

(4) Electrical metallic tubing (EMT)

(5) Busways

(6) Rigid polyvinyl chloride conduit (PVC)

(7) Cablebus

(8) Type MC cable

(9) High density polyethylene conduit (HDPE)

(10) Nonmetallic underground conduit with conductors (NUCC)

(11) Reinforced thermosetting resin conduit (RTRC)

(12) Type TC-ER cable where rated for the voltage and identified for use as service entrance conductors

(13) Insulated Bus Pipe (IBP)

238.44 Cable Trays.

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

(1) Type MC cable

(2) Single Type MV conductors 1/0 and larger that are listed for use in cable tray

(3) Type TC-ER cable

Such cable trays shall be identified with permanently affixed labels with the wording "Service-Entrance Conductors." The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier identified for use with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

238.46 Spliced and Tapped Conductors.

Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 305.15(D), 300.13, and 300.15. Pressure connectors, and devices for splices and taps shall be listed.

238.50 Protection Against Physical Damage.

(A) Underground Service-Entrance Conductors.

Underground service-entrance conductors shall be protected against physical damage in accordance with 305.15.

(B) All Other Service-Entrance Conductors.

Open wiring on insulators and Type MC cable shall not be installed within 3.0 m (10 ft) of grade level or where exposed to physical damage.

Exception: Type MC cable shall be permitted within 3.0 m (10 ft) of grade level where not exposed to physical damage or where protected in accordance with 300.5(D).

238.51 Open-Conductor Support.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

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238.52 Individual Conductors Entering Buildings or Other Structures.

Where individual open conductors enter a building or other structure, they shall enter through roof or wall bushings or through the wall in an upward slant through individual, noncombustible, nonabsorbent insulating tubes. Drip loops shall be formed on the conductors before they enter the tubes.

238.53 Raceways to Drain.

Where exposed to the weather, raceways enclosing service-entrance conductors shall be listed or approved for use in wet locations and arranged to drain. Where embedded in masonry, raceways shall be arranged to drain.

238.54 Overhead Service Locations.

Service-entrance conductors shall be held securely in place and shall be arranged so that water will not enter service raceway or equipment.

Part V. Service Equipment — General

238.62 Service Equipment — Enclosed, Guarded, and Barriered.

(A) Enclosed and Guarded.
Energized parts of service equipment shall be enclosed or guarded in accordance with 110.18 and Part III of 110.

(B) Barriered.
Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations with the service disconnect in the open position.

238.66 Listing Required.

All equipment used as service equipment shall be listed or field evaluated.

Part VI. Service Equipment — Disconncting Means

238.70 General. Means shall be provided to disconnect all ungrounded conductors from the service conductors.

(A) Location.

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(B~~C~~) Remote Control.

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For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.

(C) Marking.

Each service disconnect shall be permanently marked to identify it as a service disconnect.

(D~~B~~) Type.

Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.
Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. Service equipment installed in hazardous (classified) locations shall comply with the hazardous location requirements.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(F)~~235.404~~ Isolating Switches.

(1~~A~~) Where Required.

Where the service disconnecting means does not provide visible break contacts, ~~oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means,~~ an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.
~~Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:~~

~~(1) Cannot be opened unless the circuit is disconnected~~

~~(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position~~

(2~~B~~) Fuses as Isolating Switch.

Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.

(3~~C~~) Accessible to Qualified Persons Only.

The isolating switch shall be accessible to qualified persons only.

(4~~D~~) Connection to Ground.

Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.

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A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.

(G) Overcurrent Devices as Disconnecting Means.
Where the circuit breaker or alternative for it, as specified in 238.91 for service overcurrent devices, meets the requirements specified in 238.70(A) through (F), it shall constitute the service disconnecting means.

238.71 Maximum Number of Disconnects.

Each service shall have only one disconnecting means unless the requirements of 238.71(B) are met.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. For the purpose of this requirement, where single-pole units are used on a multi-pole circuit, these units shall be considered as one disconnecting means.

(A) General.

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

(1) Power monitoring equipment

(2) Surge-arrestor(s)

(3) Control circuit of the ground-fault protection system

(4) Power-operable service disconnecting means

(B) Two to Six Service Disconnecting Means.

Two to six service disconnects shall be permitted for each service permitted by 238.2 or for each set of service-entrance conductors permitted by 238.40, Exception Nos. 1 or 3. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:

(1) Separate enclosures with a main service disconnecting means in each enclosure

(2) Service disconnects in switchgear or transfer switches, where each disconnect is located in a separate compartment

Exception: Existing service equipment, installed in compliance with previous editions of this Code that permitted multiple service disconnecting means in a single enclosure, section, or compartment, shall be permitted to contain a maximum of six service disconnecting means.

Informational Note: Transfer switches are provided with one service disconnect or multiple service disconnects in separate compartments.

238.72 Grouping of Disconnects.

(A) General.

The two to six disconnects, if permitted in 238.71, shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six service disconnecting means permitted in 238.71, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means. If remotely installed in accordance with this exception, a plaque shall be posted at the location of the remaining grouped disconnects denoting its location.

(B) Additional Service Disconnecting Means.

The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by 238.2 shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

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(C) Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's service disconnecting means.

Exception: In a multiple-occupancy building where electric service and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the service disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

238.75 Disconnection of Grounded Conductor.

Where a grounded conductor is supplied, and the service disconnecting means does not disconnect the grounded conductor from the premises wiring, other means shall be provided for this purpose in the service equipment. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose. In a multisection switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchgear, if the switchgear section is marked to indicate a grounded conductor disconnect is located within.

Informational Note: In switchgear, the disconnecting means provided for the grounded conductor is typically identified as a neutral disconnect link and is typically located in the bus to which the service grounded conductor is connected.

238.76 Manually or Power Operable.

The service disconnecting means for ungrounded service conductors shall consist of one of the following:

(1) A manually operable switch, a set of fused cutouts, or circuit breaker, equipped with a handle or other suitable operating means

(2) Power-operated devices, provided the devices can be opened by hand in the event of a power supply failure

238.77 Indicating.

The service disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.

238.79 Rating of Service Disconnecting Means.

The service disconnecting means shall have a continuous current rating of not less than the required minimum ampacity of the service-entrance conductors, as determined by 238.42.

238.81 Connection to Terminals.

The service-entrance conductors shall be connected to the service disconnecting means by pressure connectors, clamps, or other approved means. Connections that depend on solder shall not be used.

238.82 Equipment Connected to the Supply Side of Service Disconnect.

Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(1) Cable limiters.

(2) Instrument transformers (current and voltage), impedance shunts, load management devices, surge arresters.

(3) Conductors used to supply energy management systems, circuits for standby power systems, fire pump equipment, and fire and sprinkler alarms, if provided with service equipment and installed in accordance with requirements for service-entrance conductors.

(4) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources, if provided with a disconnecting means that complies with 238.70, and overcurrent protection as specified in Part VII of Article 238.

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(5) Control circuits for power-operable service disconnecting means, if suitable overcurrent protection and disconnecting means are provided.

(6) Ground-fault protection systems, where installed as part of listed equipment, if suitable overcurrent protection and disconnecting means are provided.

(7) Control power circuits for protective relays where installed as part of listed equipment, if overcurrent protection and disconnecting means are provided.

Part VII. Service Equipment — Overcurrent Protection

238.90 Where Required.

Each ungrounded service conductor shall have overload protection.

(A) Ungrounded Conductor.

Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the ampacity of the conductor. For the purpose of this requirement, where single-pole overcurrent devices are used on a multi-pole circuit, these devices shall be considered as one protective device.

Exception No. 1: For motor-starting currents, ratings that comply with 430.52, 430.62, and 430.63 shall be permitted.

Exception No. 2: Overload protection for fire pump supply conductors shall comply with 695.4(B)(2)(a).

(B) Not in Grounded Conductor.

No overcurrent device shall be inserted in a grounded service conductor except a circuit breaker that simultaneously opens all conductors of the circuit.

238.91 Protection Requirements.

(A) General.
The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

(B) Location.
A short-circuit protective device shall be provided and shall protect all ungrounded conductors that it supplies. The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto. Where fuses are used as the service overcurrent device, the disconnecting means shall be located ahead of the supply side of the fuses.

(C) Equipment Type.

Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.

238.92 Locked Service Overcurrent Devices.

Where the service overcurrent devices are locked or sealed or are not readily accessible to the occupant, branch-circuit or feeder overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of lower ampere rating than the service overcurrent device.

238.93 Protection of Specific Circuits.

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Where necessary to prevent tampering, an automatic overcurrent device that protects service conductors supplying only a specific load, shall be permitted to be locked or sealed. The lock or seal shall be located so as to be accessible.

~~**235.402 Service-Entrance Conductors.**~~
~~Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).~~

~~**(A) Conductor Size.**~~

~~Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.~~

~~**(B) Wiring Methods.**~~

~~Service-entrance conductors shall be installed by one of the wiring methods covered in 305.3 and 305.15.~~

~~**235.404 Isolating Switches.**~~

~~**(A) Where Required.**~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means, an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment.~~

~~*Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:*~~

~~*(1) Cannot be opened unless the circuit is disconnected*~~

~~*(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position*~~

~~**(B) Fuses as Isolating Switch.**~~

~~Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.~~

~~**(C) Accessible to Qualified Persons Only.**~~

~~The isolating switch shall be accessible to qualified persons only.~~

~~**(D) Connection to Ground.**~~

~~Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.~~

~~A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.~~

~~**235.405 Disconnecting Means.**~~

~~**(A) Location.**~~

~~The service disconnecting means shall be located in accordance with 230.70.~~
~~For either overhead or underground primary distribution systems on private property, the service disconnect shall be permitted to be located in a location that is not readily accessible, if the disconnecting means can be operated by mechanical linkage from a readily accessible point, or electronically in accordance with 235.405(C), where applicable.~~

~~**(B) Type.**~~

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~~Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~(C) Remote Control.~~

~~For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.~~

~~235.406 Overcurrent Devices as Disconnecting Means.~~

~~Where the circuit breaker or alternative for it, as specified in 235.408 for service overcurrent devices, meets the requirements specified in 235.405, it shall constitute the service disconnecting means.~~

~~235.408 Protection Requirements.~~

~~A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.~~

~~Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.~~

~~Overcurrent devices shall conform to 235.408(A) and (B).~~

~~(A) Equipment Type.~~

~~Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.~~

~~(B) Enclosed Overcurrent Devices.~~

~~The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.~~

~~235.409 Surge Arresters.~~

~~Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.~~

~~Informational Note: Surge arresters may be referred to as lightning arresters in older documents.~~

~~235.410 Service Equipment — General.~~

~~Service equipment, including instrument transformers, shall conform to Part I of Article 495.~~

~~235.411 Switchgear.~~

~~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.~~

~~235.412 Over 35,000 Volts.~~

~~Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.~~

Public Input No. 3223-NFPA 70-2023 [New Article after 235]

New Article 236 for " Feeders over 1000 V ac, 1500 V dc, Nominal"

(See Attached Word Document)

Additional Proposed Changes

File Name	Description	Approved
Article_235_-_FINAL.docx	Rewritten Article 235, Including New Article 236	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Article 235 is new to the 2023 NEC® and was created to locate requirements for systems operating at over 1000 Vac, 1500 Vdc (referred to as "Medium Voltage" (MV)) from Articles 210, 215, 225, and 230 into one location. This restructuring allows for an improved focus on MV requirements. With this improved focus, it is clear that additional work is needed to ensure requirements are written to address the needs specific to MV installations. With the newly created Article 235, requirements for MV branch circuits (in Part II) and feeders (in Part III) are 'standalone' – i.e., do not require a reference back to Articles 210 and 215. However, requirements for MV Outside Branch Circuits and Feeders (Part IV) and Services (Part V) still require the user of the Code to apply "applicable requirements" from the LV Articles of 225 and 230.

The TG recommendation is to make all MV requirements in 235 'standalone', so the user does not have to determine what LV requirements are applicable. To accomplish this, it is necessary to separate the requirements into Articles, just as the requirements are separated for LV circuits. Requirements for Services are the best example of why this is needed, as those requirements are best covered when structured into Parts; however, this type of structure is not possible if all MV circuit requirements are consolidated into a single Article.

This PI is part of a series of 4 PI's that were developed to make the MV requirements 'standalone' from the LV requirements, and to structure those requirements using a similar approach. The 4 PIs would result in the following 4 Articles:

235 - Branch Circuits Over 1000 Volts ac, 1500 V dc, Nominal
236 - Feeders over 1000 V ac, 1500 V dc, Nominal
237 - Outside Feeders and Branch Circuits Over 1000 Volt ac, 1500 V dc, Nominal
238 - Services Over 1000 Volt ac, 1500 V dc, Nominal

This series of PI's were also developed to ensure that requirements are written for MV, as opposed to being written for LV, then assumed to apply to MV.

The focus of this PI is to relocate "Part III. Feeders" from Article 235 to a new Article (236) that applies only to "Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal". Below is a summary of the changes:

- Revisions are made in 235.202 (New 236.2) to correct wording regarding minimum size of the feeder circuit grounded conductor, to match the wording as corrected by CMP 10 in 215.2(B) of the 2023 NEC®.
- References to "panelboards" are removed, as there aren't MV panelboards.

- Requirements for overcurrent protection are revised to address the fact that MV equipment is rated for operation at 100% of their rating (as opposed to LV equipment, where the default is 80%). The load criteria for selecting the minimum overcurrent device rating or setting was also added to be in line with the criteria for sizing of MV feeder conductors in 235.202 (New 236.2)
- Added a reference to applicable feeder overcurrent protection requirements from Article 245.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3215-NFPA 70-2023 [Article 235]	Revised Article 235 for Branch Circuits
Public Input No. 3224-NFPA 70-2023 [New Article after 235]	New Article for Outside Branch Circuits and Feeders
Public Input No. 3225-NFPA 70-2023 [New Article after 235]	New Article for Services
Public Input No. 3215-NFPA 70-2023 [Article 235]	
Public Input No. 3224-NFPA 70-2023 [New Article after 235]	
Public Input No. 3225-NFPA 70-2023 [New Article after 235]	

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Submittal Date: Wed Aug 30 12:09:16 EDT 2023

Committee: NEC-P09

Public Input No. 3224-NFPA 70-2023 [New Article after 235]

Add New Article 237 for " Outside Feeders and Branch Circuits Over 1000 Volt ac, 1500 V dc, Nominal"

(See Attached Word Document)

Additional Proposed Changes

File Name	Description	Approved
Article_235_-_FINAL.docx	Rewritten Article 235, with text for New Article 237	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Article 235 is new to the 2023 NEC® and was created to locate requirements for systems operating at over 1000 Vac, 1500 Vdc (referred to as "Medium Voltage" (MV)) from Articles 210, 215, 225, and 230 into one location. This restructuring allows for an improved focus on MV requirements. With this improved focus, it is clear that additional work is needed to ensure requirements are written to address the needs specific to MV installations. With the newly created Article 235, requirements for MV branch circuits (in Part II) and feeders (in Part III) are 'standalone' – i.e., do not require a reference back to Articles 210 and 215. However, requirements for MV Outside Branch Circuits and Feeders (Part IV) and Services (Part V) still require the user of the Code to apply "applicable requirements" from the LV Articles of 225 and 230.

The TG recommendation is to make all MV requirements in 235 'standalone', so the user does not have to determine what LV requirements are applicable. To accomplish this, it is necessary to separate the requirements into Articles, just as the requirements are separated for LV circuits. Requirements for Services are the best example of why this is needed, as those requirements are best covered when structured into Parts; however, this type of structure is not possible if all MV circuit requirements are consolidated into a single Article.

This PI is part of a series of 4 PI's that were developed to make the MV requirements 'standalone' from the LV requirements, and to structure those requirements using a similar approach. The 4 PIs would result in the following 4 Articles:

235 - Branch Circuits Over 1000 Volts ac, 1500 V dc, Nominal
236 - Feeders over 1000 V ac, 1500 V dc, Nominal
237 - Outside Feeders and Branch Circuits Over 1000 Volt ac, 1500 V dc, Nominal
238 - Services Over 1000 Volt ac, 1500 V dc, Nominal

This series of PI's were also developed to ensure that requirements are written for MV, as opposed to being written for LV, then assumed to apply to MV.

The focus of this PI is to relocate "Part IV. Outside Branch Circuits and Feeders" from Article 235 to a new Article (237) that applies only to "Outside Branch Circuits and Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal". Below is a summary of the changes:

- The new Article is structured with Part I as "General" and Part II for "Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)", matching the format of Article 225.

- Requirements from 225 are added and amended to reflect MV requirements:
  - o 237.4 (Conductor Insulation) from 225.4
  - o 237.12 (Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures) from 225.11
  - o 237.14 (Open-Conductor Supports and Spacings) from 225.12 and 225.14
  - o 237.15 (Supports over Buildings) from 225.15
  - o 237.16 (Attachment to Buildings) from 225.16
  - o 237.20 (Protection Against Physical Damage) from 225.20
  - o 237.21 (Multiconductor Cables on Exterior Surfaces of Buildings or Other Structures) from 225.21
  - o 237.22 (Raceways on Exterior Surfaces of Buildings or Other Structures) from 225.22
  - o 237.26 (Vegetation as Support) from 225.26
  - o 237.27 (Raceway Seal) from 225.27
  - o 237.30 (Number of Supplies) from 225.30
  - o 237.31 (Disconnecting Means) from 225.31, as well as requirements from 225.36, 225.37, and 225.38, and relocated requirements from 235.351 and 235.352
  - o 237.33 (Maximum Number of Disconnects) from 225.33
  - o 237.34 (Grouping of Disconnects) from 225.34
  - o 237.35 (Access to Occupants) from 225.35
- Clearance requirements from 235.360 and 235.361 are relocated to be in the proximity of requirements for support and attachment. Requirements for clearances of overhead service conductors (see 230.24) should apply to both services and outside branch circuits and feeders, so appropriate versions of those requirements are located in 237.19.
- Requirements in 237.31 for "Disconnecting Means" are modified to be specific to MV equipment, including requirements that address fused cutouts.
- The Section on "Rating of Disconnects" is modified to reflect MV requirements, using the same requirements proposed for Feeders (235.202, or 236.2 in the newly proposed Article 236).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3215-NFPA 70-2023 [Article 235]	Revised Article 235 for Branch Circuits
Public Input No. 3223-NFPA 70-2023 [New Article after 235]	New Article 236 for Feeders
Public Input No. 3225-NFPA 70-2023 [New Article after 235]	New Article 238 For Services
Public Input No. 3215-NFPA 70-2023 [Article 235]	
Public Input No. 3223-NFPA 70-2023 [New Article after 235]	
Public Input No. 3225-NFPA 70-2023 [New Article after 235]	

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Article 235 Branch Circuits~~, Feeders, and Services~~ Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

235.1 Scope.

This article provides the general requirements for branch circuits~~, feeders, and services~~ over 1000 volts ac or 1500 volts dc, nominal.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

~~Part II. Branch Circuits~~

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment		440.6, 440.31, and 440.32
Busways		368.17
Central heating equipment other than fixed electric space-heating equipment		422.12
Fixed electric heating equipment for pipelines and vessels		427.4
Fixed electric space-heating equipment		424.4
Fixed outdoor electrical deicing and snow-melting equipment		426.4
Infrared lamp industrial heating equipment		422.48 and 424.3
Motors, motor circuits, and controllers	430	

235.5 Conductor Identification for Branch Circuits.

(A) Grounded Conductor.

The grounded conductor of a branch circuit shall be identified in accordance with 200.6.

(B) Equipment Grounding Conductor.

The equipment grounding conductor shall be identified in accordance with 250.119.

(C) Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 235.5(C)(1) or (C)(2), as applicable.

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

(b) *Posting of Identification Means.* The method used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment. The label shall

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be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

235.6 Branch-Circuit Voltage Limitations Over 1000 volts ac or 1500 volts dc, Nominal, Between Conductors.

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Circuits exceeding 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.

235.9 Circuits Derived from Autotransformers.

Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer.

235.10 Ungrounded Conductors Tapped from Grounded Systems.

Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductors of circuits that have a grounded neutral conductor. Switching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switch together where such switching devices also serve as a disconnecting means as required by the following sections:

(1) 410.93 for double-pole switched lampholders

(2) 410.104(B) for electric-discharge lamp auxiliary equipment switching devices

(3) 422.31(B) for an appliance

(4) 424.20 for a fixed electric space-heating unit

(5) 426.51 for electric deicing and snow-melting equipment

(6) 430.85 for a motor controller

(7) 430.103 for a motor

235.11 Branch Circuits Required.

The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.

Part II. Branch-Circuit Ratings

235.18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.

235.19 Conductors — Minimum Ampacity and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Branch-circuit conductors shall be sized in accordance with 235.19(A) or (B).

(A) General.

The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(B) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.

235.20 Overcurrent Protection.

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with 245.26 and 235.20(A) through (C).

(A) ~~Continuous and Noncontinuous~~Simultaneous Loads.

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The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads on the branch circuit that will be operated simultaneously. ~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load.~~

~~*Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.*~~

(B) Conductor Protection.

Conductors shall be protected in accordance with the ampacities specified in 235.19~~310.14 or 315.60, as applicable~~.

(C) Equipment.

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table 240.3 for equipment.

235.22 Permissible Loads, Individual Branch Circuits.

An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.

235.23 Permissible Loads, Multiple-Outlet Branch Circuits. A branch circuit shall be permitted to supply~~ing~~ two or more outlets or receptacles. ~~shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24, and in no case shall the load~~ The sum of all loads that will be operated simultaneously shall not exceed the branch-circuit ampere rating.

~~**(A) 15- and 20-Ampere Branch Circuits.**~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1) Cord-and-Plug-Connected Equipment Not Fastened in Place.**~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2) Utilization Equipment Fastened in Place.**~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B) 30-Ampere Branch Circuits.**~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(C) 40- and 50-Ampere Branch Circuits.**~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D) Branch Circuits Larger Than 50 Amperes.**~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

Part III. Required Outlets

235.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 235~~10~~.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

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~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

(B) Other Indoor Electrical Equipment.

~~In other than one- and two-family dwellings, a~~A receptacle outlet shall be located within the same room or other area as indoor equipment requiring servicing~~ as specified in 2~~35~~10.63(B)(1) and (B)(2)~~. The required receptacle outlet shall not be connected to the load side of the equipment's disconnecting means.

Exception: Where there is no branch circuit available from another source, the receptacle outlet shall be permitted to be connected to the load side of the equipment's disconnecting means.

~~**(1) Indoor Service Equipment.**~~

~~The required receptacle outlet shall be located within the same room or area as the service equipment.~~

~~**(2) Indoor, Other Than Service Equipment Requiring Dedicated Equipment Spaces.**~~

~~For switchgear, motor control centers, and other equipment requiring servicingWhere equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shouldshall not be connected to the load side of the equipment's disconnecting means, if practical.~~

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Article 236~~Part III.~~ Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal

236~~5~~.1~~201~~ Scope~~General~~.

~~Part III~~This article covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc, nominal.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

236~~5~~.~~20~~2 Minimum Ampacity~~Rating~~ and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than the equipment grounding conductor size ~~that~~ required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors ~~over 1000 volts~~ shall be sized in accordance with 236~~5~~.~~20~~2(A), (B), or (C).

(A) Feeders Supplying Transformers.

The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Feeders Supplying Transformers and Utilization Equipment.

The ampacity of feeder conductors~~s~~ supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100~~25~~ percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.

For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision ~~in accordance with 310.14(B) or 315.60(B)~~. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

236~~5~~.~~20~~3 Overcurrent Protection.

Feeders shall be protected against overcurrent in accordance with 245.26 and 245.27. The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads that will be operated simultaneously.

236~~5~~.~~20~~5 Diagrams of Feeders.

If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.

236~~5~~.~~20~~6 Feeder Equipment Grounding Conductor.

Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of 250.32 shall apply.

236~~5~~.~~2~~12 Identification for Feeders.

(A) Grounded Conductor.

The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6.

(B) Equipment Grounding Conductor.

The equipment grounding conductor shall be identified in accordance with 250.119.

(C) Identification of Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 236~~5~~.~~2~~12(C)(1) or (C)(2), as applicable.

(1) Feeders Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(1)(a) and (C)(1)(b).

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

(b) *Posting of Identification Means.* The method utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

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(2) Feeders Supplied from Direct-Current Systems.
Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

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Article 237 Outside Branch Circuits and Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal~~Part IV. Outside Branch Circuits and Feeders~~

Part I. General

237~~5~~.~~30~~1 Scope~~General~~.

This article~~Part IV~~ covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. ~~Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Parts I and II of Article 225 and with Part IV of this article, which supplements or modifies those requirements.~~

237.4 Conductor Insulation.

Where within 3.0 m (10 ft) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated for the nominal voltage. The insulation of conductors in cables or raceways in wet locations, shall comply with 310.10(C) for systems rated up to 2000 volt, or be rated for wet locations for systems rated over 2000 volts.

Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.

237~~5~~.~~30~~6 Conductor Sizes for Overhead Spans~~ and Support~~.

For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.

237~~5~~.~~3~~10 Wiring on Buildings (or Other Structures).

The installation of outside wiring on surfaces of buildings (or other structures) shall be one of the methods permitted ~~installed as provided~~ in 305.3.

237.12 Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures.

Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with **238.52~~XX (230.52)~~**. Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with **238.54~~XX (230.54)~~**.

237.14 Open-Conductor Supports and Spacings.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

~~**235.314 Open-Conductor Spacings.**~~
~~Conductors shall comply with the spacings provided in 110.36 and 495.24.~~

237.15 Supports over Buildings.

Outside branch-circuit and feeder conductors passing over a building shall be securely supported.

237.16 Attachment to Buildings.

(A) Point of Attachment.

The point of attachment to a building shall be in accordance with 238~~0~~.26.

(B) Means of Attachment.

The means of attachment to a building shall be in accordance with 238~~0~~.27.

237~~5~~.18~~360~~ Clearances over Roadways, Walkways, Rail, Water, and Open Land.
(A) 22 kV or Less to Ground.
The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237.18~~5.360~~(A).

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Table 237~~5.~~.18~~360~~(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land

Location	Clearance	
	m	ft
Open land subject to vehicles, cultivation, or grazing	5.6	18.5
Roadways, driveways, parking lots, and alleys	5.6	18.5
Walkways	4.1	13.5
Rails	8.1	26.5
Spaces and ways for pedestrians and restricted traffic	4.4	14.5
Water areas not suitable for boating	5.2	17.0

(B) More Than 22 kV to Ground.

Clearances for the categories shown in Table 237.18~~5.360~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

(C) Special Cases.

For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

237~~5.~~.19~~361~~ Clearances ~~over Buildings and Other Structures~~.

(A) Clearances over Buildings and Other Structures - 22 kV or Less to Ground.

The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237~~5.~~.19~~361~~(A).

Table 237~~5.~~.19~~361~~(A) Clearances over Buildings and Other Structures

Clearance from Conductors or Live Parts from:	Horizontal		Vertical	
	m	ft	m	ft
Building walls, projections, and windows	2.3	7.5	—	—
Balconies, catwalks, roofs, and similar areas readily accessible to people	2.3	7.5	4.1	13.5
Over or under roofs or projections not readily accessible to people	—	—	3.8	12.5
Over roofs accessible to vehicles but not trucks	—	—	4.1	13.5
Over roofs accessible to trucks	—	—	5.6	18.5
Other structures	2.3	7.5	—	—

(B) Clearances over Buildings and Other Structures - More Than 22 kV to Ground.

Clearances for the categories shown in Table 237~~5.~~.19~~361~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

(C) Clearance from Swimming Pools, Fountains, and Similar Installations.

Clearances from swimming pools, fountains, and similar installations shall comply with 680.9.

(D) Clearance from Communication Wires and Cables.

Conductors shall have adequate clearance from communication wires and cables.

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Informational Note: Adequate clearance from communication wires and cables may depend on both specific electrical and physical installation details. See ANSI/IEEE C2-2022, *National Electrical Safety Code*, for additional information.

237.20 Protection Against Physical Damage.

Conductors installed on buildings, structures, or poles shall be protected against physical damage as provided for services in 238.50.

237.21 Multiconductor Cables on Exterior Surfaces of Buildings (or Other Structures).

Supports for multiconductor cables on exterior surfaces of buildings (or other structures) shall be as provided in 238.51.

237.22 Raceways on Exterior Surfaces of Buildings or Other Structures.

Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations.

237.26 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead conductor spans.

237.27 Raceway Seal.

Where a raceway enters a building or structure from outside, it shall be sealed in accordance with 305.15(F) and 300.7(A). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

Part II. Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)

237.30 Number of Supplies.

A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 237.30(A) through (E).

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 237.30(A) through (E).

(A) Special Conditions.

Additional feeders or branch circuits shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Parallel power production systems

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(7) Electric vehicle power transfer systems listed, labeled, and identified for more than a single branch circuit or feeder

(8) Docking facilities and piers

(B) Common Supply Equipment.

Where feeder conductors originate in the same equipment, and each feeder terminates in a single disconnecting means, not more than six feeders shall be permitted. Where more than one feeder is installed in accordance with this section, all feeder disconnects supplying the building or structure shall be grouped in the same location, and the requirements of 237.33 shall not apply. Each disconnect shall be marked to indicate the load served.

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(C) Special Occupancies.

By special permission, additional feeders or branch circuits shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more supplies necessary

(D) Different Characteristics.

Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses.

(E) Documented Switching Procedures.

Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained.

237.31 Disconnecting Means.

(A) General.
Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

(B) Location.

The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(C) Type.

Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals. Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. If the disconnect does not have visible break contacts, an isolating switch in accordance with 237.31(J) shall be installed.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting

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means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(D) Locking.

Disconnecting means shall be lockable open in accordance with 110.25.

Exception: Where a disconnecting means consists of fused cutouts, it shall not be required to be lockable open.

(E) Indicating.

Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.

(F) Uniform Position.

Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.

Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.

(G) Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

(H) Manually or Power Operable.

The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.

(I) Disconnection of Grounded Conductor in a Grounded System.

Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multi-section ~~switchboard or~~ switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the ~~switchboard or~~ switchgear, if the ~~switchboard section or~~ switchgear section is marked to indicate a grounded conductor disconnect is contained within the equipment.

(J) Isolating Switches.

Where the building disconnecting means does not provide visible break contacts, an isolating switch with visible break contacts and meeting the requirements of 238.70(F)(2), (3),and (4)~~235.404(B), (C), and (D)~~ shall be installed on the supply side of the disconnecting means and all associated equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.

237.33 Maximum Number of Disconnects.

(A) General.

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The disconnecting means for each supply permitted by 237.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in a switchgear assembly. There shall be no more than six disconnects per supply grouped in any one location.

Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power-operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.

(B) Single-Pole Units.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. Where single-pole units are used on a multi-pole circuit, these units shall be considered as one switch, with respect to 237.33(A).

237.34 Grouping of Disconnects.

(A) General.

The two to six disconnects as permitted in 237.33 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six disconnecting means permitted in 237.33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

(B) Additional Disconnecting Means.

The one or more additional disconnecting means for fire pumps or for emergency, legally required standby or optional standby system permitted by 237.30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.

237.35 Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.

Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

237~~5~~.~~3~~39 Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the ~~calculated~~ load as determined by both 237.39(A) and (B), or by 237.39(C):

(A) Branch Circuits and Feeders.
The rating of the disconnect shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Branch Circuits and Feeders Supplying Transformers and Utilization Equipment.
The rating of the disconnect supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, the rating of the disconnect shall be permitted to be determined by qualified persons under engineering supervision, but the determined rating shall not be less than size of the feeder or branch circuit supplying the disconnect. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

~~to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.~~

237~~5~~.40~~350~~ Sizing of Conductors.

The sizing of conductors ~~over 1000 volts~~ shall be in accordance with 235.19~~(A)~~ for branch circuits and 236.2~~235.19(B)~~ for feeders.

~~**235.351 Isolating Switches.**~~
~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.404(B), (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.~~
~~*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*~~
~~**235.352 Disconnecting Means.**~~
~~**(A) Location.**~~
~~or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~~~A building or structure disconnecting means shall be located in accordance with 225.31(B), or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~
~~**(B) Type.**~~
~~Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.~~
~~*Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.*~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~
~~**(C) Locking.**~~
~~Disconnecting means shall be lockable open in accordance with 110.25.~~
~~*Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.*~~
~~**(D) Indicating.**~~
~~Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.~~
~~**(E) Uniform Position.**~~
~~Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.~~
~~*Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.*~~
~~**(F) Identification.**~~
~~Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

237~~5~~.42~~356~~ Inspections and Tests.

(A) Pre-Energization and Operating Tests.

The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.

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(1) Instrument Transformers.

All instrument transformers shall be tested to verify correct polarity and burden.

(2) Protective Relays.

Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.

(3) Switching Circuits.

Each switching circuit shall be observed to operate the associated equipment being switched.

(4) Control and Signal Circuits.
Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

(5) Metering Circuits.

All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.

(6) Acceptance Tests.

Complete acceptance tests shall be performed, after the ~~substation~~ installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

(7) Relays and Metering Utilizing Phase Differences.

All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.

(B) Test Report.

A test report covering the results of the tests required in 237~~5~~.42~~356~~(A) shall be delivered to the authority having jurisdiction prior to energization.

Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*, for an example of acceptance specifications.

~~**235.360 Clearances over Roadways, Walkways, Rail, Water, and Open Land.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.360(A).~~

~~**Table 235.360(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land**~~

~~**Location**~~	~~**Clearance**~~	
	~~**m**~~	~~**ft**~~
~~Open land subject to vehicles, cultivation, or grazing~~	~~5.6~~	~~18.5~~
~~Roadways, driveways, parking lots, and alleys~~	~~5.6~~	~~18.5~~
~~Walkways~~	~~4.1~~	~~13.5~~
~~Rails~~	~~8.1~~	~~26.5~~
~~Spaces and ways for pedestrians and restricted traffic~~	~~4.4~~	~~14.5~~
~~Water areas not suitable for boating~~	~~5.2~~	~~17.0~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.360(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~**(C) Special Cases.**~~

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~~For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

~~**235.361 Clearances over Buildings and Other Structures.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.361(A).~~

~~**Table 235.361(A) Clearances over Buildings and Other Structures**~~

~~**Clearance from Conductors or Live Parts from:**~~	~~**Horizontal**~~		~~**Vertical**~~	
	~~**m**~~	~~**ft**~~	~~**m**~~	~~**ft**~~
~~Building walls, projections, and windows~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~
~~Balconies, catwalks, and similar areas accessible to people~~	~~2.3~~	~~7.5~~	~~4.1~~	~~13.5~~
~~Over or under roofs or projections not readily accessible to people~~	~~—~~	~~—~~	~~3.8~~	~~12.5~~
~~Over roofs accessible to vehicles but not trucks~~	~~—~~	~~—~~	~~4.1~~	~~13.5~~
~~Over roofs accessible to trucks~~	~~—~~	~~—~~	~~5.6~~	~~18.5~~
~~Other structures~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.361(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

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Article 238 Services Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

~~**Part V. Services**~~

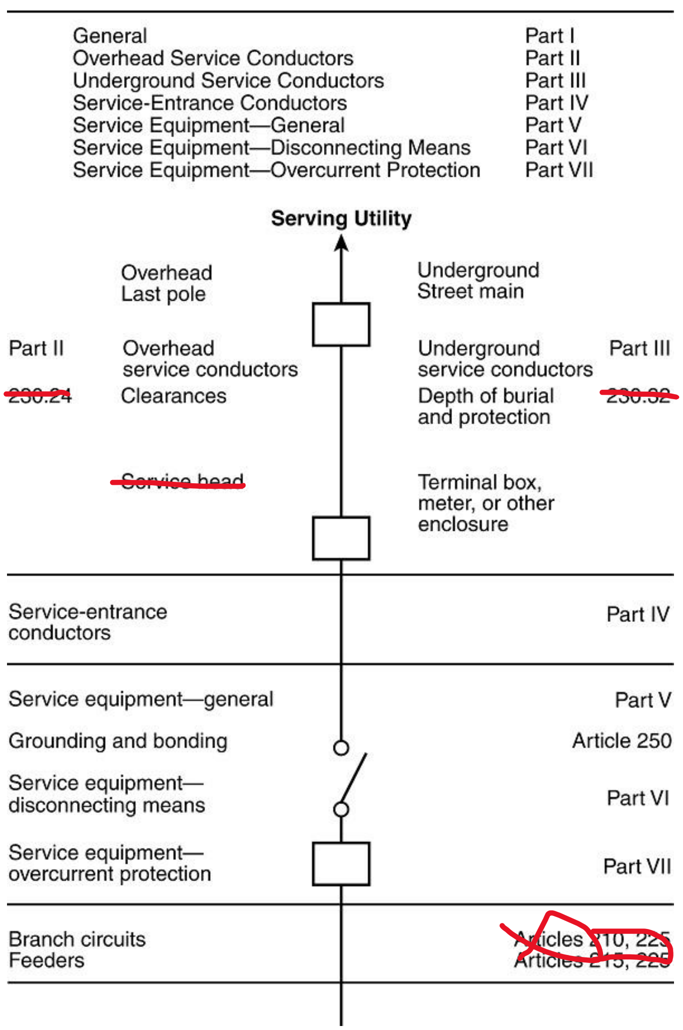
23~~5~~8.~~40~~1 Scope~~General~~.

This article ~~Part V~~ covers requirements for service conductors and equipment for control and protection of services over 1000 volts ac or 1500 volts dc, nominal, and their installation requirements. ~~used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Parts I through VII of Article 230 and with Part V of this article, which supplements or modifies those requirements~~. In no case shall ~~the provisions of~~ this article~~Part V~~ apply to equipment on the supply side of the service point.

Informational Note No. 1: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 2: See Informational Note Figure 238.1

Figure Informational Note Figure 238.1 Services.



238.2 Number of Services.

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A building or other structure served shall be supplied by only one service unless permitted in 238.2(A) through (D). For the purpose of 238.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.

(A) Special Conditions.

Additional services shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Interconnected electric power production sources

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(B) Special Occupancies.

By special permission, additional services shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more services necessary

(C) Capacity Requirements.

Additional services shall be permitted under any of the following:

(1) Where the capacity requirements are in excess of 2000 amperes

(2) Where the load requirements of an installation are greater than the serving agency normally supplies through one service

(3) By special permission

(D) Different Characteristics.

Additional services shall be permitted for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

(E) Identification.

Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders, and branch circuits supplying that building or structure and the area served by each.

238.3 One Building or Other Structure Not to Be Supplied Through Another.

Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure.

238.6 Conductors Considered Outside the Building.

Conductors shall be considered outside of a building or other structure under any of the following conditions:

(1) Where installed under not less than 50 mm (2 in.) of concrete beneath a building or other structure.

(2) Where installed within a building or other structure in a raceway that is encased in concrete or masonry structure not less than 50 mm (2 in.) thick

(3) Where installed in any vault that meets the construction requirements of Part III of Article 450

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(4) Where installed in conduit and under not less than 450 mm (18 in.) of earth beneath a building or other structure.

Informational Note: See 305.15 for cover requirements for underground installations.

238.7 Other Conductors.

Circuit conductors other than service conductors, shall not be installed in the same raceway, cable, handhole enclosure, underground box, cable tray, or cable bus as the service conductors.

Exception No. 1: Grounding electrode conductors or supply side bonding jumpers or conductors shall be permitted within service raceways.

Exception No. 2: Load management control conductors having overcurrent protection shall be permitted within service raceways.

Exception No. 3: Conductors associated with sump pumps, having overcurrent protection, shall be permitted within underground boxes.

238.8 Raceway Seal.

Where a service raceway enters a building or structure, it shall be sealed in accordance with 305.5(F) and 305.16(A), as applicable. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

238.9 Clearances.

Clearances for service conductors shall comply with 237.19.

238.10 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead service conductors or service equipment.

238~~5~~.15~~412~~ Over 35,000 Volts.

Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.

Part II. Overhead Service Conductors

238.23 Size and Ampacity.

Conductors shall have adequate mechanical strength and shall be sized in accordance with 238.23(A), (B), or (C).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.26 Point of Attachment.

The point of attachment of the overhead service conductors to a building or other structure shall provide the minimum clearances as specified in 237.19. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

238.27 Means of Attachment.

Conductors shall be attached to noncombustible, nonabsorbent insulators securely attached to the building or other structure.

238.28 Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.

238.29 Surge Arresters.

Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.

Informational Note: Surge arresters may be referred to as lightning arresters in older documents.

Part III. Underground Service Conductors

238.30 Installation.

(A) Insulation.

Underground service conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial

(B) Wiring Methods.

Underground service conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Rigid metal conduit (RMC)

(2) Intermediate metal conduit (IMC)

(3) Nonmetallic underground conduit with conductors (NUCC)

(4) High density polyethylene conduit (HDPE)

(5) Rigid polyvinyl chloride conduit (PVC)

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(6) Reinforced thermosetting resin conduit (RTRC)

(7) Type MV or Type MC cable identified for direct burial applications

(8) Type TC-ER cable where rated for the voltage and identified for service entrance use and direct burial applications

238.31 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Conductors shall be sized in accordance with 238.31(A), (B), or (C), and shall have a minimum size in accordance with 238.31(D) and (E).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

(D) Minimum Size.
The conductors shall not be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(E) Grounded Conductors.
The grounded conductor shall not be smaller than the minimum size required by 250.24(D) and Part X of Article 250.

238.32 Protection Against Damage.

Underground service conductors shall be protected against damage in accordance with 305.15. Service conductors entering a building or other structure shall be installed in accordance with 238.6 or protected by a raceway wiring method identified in 238.43.

238.33 Spliced Conductors.

Service conductors shall be permitted to be spliced or tapped in accordance with 110.14, 238.46, 305.15(D), 300.13, and 300.15.

Part IV. Service-Entrance Conductors

238.40 Number of Service-Entrance Conductor Sets.

Each service drop, set of overhead service conductors, set of underground service conductors, or service lateral shall supply only one set of service-entrance conductors.

Exception No. 1: A building with more than one occupancy shall be permitted to have one set of service-entrance conductors for each service, as permitted in 238.2, run to each occupancy or group of occupancies. If the number of service disconnect locations for any given classification of service does not exceed six, the requirements of 238.2(E) shall apply at each location. If the number of service disconnect locations exceeds six for any given supply classification, the following conditions shall apply:

(1) All service disconnect locations for all supply characteristics, together with any branch circuit or feeder supply sources, shall be clearly described using graphics or text, or both, on one or more plaques

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(2) The plaques shall be located in an approved, readily accessible location(s) on the building or structure served and as near as practicable to the point(s) of attachment or entry(ies) for each service drop or service lateral and for each set of overhead or underground service conductors.

Exception No. 2: Where two to six service disconnecting means in separate enclosures are grouped at one location and supply separate loads from one service drop, set of overhead service conductors, set of underground service conductors, or service lateral, one set of service-entrance conductors shall be permitted to supply each or several such service equipment enclosures.

Exception No. 3: One set of service-entrance conductors connected to the supply side of the normal service disconnecting means shall be permitted to supply each or several systems covered by 238.82(5) or 238.82(6).

238.41 Insulation of Service-Entrance Conductors.

Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial

238.42 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the service circuit grounded conductor shall not be smaller than the equipment grounding conductor size required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Service entrance conductors shall be sized in accordance with 238.42(A), (B), or (C), but shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.

(A) Services Supplying Transformers.
The ampacity of service entrance conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service entrance conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service entrance conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.43 Wiring Methods.

Service-entrance conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Open wiring on insulators

(2) Rigid metal conduit (RMC)

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(3) Intermediate metal conduit (IMC)

(4) Electrical metallic tubing (EMT)

(5) Busways

(6) Rigid polyvinyl chloride conduit (PVC)

(7) Cablebus

(8) Type MC cable

(9) High density polyethylene conduit (HDPE)

(10) Nonmetallic underground conduit with conductors (NUCC)

(11) Reinforced thermosetting resin conduit (RTRC)

(12) Type TC-ER cable where rated for the voltage and identified for use as service entrance conductors

(13) Insulated Bus Pipe (IBP)

238.44 Cable Trays.

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

(1) Type MC cable

(2) Single Type MV conductors 1/0 and larger that are listed for use in cable tray

(3) Type TC-ER cable

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors.” The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier identified for use with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

238.46 Spliced and Tapped Conductors.

Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 305.15(D), 300.13, and 300.15. Pressure connectors, and devices for splices and taps shall be listed.

238.50 Protection Against Physical Damage.

(A) Underground Service-Entrance Conductors.

Underground service-entrance conductors shall be protected against physical damage in accordance with 305.15.

(B) All Other Service-Entrance Conductors.

Open wiring on insulators and Type MC cable shall not be installed within 3.0 m (10 ft) of grade level or where exposed to physical damage.

Exception: Type MC cable shall be permitted within 3.0 m (10 ft) of grade level where not exposed to physical damage or where protected in accordance with 300.5(D).

238.51 Open-Conductor Support.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

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238.52 Individual Conductors Entering Buildings or Other Structures.

Where individual open conductors enter a building or other structure, they shall enter through roof or wall bushings or through the wall in an upward slant through individual, noncombustible, nonabsorbent insulating tubes. Drip loops shall be formed on the conductors before they enter the tubes.

238.53 Raceways to Drain.

Where exposed to the weather, raceways enclosing service-entrance conductors shall be listed or approved for use in wet locations and arranged to drain. Where embedded in masonry, raceways shall be arranged to drain.

238.54 Overhead Service Locations.

Service-entrance conductors shall be held securely in place and shall be arranged so that water will not enter service raceway or equipment.

Part V. Service Equipment — General

238.62 Service Equipment — Enclosed, Guarded, and Barriered.

(A) Enclosed and Guarded.
Energized parts of service equipment shall be enclosed or guarded in accordance with 110.18 and Part III of 110.

(B) Barriered.
Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations with the service disconnect in the open position.

238.66 Listing Required.

All equipment used as service equipment shall be listed or field evaluated.

Part VI. Service Equipment — Disconncting Means

238.70 General. Means shall be provided to disconnect all ungrounded conductors from the service conductors.

(A) Location.

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(B~~C~~) Remote Control.

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For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.

(C) Marking.

Each service disconnect shall be permanently marked to identify it as a service disconnect.

(D~~B~~) Type.

Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.
Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. Service equipment installed in hazardous (classified) locations shall comply with the hazardous location requirements.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(F)~~235.404~~ Isolating Switches.

(1~~A~~) Where Required.

Where the service disconnecting means does not provide visible break contacts, ~~oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means,~~ an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.
~~*Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:*~~

~~*(1) Cannot be opened unless the circuit is disconnected*~~

~~*(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position*~~

(2~~B~~) Fuses as Isolating Switch.

Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.

(3~~C~~) Accessible to Qualified Persons Only.

The isolating switch shall be accessible to qualified persons only.

(4~~D~~) Connection to Ground.

Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.

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A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.

(G) Overcurrent Devices as Disconnecting Means.
Where the circuit breaker or alternative for it, as specified in 238.91 for service overcurrent devices, meets the requirements specified in 238.70(A) through (F), it shall constitute the service disconnecting means.

238.71 Maximum Number of Disconnects.

Each service shall have only one disconnecting means unless the requirements of 238.71(B) are met.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. For the purpose of this requirement, where single-pole units are used on a multi-pole circuit, these units shall be considered as one disconnecting means.

(A) General.

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

(1) Power monitoring equipment

(2) Surge-arrestor(s)

(3) Control circuit of the ground-fault protection system

(4) Power-operable service disconnecting means

(B) Two to Six Service Disconnecting Means.

Two to six service disconnects shall be permitted for each service permitted by 238.2 or for each set of service-entrance conductors permitted by 238.40, Exception Nos. 1 or 3. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:

(1) Separate enclosures with a main service disconnecting means in each enclosure

(2) Service disconnects in switchgear or transfer switches, where each disconnect is located in a separate compartment

Exception: Existing service equipment, installed in compliance with previous editions of this Code that permitted multiple service disconnecting means in a single enclosure, section, or compartment, shall be permitted to contain a maximum of six service disconnecting means.

Informational Note: Transfer switches are provided with one service disconnect or multiple service disconnects in separate compartments.

238.72 Grouping of Disconnects.

(A) General.

The two to six disconnects, if permitted in 238.71, shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six service disconnecting means permitted in 238.71, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means. If remotely installed in accordance with this exception, a plaque shall be posted at the location of the remaining grouped disconnects denoting its location.

(B) Additional Service Disconnecting Means.

The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by 238.2 shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

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(C) Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's service disconnecting means.

Exception: In a multiple-occupancy building where electric service and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the service disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

238.75 Disconnection of Grounded Conductor.

Where a grounded conductor is supplied, and the service disconnecting means does not disconnect the grounded conductor from the premises wiring, other means shall be provided for this purpose in the service equipment. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose. In a multisection switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchgear, if the switchgear section is marked to indicate a grounded conductor disconnect is located within.

Informational Note: In switchgear, the disconnecting means provided for the grounded conductor is typically identified as a neutral disconnect link and is typically located in the bus to which the service grounded conductor is connected.

238.76 Manually or Power Operable.

The service disconnecting means for ungrounded service conductors shall consist of one of the following:

(1) A manually operable switch, a set of fused cutouts, or circuit breaker, equipped with a handle or other suitable operating means

(2) Power-operated devices, provided the devices can be opened by hand in the event of a power supply failure

238.77 Indicating.

The service disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.

238.79 Rating of Service Disconnecting Means.

The service disconnecting means shall have a continuous current rating of not less than the required minimum ampacity of the service-entrance conductors, as determined by 238.42.

238.81 Connection to Terminals.

The service-entrance conductors shall be connected to the service disconnecting means by pressure connectors, clamps, or other approved means. Connections that depend on solder shall not be used.

238.82 Equipment Connected to the Supply Side of Service Disconnect.

Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(1) Cable limiters.

(2) Instrument transformers (current and voltage), impedance shunts, load management devices, surge arresters.

(3) Conductors used to supply energy management systems, circuits for standby power systems, fire pump equipment, and fire and sprinkler alarms, if provided with service equipment and installed in accordance with requirements for service-entrance conductors.

(4) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources, if provided with a disconnecting means that complies with 238.70, and overcurrent protection as specified in Part VII of Article 238.

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(5) Control circuits for power-operable service disconnecting means, if suitable overcurrent protection and disconnecting means are provided.

(6) Ground-fault protection systems, where installed as part of listed equipment, if suitable overcurrent protection and disconnecting means are provided.

(7) Control power circuits for protective relays where installed as part of listed equipment, if overcurrent protection and disconnecting means are provided.

Part VII. Service Equipment — Overcurrent Protection

238.90 Where Required.

Each ungrounded service conductor shall have overload protection.

(A) Ungrounded Conductor.

Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the ampacity of the conductor. For the purpose of this requirement, where single-pole overcurrent devices are used on a multi-pole circuit, these devices shall be considered as one protective device.

Exception No. 1: For motor-starting currents, ratings that comply with 430.52, 430.62, and 430.63 shall be permitted.

Exception No. 2: Overload protection for fire pump supply conductors shall comply with 695.4(B)(2)(a).

(B) Not in Grounded Conductor.

No overcurrent device shall be inserted in a grounded service conductor except a circuit breaker that simultaneously opens all conductors of the circuit.

238.91 Protection Requirements.

(A) General.
The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

(B) Location.
A short-circuit protective device shall be provided and shall protect all ungrounded conductors that it supplies. The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto. Where fuses are used as the service overcurrent device, the disconnecting means shall be located ahead of the supply side of the fuses.

(C) Equipment Type.

Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.

238.92 Locked Service Overcurrent Devices.

Where the service overcurrent devices are locked or sealed or are not readily accessible to the occupant, branch-circuit or feeder overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of lower ampere rating than the service overcurrent device.

238.93 Protection of Specific Circuits.

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Where necessary to prevent tampering, an automatic overcurrent device that protects service conductors supplying only a specific load, shall be permitted to be locked or sealed. The lock or seal shall be located so as to be accessible.

~~**235.402 Service-Entrance Conductors.**~~
~~Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).~~

~~**(A) Conductor Size.**~~

~~Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.~~

~~**(B) Wiring Methods.**~~

~~Service-entrance conductors shall be installed by one of the wiring methods covered in 305.3 and 305.15.~~

~~**235.404 Isolating Switches.**~~

~~**(A) Where Required.**~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means, an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment.~~

~~*Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:*~~

~~*(1) Cannot be opened unless the circuit is disconnected*~~

~~*(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position*~~

~~**(B) Fuses as Isolating Switch.**~~

~~Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.~~

~~**(C) Accessible to Qualified Persons Only.**~~

~~The isolating switch shall be accessible to qualified persons only.~~

~~**(D) Connection to Ground.**~~

~~Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.~~

~~A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.~~

~~**235.405 Disconnecting Means.**~~

~~**(A) Location.**~~

~~The service disconnecting means shall be located in accordance with 230.70.~~
~~For either overhead or underground primary distribution systems on private property, the service disconnect shall be permitted to be located in a location that is not readily accessible, if the disconnecting means can be operated by mechanical linkage from a readily accessible point, or electronically in accordance with 235.405(C), where applicable.~~

~~**(B) Type.**~~

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~~Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~(C) Remote Control.~~

~~For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.~~

~~235.406 Overcurrent Devices as Disconnecting Means.~~

~~Where the circuit breaker or alternative for it, as specified in 235.408 for service overcurrent devices, meets the requirements specified in 235.405, it shall constitute the service disconnecting means.~~

~~235.408 Protection Requirements.~~

~~A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.~~

~~Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.~~

~~Overcurrent devices shall conform to 235.408(A) and (B).~~

~~(A) Equipment Type.~~

~~Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.~~

~~(B) Enclosed Overcurrent Devices.~~

~~The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.~~

~~235.409 Surge Arresters.~~

~~Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.~~

~~Informational Note: Surge arresters may be referred to as lightning arresters in older documents.~~

~~235.410 Service Equipment — General.~~

~~Service equipment, including instrument transformers, shall conform to Part I of Article 495.~~

~~235.411 Switchgear.~~

~~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.~~

~~235.412 Over 35,000 Volts.~~

~~Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.~~

Public Input No. 3225-NFPA 70-2023 [New Article after 235]

Add New Article 230 for " Services Over 1000 Volt ac, 1500 V dc, Nominal"

(See attached Word document)

Additional Proposed Changes

File Name	Description	Approved
Article_235_-_FINAL.docx	Rewrite of Article 235 with New Article 238	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Article 235 is new to the 2023 NEC® and was created to locate requirements for systems operating at over 1000 Vac, 1500 Vdc (referred to as "Medium Voltage" (MV)) from Articles 210, 215, 225, and 230 into one location. This restructuring allows for an improved focus on MV requirements. With this improved focus, it is clear that additional work is needed to ensure requirements are written to address the needs specific to MV installations. With the newly created Article 235, requirements for MV branch circuits (in Part II) and feeders (in Part III) are 'standalone' – i.e., do not require a reference back to Articles 210 and 215. However, requirements for MV Outside Branch Circuits and Feeders (Part IV) and Services (Part V) still require the user of the Code to apply "applicable requirements" from the LV Articles of 225 and 230.

The TG recommendation is to make all MV requirements in 235 'standalone', so the user does not have to determine what LV requirements are applicable. To accomplish this, it is necessary to separate the requirements into Articles, just as the requirements are separated for LV circuits. Requirements for Services are the best example of why this is needed, as those requirements are best covered when structured into Parts; however, this type of structure is not possible if all MV circuit requirements are consolidated into a single Article.

This PI is part of a series of 4 PI's that were developed to make the MV requirements 'standalone' from the LV requirements, and to structure those requirements using a similar approach. The 4 PIs would result in the following 4 Articles:

235 - Branch Circuits Over 1000 Volts ac, 1500 V dc, Nominal
236 - Feeders over 1000 V ac, 1500 V dc, Nominal
237 - Outside Feeders and Branch Circuits Over 1000 Volt ac, 1500 V dc, Nominal
238 - Services Over 1000 Volt ac, 1500 V dc, Nominal

This series of PI's were also developed to ensure that requirements are written for MV, as opposed to being written for LV, then assumed to apply to MV.

The focus of this PI is to relocate "Part V. Services" from Article 235 to a new Article (238) that applies only to "Services Over 1000 Volts ac, 1500 Volts dc, Nominal". Below is a summary of the changes:

• The new Article is structured with Parts I – VII that match the format of Article 230.
Requirements from 230 are added and amended to reflect MV requirements:
Part I General
o 238.2 (Number of Services) from 230.2

o 238.3 (One Building or Other Structure Not to Be Supplied Through Another) from 230.3
o 238.6 (Conductors Considered Outside the Building) from 230.6
o 238.7 (Other Conductors) from 230.7
o 238.8 (Raceway Seal) from 230.8
o 238.9 (Clearances) from 230.9
o 238.10 (Vegetation as Support) from 230.10
Part II Underground Service Conductors
o 238.23 (Size and Ampacity) from 230.23
o 238.26 (Point of Attachment) from 230.26
o 238.27 (Means of Attachment) from 230.27
o 238.28 (Supports over Buildings) from 230.29
o 238.30 (Installation) from 230.30
Part III Underground Service Conductors
o 238.31 (Minimum Ampacity and Size) from 230.31
o 238.32 (Protection Against Damage) from 230.32
o 238.33 (Spliced Conductors) from 230.33
Part IV Service Entrance Conductors
o 238.40 (Number of Service-Entrance Conductor Sets) from 230.40
o 238.41 (Insulation of Service-Entrance Conductors) from 230.41
o 238.42 (Minimum Ampacity and Size) from 238.42
o 238.43 (Wiring Methods) from 230.43
o 238.44 (Cable Trays) from 230.44
o 238.46 (Spliced and Tapped Conductors) from 230.46
o 238.50 (Protection Against Physical Damage) from 230.50
o 238.51 (Open-Conductor Support) from 230.51 (Mounting Supports)
o 238.52 (Individual Conductors Entering Buildings or Other Structures) from 230.52
o 238.53 (Raceways to Drain) from 230.53
o 238.54 (Overhead Service Locations) from 230.54
Part V Service Equipment - General
o 238.62 (Service Equipment – Enclosed, Guarded, and Barriered) from 230.62
Part VI Service Equipment – Disconnecting Means
o 238.70 (General) from 230.70
o 238.71 (Maximum Number of Disconnects) from 230.71
o 238.72 (Grouping of Disconnects) from 230.72
o 238.75 (Disconnection of Grounded Conductor) from 230.75
o 238.76 (Manually or Power Operable) from 230.76
o 238.77 (Indicating) from 230.77
o 238.79 (Rating of Service Disconnecting Means) from 230.79
o 238.81 (Connection to Terminals) from 230.81
o 238.82 (Equipment Connected to the Supply Side of Service Disconnect) from 230.82
Part VII Service Equipment – Overcurrent Protection
o 238.90 (Where Required) from 230.90
o 238.92 (Locked Service Overcurrent Devices) from 230.92
o 238.93 (Protection of Specific Circuits) from 230.93

• Notable Article 230 Sections that were not included or were retitled in Article 238:
o 230.24 for "Clearances" is not included in Part II, as it is already addressed in "Part I. General" as 238.9.
o 230.28 for "Service Masts as Supports" is not included as service masts are not utilized in MV.
o 230.56 for "Service Conductor with the Higer Voltage to Ground" is not included as these systems are not used in MV installations.
o 230.66 for "Markings" is revised to remove the "Service Equipment" marking requirement, as that only applies to services rated 1000 V or less. References to Meter Sockets are removed, as those are not used in MV circuits. The remaining requirement in 230.66 that applies to MV is the listing requirement; therefore, the section is renamed "Listing Required".
o 230.67 for "Surge Protection" is removed as SPD's are not rated for use in MV circuits (but a new Section for Surge Arresters is added, as is noted later in this substantiation).
o 230.80 for "Combined Rating of Disconnects" is not applicable to MV installations.
o 230.85 for "Emergency Disconnects" is not applicable to MV installations (as these apply only to services for one-and two-family dwelling units).
o 230.91(B) for "Location" of the protective device was expanded beyond "location" to include

requirements from 235.408. In doing so, the location for the overcurrent devices, which is missing in 235.408, is now addressed, maintaining the same "…integral part of the service disconnecting means or shall be located immediately adjacent thereto" requirement that exists for LV installations. This is also covered in a Related PI for 235.408.

o 230.94 is not considered necessary.
o 230.95 does not apply to MV installations.

- New Section 238.29 added to include a permissive allowance for surge arresters on ungrounded overhead service conductors.
- 235.412 is a 'general' requirement and is relocated to Part I as 238.15 (Over 35,000 Volts).
- Sizing and ampacity requirements for overhead service conductors (238.23),underground service conductors (238.31), and service entrance conductors (238.42), are rewritten to reflect MV practices, and aligns with existing requirements for MV feeders (2023 235.202 and proposed 236.2 for 2026)
- Requirements specific to "one-family" and "two-family" dwelling units are removed in multiple places.
- Requirements referencing low voltage equipment (such as panelboards, switchboards, meter sockets, etc.) are either revised or removed to reflect MV installations and equipment.
- Wiring Methods in 238.30 and 238.43 are updated to only reflect methods that are allowed for MV installations.
- Requirements related to the use of "service entrance cable" are removed, as those conductors are not rated for MV.
- Requirements for "Isolating Switches" and "Disconnecting Means" (235.404 and 235.405) are relocated to Section 238.70 for requirements for service disconnects.
- Requirements for "Disconnecting Means" in 238.70 are updated to address the use of fused cutouts.
- Requirements for the "Two to Six Service Disconnecting Means" (new 238.71(B)) are updated to reflect the realities of MV equipment.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3215-NFPA 70-2023 [Article 235]	Revised Article 235 for Branch Circuits
Public Input No. 3223-NFPA 70-2023 [New Article after 235]	New Article 236 for Feeders
Public Input No. 3224-NFPA 70-2023 [New Article after 235]	New Article 237 for Outside Branch Circuits and Feeders
Public Input No. 3215-NFPA 70-2023 [Article 235]	
Public Input No. 3223-NFPA 70-2023 [New Article after 235]	
Public Input No. 3224-NFPA 70-2023 [New Article after 235]	

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Article 235 Branch Circuits~~, Feeders, and Services~~ Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

235.1 Scope.

This article provides the general requirements for branch circuits~~, feeders, and services~~ over 1000 volts ac or 1500 volts dc, nominal.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

~~Part II. Branch Circuits~~

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment		440.6, 440.31, and 440.32
Busways		368.17
Central heating equipment other than fixed electric space-heating equipment		422.12
Fixed electric heating equipment for pipelines and vessels		427.4
Fixed electric space-heating equipment		424.4
Fixed outdoor electrical deicing and snow-melting equipment		426.4
Infrared lamp industrial heating equipment		422.48 and 424.3
Motors, motor circuits, and controllers	430	

235.5 Conductor Identification for Branch Circuits.

(A) Grounded Conductor.

The grounded conductor of a branch circuit shall be identified in accordance with 200.6.

(B) Equipment Grounding Conductor.

The equipment grounding conductor shall be identified in accordance with 250.119.

(C) Ungrounded Conductors.

Ungrounded conductors shall be identified in accordance with 235.5(C)(1) or (C)(2), as applicable.

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

(b) *Posting of Identification Means.* The method used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment. The label shall

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be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means and each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 235.5(C)(2)(a) and (C)(2)(b). The identification methods used for conductors originating within each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment shall be documented in a manner that is readily available or be permanently posted at each ~~branch-circuit panelboard or similar~~ branch-circuit distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

235.6 Branch-Circuit Voltage Limitations Over 1000 volts ac or 1500 volts dc, Nominal, Between Conductors.

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Circuits exceeding 1000 volts ac or 1500 volts dc, nominal, between conductors shall be permitted to supply utilization equipment in installations where conditions of maintenance and supervision ensure that only qualified persons service the installation.

235.9 Circuits Derived from Autotransformers.

Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer.

235.10 Ungrounded Conductors Tapped from Grounded Systems.

Two-wire dc circuits and ac circuits of two or more ungrounded conductors shall be permitted to be tapped from the ungrounded conductors of circuits that have a grounded neutral conductor. Switching devices in each tapped circuit shall have a pole in each ungrounded conductor. All poles of multipole switching devices shall manually switch together where such switching devices also serve as a disconnecting means as required by the following sections:

(1) 410.93 for double-pole switched lampholders

(2) 410.104(B) for electric-discharge lamp auxiliary equipment switching devices

(3) 422.31(B) for an appliance

(4) 424.20 for a fixed electric space-heating unit

(5) 426.51 for electric deicing and snow-melting equipment

(6) 430.85 for a motor controller

(7) 430.103 for a motor

235.11 Branch Circuits Required.

The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. In all installations, the number of circuits shall be sufficient to supply the load served.

Part II. Branch-Circuit Ratings

235.18 Rating.

Branch circuits recognized by this article shall be rated in accordance with the maximum permitted ampere rating or setting of the overcurrent device. Where conductors of higher ampacity are used for any reason, the ampere rating or setting of the specified overcurrent device shall determine the circuit rating.

235.19 Conductors — Minimum Ampacity and Size.

The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Branch-circuit conductors shall be sized in accordance with 235.19(A) or (B).

(A) General.

The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(B) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems provide maintenance, monitoring, and servicing of the system.

235.20 Overcurrent Protection.

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with 245.26 and 235.20(A) through (C).

(A) ~~Continuous and Noncontinuous~~Simultaneous Loads.

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The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads on the branch circuit that will be operated simultaneously. ~~Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load.~~

~~*Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent device shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.*~~

(B) Conductor Protection.

Conductors shall be protected in accordance with the ampacities specified in 235.19~~310.14 or 315.60, as applicable~~.

(C) Equipment.

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table 240.3 for equipment.

235.22 Permissible Loads, Individual Branch Circuits.

An individual branch circuit shall be permitted to supply any load for which it is rated, but in no case shall the load exceed the branch-circuit ampere rating.

235.23 Permissible Loads, Multiple-Outlet Branch Circuits. A branch circuit shall be permitted to supply~~ing~~ two or more outlets or receptacles. ~~shall supply only the loads specified according to its size in accordance with 210.23(A) through (E) and as summarized in 210.24, and in no case shall the load~~ The sum of all loads that will be operated simultaneously shall not exceed the branch-circuit ampere rating.

~~**(A) 15- and 20-Ampere Branch Circuits.**~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1) Cord-and-Plug-Connected Equipment Not Fastened in Place.**~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2) Utilization Equipment Fastened in Place.**~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B) 30-Ampere Branch Circuits.**~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(C) 40- and 50-Ampere Branch Circuits.**~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D) Branch Circuits Larger Than 50 Amperes.**~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

Part III. Required Outlets

235.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 235~~10~~.63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment’s branch-circuit disconnecting means.

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~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

(B) Other Indoor Electrical Equipment.

~~In other than one- and two-family dwellings, a~~A receptacle outlet shall be located within the same room or other area as indoor equipment requiring servicing~~as specified in 2~~35~~10.63(B)(1) and (B)(2)~~. The required receptacle outlet shall not be connected to the load side of the equipment's disconnecting means.

Exception: Where there is no branch circuit available from another source, the receptacle outlet shall be permitted to be connected to the load side of the equipment's disconnecting means.

~~**(1) Indoor Service Equipment.**~~

~~The required receptacle outlet shall be located within the same room or area as the service equipment.~~

~~**(2) Indoor, Other Than Service Equipment Requiring Dedicated Equipment Spaces.**~~

~~For switchgear, motor control centers, and other equipment requiring servicingWhere equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shouldshall not be connected to the load side of the equipment's disconnecting means, if practical.~~

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Article 236~~Part III.~~ Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal

236~~5~~.1~~201~~ Scope~~General~~.
~~Part III~~This article covers the installation requirements, overcurrent protection requirements, minimum size, and ampacity of conductors for feeders over 1000 volts ac or 1500 volts dc, nominal.
Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts, nominal.

236~~5~~.~~20~~2 Minimum Ampacity~~Rating~~ and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than the equipment grounding conductor size ~~that~~ required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Feeder conductors ~~over 1000 volts~~ shall be sized in accordance with 236~~5~~.~~20~~2(A), (B), or (C).
(A) Feeders Supplying Transformers.
The ampacity of feeder conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.
(B) Feeders Supplying Transformers and Utilization Equipment.
The ampacity of feeder conductors~~s~~ supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100~~25~~ percent of the designed potential load of the utilization equipment that will be operated simultaneously.
(C) Supervised Installations.
For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision~~ in accordance with 310.14(B) or 315.60(B)~~. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

236~~5~~.~~20~~3 Overcurrent Protection.
Feeders shall be protected against overcurrent in accordance with 245.26 and 245.27. The rating or setting of the overcurrent device shall not be less than 100 percent of the sum of all loads that will be operated simultaneously.

236~~5~~.~~20~~5 Diagrams of Feeders.
If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, and the size and type of conductors to be used.
236~~5~~.~~20~~6 Feeder Equipment Grounding Conductor.
Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an equipment grounding conductor, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of 250.32 shall apply.
236~~5~~.~~2~~12 Identification for Feeders.

(A) Grounded Conductor.
The grounded conductor of a feeder, if insulated, shall be identified in accordance with 200.6.
(B) Equipment Grounding Conductor.
The equipment grounding conductor shall be identified in accordance with 250.119.
(C) Identification of Ungrounded Conductors.
Ungrounded conductors shall be identified in accordance with 236~~5~~.~~2~~12(C)(1) or (C)(2), as applicable.
(1) Feeders Supplied from More Than One Nominal Voltage System.
Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(1)(a) and (C)(1)(b).

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

(b) *Posting of Identification Means.* The method utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

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(2) Feeders Supplied from Direct-Current Systems.
Where a feeder is supplied from a dc system operating at more than 1500 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 236~~5~~.~~2~~12(C)(2)(a) and (C)(2)(b). The identification methods utilized for conductors originating within each ~~feeder panelboard or similar~~ feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each ~~feeder panelboard or similar~~ feeder distribution equipment.

(a) *Positive Polarity, Sizes 6 AWG or Smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black

(b) *Negative Polarity, Sizes 6 AWG or Smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.8(B)

(4) An approved permanent marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red

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Article 237 Outside Branch Circuits and Feeders Over 1000 Volts ac, 1500 Volts dc, Nominal~~Part IV. Outside Branch Circuits and Feeders~~

Part I. General

237~~5~~.~~30~~1 Scope~~General~~.
This article~~Part IV~~ covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. ~~Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Parts I and II of Article 225 and with Part IV of this article, which supplements or modifies those requirements.~~

237.4 Conductor Insulation.

Where within 3.0 m (10 ft) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated for the nominal voltage. The insulation of conductors in cables or raceways in wet locations, shall comply with 310.10(C) for systems rated up to 2000 volt, or be rated for wet locations for systems rated over 2000 volts.

Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.

237~~5~~.~~30~~6 Conductor Sizes for Overhead Spans~~ and Support~~.
For overhead spans, open individual conductors shall not be smaller than 6 AWG copper or 4 AWG aluminum where open individual conductors and 8 AWG copper or 6 AWG aluminum where in cable.

237~~5~~.~~3~~10 Wiring on Buildings (or Other Structures).
The installation of outside wiring on surfaces of buildings (or other structures) shall be one of the methods permitted ~~installed as provided~~ in 305.3.

237.12 Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures.

Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with **238.52~~XX (230.52)~~**. Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with **238.54~~XX (230.54)~~**.

237.14 Open-Conductor Supports and Spacings.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

~~**235.314 Open-Conductor Spacings.**~~
~~Conductors shall comply with the spacings provided in 110.36 and 495.24.~~

237.15 Supports over Buildings.

Outside branch-circuit and feeder conductors passing over a building shall be securely supported.

237.16 Attachment to Buildings.

(A) Point of Attachment.

The point of attachment to a building shall be in accordance with 238~~0~~.26.

(B) Means of Attachment.

The means of attachment to a building shall be in accordance with 238~~0~~.27.

237~~5~~.18~~360~~ Clearances over Roadways, Walkways, Rail, Water, and Open Land.
(A) 22 kV or Less to Ground.
The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237.18~~5.360~~(A).

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Table 237~~5.~~18~~360~~(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land

Location	Clearance m	Clearance ft
Open land subject to vehicles, cultivation, or grazing	5.6	18.5
Roadways, driveways, parking lots, and alleys	5.6	18.5
Walkways	4.1	13.5
Rails	8.1	26.5
Spaces and ways for pedestrians and restricted traffic	4.4	14.5
Water areas not suitable for boating	5.2	17.0

(B) More Than 22 kV to Ground.

Clearances for the categories shown in Table 237.18~~5.360~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

(C) Special Cases.

For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

237~~5.~~19~~361~~ Clearances ~~over Buildings and Other Structures.~~

(A) Clearances over Buildings and Other Structures - 22 kV or Less to Ground.

The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 237~~5.~~19~~361~~(A).

Table 237~~5.~~19~~361~~(A) Clearances over Buildings and Other Structures

Clearance from Conductors or Live Parts from:	Horizontal m	Horizontal ft	Vertical m	Vertical ft
Building walls, projections, and windows	2.3	7.5	—	—
Balconies, catwalks, roofs, and similar areas readily accessible to people	2.3	7.5	4.1	13.5
Over or under roofs or projections not readily accessible to people	—	—	3.8	12.5
Over roofs accessible to vehicles but not trucks	—	—	4.1	13.5
Over roofs accessible to trucks	—	—	5.6	18.5
Other structures	2.3	7.5	—	—

(B) Clearances over Buildings and Other Structures - More Than 22 kV to Ground.

Clearances for the categories shown in Table 237~~5.~~19~~361~~(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.

Informational Note: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information.

(C) Clearance from Swimming Pools, Fountains, and Similar Installations.

Clearances from swimming pools, fountains, and similar installations shall comply with 680.9.

(D) Clearance from Communication Wires and Cables.

Conductors shall have adequate clearance from communication wires and cables.

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Informational Note: Adequate clearance from communication wires and cables may depend on both specific electrical and physical installation details. See ANSI/IEEE C2-2022, *National Electrical Safety Code*, for additional information.

237.20 Protection Against Physical Damage.

Conductors installed on buildings, structures, or poles shall be protected against physical damage as provided for services in 238.50.

237.21 Multiconductor Cables on Exterior Surfaces of Buildings (or Other Structures).

Supports for multiconductor cables on exterior surfaces of buildings (or other structures) shall be as provided in 238.51.

237.22 Raceways on Exterior Surfaces of Buildings or Other Structures.

Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations.

237.26 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead conductor spans.

237.27 Raceway Seal.

Where a raceway enters a building or structure from outside, it shall be sealed in accordance with 305.15(F) and 300.7(A). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

Part II. Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)

237.30 Number of Supplies.

A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 237.30(A) through (E).

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 237.30(A) through (E).

(A) Special Conditions.

Additional feeders or branch circuits shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Parallel power production systems

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(7) Electric vehicle power transfer systems listed, labeled, and identified for more than a single branch circuit or feeder

(8) Docking facilities and piers

(B) Common Supply Equipment.

Where feeder conductors originate in the same equipment, and each feeder terminates in a single disconnecting means, not more than six feeders shall be permitted. Where more than one feeder is installed in accordance with this section, all feeder disconnects supplying the building or structure shall be grouped in the same location, and the requirements of 237.33 shall not apply. Each disconnect shall be marked to indicate the load served.

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(C) Special Occupancies.

By special permission, additional feeders or branch circuits shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more supplies necessary

(D) Different Characteristics.

Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses.

(E) Documented Switching Procedures.

Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained.

237.31 Disconnecting Means.

(A) General.
Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

(B) Location.

The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(C) Type.

Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals. Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. If the disconnect does not have visible break contacts, an isolating switch in accordance with 237.31(J) shall be installed.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting

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means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(D) Locking.

Disconnecting means shall be lockable open in accordance with 110.25.

Exception: Where a disconnecting means consists of fused cutouts, it shall not be required to be lockable open.

(E) Indicating.

Disconnecting means shall clearly indicate whether they are in the open “off” or closed “on” position.

(F) Uniform Position.

Where disconnecting means handles are operated vertically, the “up” position of the handle shall be the “on” position.

Exception: A switching device having more than one “on” position, such as a double throw switch, shall not be required to comply with this requirement.

(G) Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

(H) Manually or Power Operable.

The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.

(I) Disconnection of Grounded Conductor in a Grounded System.

Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multi-section ~~switchboard or~~ switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the ~~switchboard or~~ switchgear, if the ~~switchboard section or~~ switchgear section is marked to indicate a grounded conductor disconnect is contained within the equipment.

(J) Isolating Switches.

Where the building disconnecting means does not provide visible break contacts, an isolating switch with visible break contacts and meeting the requirements of 238.70(F)(2), (3),and (4)~~235.404(B), (C), and (D)~~ shall be installed on the supply side of the disconnecting means and all associated equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.

237.33 Maximum Number of Disconnects.

(A) General.

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The disconnecting means for each supply permitted by 237.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in a switchgear assembly. There shall be no more than six disconnects per supply grouped in any one location.

Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power-operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.

(B) Single-Pole Units.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. Where single-pole units are used on a multi-pole circuit, these units shall be considered as one switch, with respect to 237.33(A).

237.34 Grouping of Disconnects.

(A) General.

The two to six disconnects as permitted in 237.33 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six disconnecting means permitted in 237.33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

(B) Additional Disconnecting Means.

The one or more additional disconnecting means for fire pumps or for emergency, legally required standby or optional standby system permitted by 237.30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.

237.35 Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.

Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

237~~5~~.~~3~~39 Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the ~~calculated~~ load as determined by both 237.39(A) and (B), or by 237.39(C):

(A) Branch Circuits and Feeders.
The rating of the disconnect shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Branch Circuits and Feeders Supplying Transformers and Utilization Equipment.
The rating of the disconnect supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, the rating of the disconnect shall be permitted to be determined by qualified persons under engineering supervision, but the determined rating shall not be less than size of the feeder or branch circuit supplying the disconnect. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

~~to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads.~~

237~~5~~.40~~350~~ Sizing of Conductors.

The sizing of conductors ~~over 1000 volts~~ shall be in accordance with 235.19~~(A)~~ for branch circuits and 236.2~~235.19(B)~~ for feeders.

~~**235.351 Isolating Switches.**~~
~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 235.404(B), (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.~~
~~*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*~~
~~**235.352 Disconnecting Means.**~~
~~**(A) Location.**~~
~~or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~~~A building or structure disconnecting means shall be located in accordance with 225.31(B),~~ ~~or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.~~
~~**(B) Type.**~~
~~Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the available fault current at its supply terminals.~~
~~*Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.*~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~
~~**(C) Locking.**~~
~~Disconnecting means shall be lockable open in accordance with 110.25.~~
~~*Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.*~~
~~**(D) Indicating.**~~
~~Disconnecting means shall clearly indicate whether they are in the open "off" or closed "on" position.~~
~~**(E) Uniform Position.**~~
~~Where disconnecting means handles are operated vertically, the "up" position of the handle shall be the "on" position.~~
~~*Exception: A switching device having more than one "on" position, such as a double throw switch, shall not be required to comply with this requirement.*~~
~~**(F) Identification.**~~
~~Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.~~

237~~5~~.42~~356~~ Inspections and Tests.

(A) Pre-Energization and Operating Tests.

The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.

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(1) Instrument Transformers.

All instrument transformers shall be tested to verify correct polarity and burden.

(2) Protective Relays.

Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.

(3) Switching Circuits.

Each switching circuit shall be observed to operate the associated equipment being switched.

(4) Control and Signal Circuits.
Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

(5) Metering Circuits.

All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.

(6) Acceptance Tests.

Complete acceptance tests shall be performed, after the ~~substation~~ installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

(7) Relays and Metering Utilizing Phase Differences.

All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.

(B) Test Report.

A test report covering the results of the tests required in 237~~5~~.42~~356~~(A) shall be delivered to the authority having jurisdiction prior to energization.

Informational Note: See ANSI/NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*, for an example of acceptance specifications.

~~**235.360 Clearances over Roadways, Walkways, Rail, Water, and Open Land.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.360(A).~~

~~**Table 235.360(A) Clearances over Roadways, Walkways, Rail, Water, and Open Land**~~

~~**Location**~~	~~**Clearance**~~	
	~~**m**~~	~~**ft**~~
~~Open land subject to vehicles, cultivation, or grazing~~	~~5.6~~	~~18.5~~
~~Roadways, driveways, parking lots, and alleys~~	~~5.6~~	~~18.5~~
~~Walkways~~	~~4.1~~	~~13.5~~
~~Rails~~	~~8.1~~	~~26.5~~
~~Spaces and ways for pedestrians and restricted traffic~~	~~4.4~~	~~14.5~~
~~Water areas not suitable for boating~~	~~5.2~~	~~17.0~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.360(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~**(C) Special Cases.**~~

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~~For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

~~**235.361 Clearances over Buildings and Other Structures.**~~

~~**(A) 22 kV or Less to Ground.**~~

~~The clearances over buildings and other structures for conductors and live parts up to 22 kV or less to ground shall be not less than the values shown in Table 235.361(A).~~

~~**Table 235.361(A) Clearances over Buildings and Other Structures**~~

~~**Clearance from Conductors or Live Parts from:**~~	~~**Horizontal**~~		~~**Vertical**~~	
	~~**m**~~	~~**ft**~~	~~**m**~~	~~**ft**~~
~~Building walls, projections, and windows~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~
~~Balconies, catwalks, and similar areas accessible to people~~	~~2.3~~	~~7.5~~	~~4.1~~	~~13.5~~
~~Over or under roofs or projections not readily accessible to people~~	~~—~~	~~—~~	~~3.8~~	~~12.5~~
~~Over roofs accessible to vehicles but not trucks~~	~~—~~	~~—~~	~~4.1~~	~~13.5~~
~~Over roofs accessible to trucks~~	~~—~~	~~—~~	~~5.6~~	~~18.5~~
~~Other structures~~	~~2.3~~	~~7.5~~	~~—~~	~~—~~

~~**(B) More Than 22 kV to Ground.**~~

~~Clearances for the categories shown in Table 235.361(A) shall be increased by 10 mm (0.4 in.) per kV, or major fraction thereof, more than 22 kV.~~

~~Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information.~~

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Article 238 Services Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General

~~Part V. Services~~

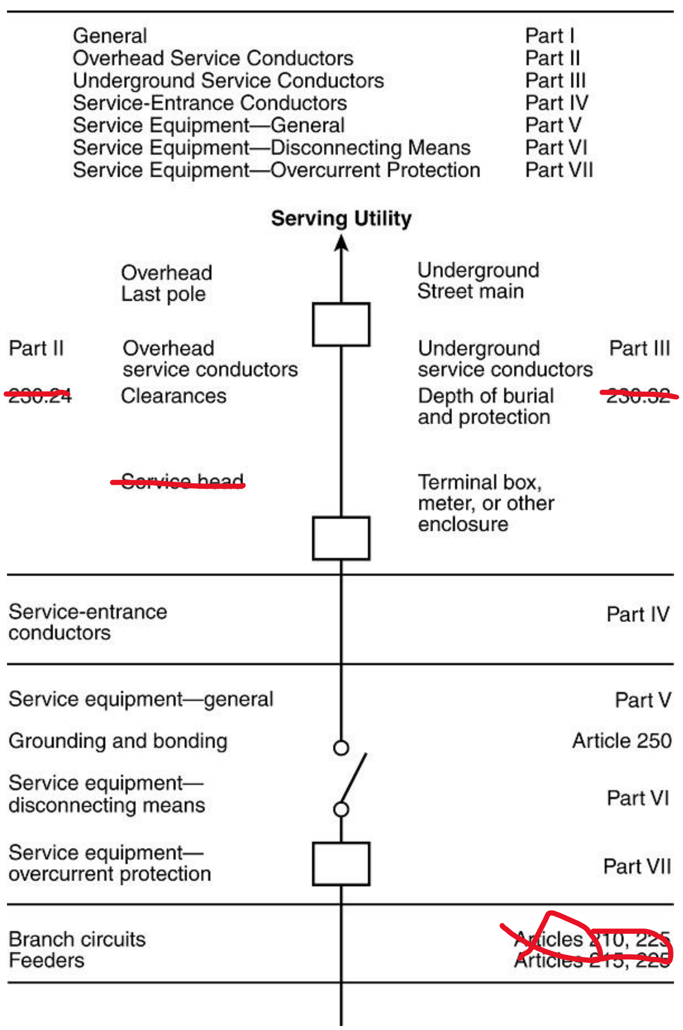
23~~5~~8.~~40~~1 Scope~~General~~.

This article ~~Part V~~ covers requirements for service conductors and equipment for control and protection of services over 1000 volts ac or 1500 volts dc, nominal, and their installation requirements. ~~used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Parts I through VII of Article 230 and with Part V of this article, which supplements or modifies those requirements~~. In no case shall ~~the provisions of~~ this article~~Part V~~ apply to equipment on the supply side of the service point.

Informational Note No. 1: See ANSI/IEEE C2-2022~~17~~, *National Electrical Safety Code*, for additional information on wiring over 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 2: See Informational Note Figure 238.1

Figure Informational Note Figure 238.1 Services.



238.2 Number of Services.

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A building or other structure served shall be supplied by only one service unless permitted in 238.2(A) through (D). For the purpose of 238.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.

(A) Special Conditions.

Additional services shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Interconnected electric power production sources

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(B) Special Occupancies.

By special permission, additional services shall be permitted for either of the following:

(1) Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants

(2) A single building or other structure sufficiently large to make two or more services necessary

(C) Capacity Requirements.

Additional services shall be permitted under any of the following:

(1) Where the capacity requirements are in excess of 2000 amperes

(2) Where the load requirements of an installation are greater than the serving agency normally supplies through one service

(3) By special permission

(D) Different Characteristics.

Additional services shall be permitted for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

(E) Identification.

Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders, and branch circuits supplying that building or structure and the area served by each.

238.3 One Building or Other Structure Not to Be Supplied Through Another.

Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure.

238.6 Conductors Considered Outside the Building.

Conductors shall be considered outside of a building or other structure under any of the following conditions:

(1) Where installed under not less than 50 mm (2 in.) of concrete beneath a building or other structure.

(2) Where installed within a building or other structure in a raceway that is encased in concrete or masonry structure not less than 50 mm (2 in.) thick

(3) Where installed in any vault that meets the construction requirements of Part III of Article 450

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(4) Where installed in conduit and under not less than 450 mm (18 in.) of earth beneath a building or other structure.

Informational Note: See 305.15 for cover requirements for underground installations.

238.7 Other Conductors.

Circuit conductors other than service conductors, shall not be installed in the same raceway, cable, handhole enclosure, underground box, cable tray, or cable bus as the service conductors.

Exception No. 1: Grounding electrode conductors or supply side bonding jumpers or conductors shall be permitted within service raceways.

Exception No. 2: Load management control conductors having overcurrent protection shall be permitted within service raceways.

Exception No. 3: Conductors associated with sump pumps, having overcurrent protection, shall be permitted within underground boxes.

238.8 Raceway Seal.

Where a service raceway enters a building or structure, it shall be sealed in accordance with 305.5(F) and 305.16(A), as applicable. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

238.9 Clearances.

Clearances for service conductors shall comply with 237.19.

238.10 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead service conductors or service equipment.

238~~5~~.15~~412~~ Over 35,000 Volts.

Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.

Part II. Overhead Service Conductors

238.23 Size and Ampacity.

Conductors shall have adequate mechanical strength and shall be sized in accordance with 238.23(A), (B), or (C).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

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(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.26 Point of Attachment.

The point of attachment of the overhead service conductors to a building or other structure shall provide the minimum clearances as specified in 237.19. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

238.27 Means of Attachment.

Conductors shall be attached to noncombustible, nonabsorbent insulators securely attached to the building or other structure.

238.28 Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.

238.29 Surge Arresters.

Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.

Informational Note: Surge arresters may be referred to as lightning arresters in older documents.

Part III. Underground Service Conductors

238.30 Installation.

(A) Insulation.

Underground service conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial

(B) Wiring Methods.

Underground service conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Rigid metal conduit (RMC)

(2) Intermediate metal conduit (IMC)

(3) Nonmetallic underground conduit with conductors (NUCC)

(4) High density polyethylene conduit (HDPE)

(5) Rigid polyvinyl chloride conduit (PVC)

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(6) Reinforced thermosetting resin conduit (RTRC)

(7) Type MV or Type MC cable identified for direct burial applications

(8) Type TC-ER cable where rated for the voltage and identified for service entrance use and direct burial applications

238.31 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60, as applicable. Conductors shall be sized in accordance with 238.31(A), (B), or (C), and shall have a minimum size in accordance with 238.31(D) and (E).

(A) Services Supplying Transformers.
The ampacity of service conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

(D) Minimum Size.
The conductors shall not be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(E) Grounded Conductors.
The grounded conductor shall not be smaller than the minimum size required by 250.24(D) and Part X of Article 250.

238.32 Protection Against Damage.

Underground service conductors shall be protected against damage in accordance with 305.15. Service conductors entering a building or other structure shall be installed in accordance with 238.6 or protected by a raceway wiring method identified in 238.43.

238.33 Spliced Conductors.

Service conductors shall be permitted to be spliced or tapped in accordance with 110.14, 238.46, 305.15(D), 300.13, and 300.15.

Part IV. Service-Entrance Conductors

238.40 Number of Service-Entrance Conductor Sets.

Each service drop, set of overhead service conductors, set of underground service conductors, or service lateral shall supply only one set of service-entrance conductors.

Exception No. 1: A building with more than one occupancy shall be permitted to have one set of service-entrance conductors for each service, as permitted in 238.2, run to each occupancy or group of occupancies. If the number of service disconnect locations for any given classification of service does not exceed six, the requirements of 238.2(E) shall apply at each location. If the number of service disconnect locations exceeds six for any given supply classification, the following conditions shall apply:

(1) All service disconnect locations for all supply characteristics, together with any branch circuit or feeder supply sources, shall be clearly described using graphics or text, or both, on one or more plaques

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(2) The plaques shall be located in an approved, readily accessible location(s) on the building or structure served and as near as practicable to the point(s) of attachment or entry(ies) for each service drop or service lateral and for each set of overhead or underground service conductors.

Exception No. 2: Where two to six service disconnecting means in separate enclosures are grouped at one location and supply separate loads from one service drop, set of overhead service conductors, set of underground service conductors, or service lateral, one set of service-entrance conductors shall be permitted to supply each or several such service equipment enclosures.

Exception No. 3: One set of service-entrance conductors connected to the supply side of the normal service disconnecting means shall be permitted to supply each or several systems covered by 238.82(5) or 238.82(6).

238.41 Insulation of Service-Entrance Conductors.

Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway

(2) Bare copper for direct burial where bare copper is approved for the soil conditions

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use

(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial

238.42 Minimum Ampacity and Size.
The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the service circuit grounded conductor shall not be smaller than the equipment grounding conductor size required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. Service entrance conductors shall be sized in accordance with 238.42(A), (B), or (C), but shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.

(A) Services Supplying Transformers.
The ampacity of service entrance conductors shall not be less than the sum of the nameplate ratings of the transformers supplied when only transformers are supplied.

(B) Services Supplying Transformers and Utilization Equipment.
The ampacity of service entrance conductors supplying a combination of transformers and utilization equipment shall not be less than the sum of the nameplate ratings of the transformers and 100 percent of the designed potential load of the utilization equipment that will be operated simultaneously.

(C) Supervised Installations.
For supervised installations, service entrance conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

238.43 Wiring Methods.

Service-entrance conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Open wiring on insulators

(2) Rigid metal conduit (RMC)

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(3) Intermediate metal conduit (IMC)

(4) Electrical metallic tubing (EMT)

(5) Busways

(6) Rigid polyvinyl chloride conduit (PVC)

(7) Cablebus

(8) Type MC cable

(9) High density polyethylene conduit (HDPE)

(10) Nonmetallic underground conduit with conductors (NUCC)

(11) Reinforced thermosetting resin conduit (RTRC)

(12) Type TC-ER cable where rated for the voltage and identified for use as service entrance conductors

(13) Insulated Bus Pipe (IBP)

238.44 Cable Trays.

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

(1) Type MC cable

(2) Single Type MV conductors 1/0 and larger that are listed for use in cable tray

(3) Type TC-ER cable

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors.” The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier identified for use with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

238.46 Spliced and Tapped Conductors.

Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 305.15(D), 300.13, and 300.15. Pressure connectors, and devices for splices and taps shall be listed.

238.50 Protection Against Physical Damage.

(A) Underground Service-Entrance Conductors.

Underground service-entrance conductors shall be protected against physical damage in accordance with 305.15.

(B) All Other Service-Entrance Conductors.

Open wiring on insulators and Type MC cable shall not be installed within 3.0 m (10 ft) of grade level or where exposed to physical damage.

Exception: Type MC cable shall be permitted within 3.0 m (10 ft) of grade level where not exposed to physical damage or where protected in accordance with 300.5(D).

238.51 Open-Conductor Support.

Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials. Overhead conductors shall comply with Section 395.30.
Informational Note: See 110.36 for spacing requirements.

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238.52 Individual Conductors Entering Buildings or Other Structures.

Where individual open conductors enter a building or other structure, they shall enter through roof or wall bushings or through the wall in an upward slant through individual, noncombustible, nonabsorbent insulating tubes. Drip loops shall be formed on the conductors before they enter the tubes.

238.53 Raceways to Drain.

Where exposed to the weather, raceways enclosing service-entrance conductors shall be listed or approved for use in wet locations and arranged to drain. Where embedded in masonry, raceways shall be arranged to drain.

238.54 Overhead Service Locations.

Service-entrance conductors shall be held securely in place and shall be arranged so that water will not enter service raceway or equipment.

Part V. Service Equipment — General

238.62 Service Equipment — Enclosed, Guarded, and Barriered.

(A) Enclosed and Guarded.
Energized parts of service equipment shall be enclosed or guarded in accordance with 110.18 and Part III of 110.

(B) Barriered.
Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations with the service disconnect in the open position.

238.66 Listing Required.

All equipment used as service equipment shall be listed or field evaluated.

Part VI. Service Equipment — Disconncting Means

238.70 General. Means shall be provided to disconnect all ungrounded conductors from the service conductors.

(A) Location.

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors. Disconnecting means that are not readily accessible, shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure. For the purposes of this section, the requirements in 238.6 shall apply.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to be located elsewhere on the premises or located within an enclosure that requires a tool for access. The tool shall be identified in the switching procedures and be available only to qualified personnel.

Exception No. 2: For buildings or other structures qualifying under 685.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with 600.1, the disconnecting means shall be permitted to be located elsewhere on the premises.

(B~~C~~) Remote Control.

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For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.

(C) Marking.

Each service disconnect shall be permanently marked to identify it as a service disconnect.

(D~~B~~) Type.

Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.
Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means. Service equipment installed in hazardous (classified) locations shall comply with the hazardous location requirements.

Exception No. 1: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Exception No. 2: : For installations under single management, where documented safe switching procedures are established and maintained, and where the installation is monitored by qualified personnel, the disconnecting means shall be permitted to consist of single-pole units. Single-pole units shall be provided for each phase of the supply.

(F)~~235.404~~ Isolating Switches.

(1~~A~~) Where Required.

Where the service disconnecting means does not provide visible break contacts, ~~oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means,~~ an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment. The isolating switch shall comply with 495.22.

Informational Note: A visible break contact device is one that permits visual verification of the contact position to verify that there is an open gap in each pole of the circuit.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.
~~Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:~~

~~(1) Cannot be opened unless the circuit is disconnected~~

~~(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position~~

(2~~B~~) Fuses as Isolating Switch.

Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.

(3~~C~~) Accessible to Qualified Persons Only.

The isolating switch shall be accessible to qualified persons only.

(4~~D~~) Connection to Ground.

Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.

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A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.

(G) Overcurrent Devices as Disconnecting Means.
Where the circuit breaker or alternative for it, as specified in 238.91 for service overcurrent devices, meets the requirements specified in 238.70(A) through (F), it shall constitute the service disconnecting means.

238.71 Maximum Number of Disconnects.

Each service shall have only one disconnecting means unless the requirements of 238.71(B) are met.

Single-pole switches or circuit breakers, capable of individual operation, shall be permitted. A single-pole unit shall be provided for each phase of the supply. For the purpose of this requirement, where single-pole units are used on a multi-pole circuit, these units shall be considered as one disconnecting means.

(A) General.

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

(1) Power monitoring equipment

(2) Surge-arrestor(s)

(3) Control circuit of the ground-fault protection system

(4) Power-operable service disconnecting means

(B) Two to Six Service Disconnecting Means.

Two to six service disconnects shall be permitted for each service permitted by 238.2 or for each set of service-entrance conductors permitted by 238.40, Exception Nos. 1 or 3. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:

(1) Separate enclosures with a main service disconnecting means in each enclosure

(2) Service disconnects in switchgear or transfer switches, where each disconnect is located in a separate compartment

Exception: Existing service equipment, installed in compliance with previous editions of this Code that permitted multiple service disconnecting means in a single enclosure, section, or compartment, shall be permitted to contain a maximum of six service disconnecting means.

Informational Note: Transfer switches are provided with one service disconnect or multiple service disconnects in separate compartments.

238.72 Grouping of Disconnects.

(A) General.

The two to six disconnects, if permitted in 238.71, shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six service disconnecting means permitted in 238.71, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means. If remotely installed in accordance with this exception, a plaque shall be posted at the location of the remaining grouped disconnects denoting its location.

(B) Additional Service Disconnecting Means.

The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by 238.2 shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

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(C) Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's service disconnecting means.

Exception: In a multiple-occupancy building where electric service and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the service disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

238.75 Disconnection of Grounded Conductor.

Where a grounded conductor is supplied, and the service disconnecting means does not disconnect the grounded conductor from the premises wiring, other means shall be provided for this purpose in the service equipment. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose. In a multisection switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchgear, if the switchgear section is marked to indicate a grounded conductor disconnect is located within.

Informational Note: In switchgear, the disconnecting means provided for the grounded conductor is typically identified as a neutral disconnect link and is typically located in the bus to which the service grounded conductor is connected.

238.76 Manually or Power Operable.

The service disconnecting means for ungrounded service conductors shall consist of one of the following:

(1) A manually operable switch, a set of fused cutouts, or circuit breaker, equipped with a handle or other suitable operating means

(2) Power-operated devices, provided the devices can be opened by hand in the event of a power supply failure

238.77 Indicating.

The service disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.

238.79 Rating of Service Disconnecting Means.

The service disconnecting means shall have a continuous current rating of not less than the required minimum ampacity of the service-entrance conductors, as determined by 238.42.

238.81 Connection to Terminals.

The service-entrance conductors shall be connected to the service disconnecting means by pressure connectors, clamps, or other approved means. Connections that depend on solder shall not be used.

238.82 Equipment Connected to the Supply Side of Service Disconnect.

Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(1) Cable limiters.

(2) Instrument transformers (current and voltage), impedance shunts, load management devices, surge arresters.

(3) Conductors used to supply energy management systems, circuits for standby power systems, fire pump equipment, and fire and sprinkler alarms, if provided with service equipment and installed in accordance with requirements for service-entrance conductors.

(4) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources, if provided with a disconnecting means that complies with 238.70, and overcurrent protection as specified in Part VII of Article 238.

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(5) Control circuits for power-operable service disconnecting means, if suitable overcurrent protection and disconnecting means are provided.

(6) Ground-fault protection systems, where installed as part of listed equipment, if suitable overcurrent protection and disconnecting means are provided.

(7) Control power circuits for protective relays where installed as part of listed equipment, if overcurrent protection and disconnecting means are provided.

Part VII. Service Equipment — Overcurrent Protection

238.90 Where Required.

Each ungrounded service conductor shall have overload protection.

(A) Ungrounded Conductor.

Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the ampacity of the conductor. For the purpose of this requirement, where single-pole overcurrent devices are used on a multi-pole circuit, these devices shall be considered as one protective device.

Exception No. 1: For motor-starting currents, ratings that comply with 430.52, 430.62, and 430.63 shall be permitted.

Exception No. 2: Overload protection for fire pump supply conductors shall comply with 695.4(B)(2)(a).

(B) Not in Grounded Conductor.

No overcurrent device shall be inserted in a grounded service conductor except a circuit breaker that simultaneously opens all conductors of the circuit.

238.91 Protection Requirements.

(A) General.
The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

(B) Location.
A short-circuit protective device shall be provided and shall protect all ungrounded conductors that it supplies. The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto. Where fuses are used as the service overcurrent device, the disconnecting means shall be located ahead of the supply side of the fuses.

(C) Equipment Type.

Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.

238.92 Locked Service Overcurrent Devices.

Where the service overcurrent devices are locked or sealed or are not readily accessible to the occupant, branch-circuit or feeder overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of lower ampere rating than the service overcurrent device.

238.93 Protection of Specific Circuits.

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Where necessary to prevent tampering, an automatic overcurrent device that protects service conductors supplying only a specific load, shall be permitted to be locked or sealed. The lock or seal shall be located so as to be accessible.

~~**235.402 Service-Entrance Conductors.**~~
~~Service-entrance conductors to buildings or enclosures shall be installed to conform to 235.402(A) and (B).~~

~~**(A) Conductor Size.**~~

~~Service-entrance conductors shall not be smaller than 6 AWG unless in multiconductor cable. Multiconductor cable shall not be smaller than 8 AWG.~~

~~**(B) Wiring Methods.**~~

~~Service-entrance conductors shall be installed by one of the wiring methods covered in 305.3 and 305.15.~~

~~**235.404 Isolating Switches.**~~

~~**(A) Where Required.**~~

~~Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute the service disconnecting means, an isolating switch with visible break contacts shall be installed on the supply side of the disconnecting means and all associated service equipment.~~

~~*Exception: An isolating switch shall not be required where the circuit breaker or switch is mounted on removable truck panels or switchgear units where both of the following conditions apply:*~~

~~*(1) Cannot be opened unless the circuit is disconnected*~~

~~*(2) Where all energized parts are automatically disconnected when the circuit breaker or switch is removed from the normal operating position*~~

~~**(B) Fuses as Isolating Switch.**~~

~~Where fuses are of the type that can be operated as a disconnecting switch, a set of such fuses shall be permitted as the isolating switch.~~

~~**(C) Accessible to Qualified Persons Only.**~~

~~The isolating switch shall be accessible to qualified persons only.~~

~~**(D) Connection to Ground.**~~

~~Isolating switches shall be provided with a means for readily connecting the load side conductors to a grounding electrode system, equipment ground busbar, or grounded steel structure when disconnected from the source of supply.~~

~~A means for grounding the load side conductors to a grounding electrode system, equipment grounding busbar, or grounded structural steel shall not be required for any duplicate isolating switch installed and maintained by the electric supply company.~~

~~**235.405 Disconnecting Means.**~~

~~**(A) Location.**~~

~~The service disconnecting means shall be located in accordance with 230.70.~~
~~For either overhead or underground primary distribution systems on private property, the service disconnect shall be permitted to be located in a location that is not readily accessible, if the disconnecting means can be operated by mechanical linkage from a readily accessible point, or electronically in accordance with 235.405(C), where applicable.~~

~~**(B) Type.**~~

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~~Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls and shall have a fault-closing rating that is not less than the available fault current at its supply terminals.~~
~~Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault-closing rating of the disconnecting means.~~

~~(C) Remote Control.~~

~~For multibuilding, industrial installations under single management, the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.~~

~~235.406 Overcurrent Devices as Disconnecting Means.~~

~~Where the circuit breaker or alternative for it, as specified in 235.408 for service overcurrent devices, meets the requirements specified in 235.405, it shall constitute the service disconnecting means.~~

~~235.408 Protection Requirements.~~

~~A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.~~

~~Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.~~

~~Overcurrent devices shall conform to 235.408(A) and (B).~~

~~(A) Equipment Type.~~

~~Equipment used to protect service-entrance conductors shall meet the requirements of Article 495, Part II.~~

~~(B) Enclosed Overcurrent Devices.~~

~~The restriction to 80 percent of the rating for an enclosed overcurrent device for continuous loads shall not apply to overcurrent devices installed in systems operating at over 1000 volts.~~

~~235.409 Surge Arresters.~~

~~Surge arresters installed in accordance with the requirements of Parts II and III of Article 242 shall be permitted on each ungrounded overhead service conductor.~~

~~Informational Note: Surge arresters may be referred to as lightning arresters in older documents.~~

~~235.410 Service Equipment — General.~~

~~Service equipment, including instrument transformers, shall conform to Part I of Article 495.~~

~~235.411 Switchgear.~~

~~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.~~

~~235.412 Over 35,000 Volts.~~

~~Where the voltage exceeds 35,000 volts between conductors that enter a building, they shall terminate in a switchgear compartment or a vault conforming to the requirements of 450.41 through 450.48.~~

Public Input No. 4222-NFPA 70-2023 [Section No. 235.3]

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section	
~~Air-conditioning and refrigerating equipment~~	-	~~440.6, 440.31, and 440.32~~	
Busways	-		368 ~~.17~~
~~Central heating equipment other than fixed electric space-heating equipment~~	-	~~422.12~~	
~~Fixed electric heating equipment for pipelines and vessels~~	-	~~427.4~~	
~~Fixed electric space-heating equipment~~	-	~~424.4~~	
~~Fixed outdoor electrical deicing and snow-melting equipment~~	-	~~426.4~~	
~~Infrared lamp industrial heating equipment~~	-	~~422.48 and 424.3~~	
Part IV			
Motors, motor circuits, and controllers	430	-	

Statement of Problem and Substantiation for Public Input

Propose to delete all the below references since they are not related or don't have any provisions that will amend or supplement the requirement in Article 235

Air-conditioning and refrigerating equipment
Central heating equipment other than fixed electric space-heating equipment
Fixed electric heating equipment for pipelines and vessels
Fixed electric space-heating equipment
Fixed outdoor electrical deicing and snow-melting equipment
Infrared lamp industrial heating equipment

Retained two references from the original table since they have requirements for 1000V or more
Busways
Motors, motor circuits, and controllers

Submitter Information Verification

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Submittal Date: Thu Sep 07 00:03:11 EDT 2023
Committee: NEC-P09

Public Input No. 514-NFPA 70-2023 [Section No. 235.3]

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment	-	440.6, 440.31, and 440.32
Busways	-	368.17
Central heating equipment other than fixed electric space-heating equipment	-	422.12
Fixed electric heating equipment for pipelines and vessels	-	427.4
Fixed electric space-heating equipment	-	424.4
Fixed outdoor electrical deicing and snow-melting equipment	-	426.4
Infrared lamp industrial heating equipment	-	422.48 and 424.3
Motors, motor circuits, and controllers	430	
Capacitors	460	

Statement of Problem and Substantiation for Public Input

Article 460 should be referenced to include the provision for capacitors

Submitter Information Verification

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Submittal Date: Mon Mar 27 15:00:11 EDT 2023
Committee: NEC-P09

Public Input No. 981-NFPA 70-2023 [Section No. 235.3]

235.3 Other Articles for Specific-Purpose Branch Circuits.

Table 235.3 lists references for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 235.3 References for Specific Equipment and Applications Not Located in Chapters 5, 6, and 7

Equipment	Article	Section
Air-conditioning and refrigerating equipment	–	440.6, 440.31, and 440.32
Busways	–	368.17
Central heating equipment other than fixed electric space-heating equipment	–	422.12
Fixed electric heating equipment for pipelines and vessels	–	427.4
Fixed electric space-heating equipment	–	424.4
Fixed outdoor electrical deicing and snow-melting equipment	–	426.4
Infrared lamp industrial heating equipment	–	422.48 and 424.3
Motors, motor circuits, and controllers	430 ~~–~~	, Part II, Part III, Part IV, and Part V

Statement of Problem and Substantiation for Public Input

Section 4.1. of the NEC(r) Style Manual prohibits references to entire articles except Article 100 or where required for context. In this table, it is recommended to add the specific parts of Article 430 applicable to branch circuits or delete this item from the table to comply with the style manual and improve usability of the code.

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Submittal Date: Thu Jun 08 10:57:47 EDT 2023
Committee: NEC-P09

Public Input No. 3736-NFPA 70-2023 [Section No. 235.5(C)(1)]

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits ~~supplied from more~~ of more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by nominal system voltage at all termination, connection, and splice points in accordance with 235.5(C)(1)(a) and (C)(1)(b). Different systems within the same premises that have the same nominal voltage shall be permitted to use the same identification.

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

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

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in accordance with 235.5(C)(1)(a) and (C)(1)(b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."

Statement of Problem and Substantiation for Public Input

It appears that the requirement would only apply if the building were supplied by branch circuits of different voltages. So if a different voltage is derived within the building the marking could be misinterpreted to not being required.

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Submittal Date: Tue Sep 05 15:10:09 EDT 2023

Committee: NEC-P09

Public Input No. 2590-NFPA 70-2023 [Section No. 235.9]

235.9 Circuits Derived from Autotransformers.

Branch circuits shall not be derived from autotransformers unless the circuit supplied has a grounded conductor that is electrically connected to a grounded conductor of the system supplying the autotransformer or for a reduced voltage motor starter that utilizes an autotransformer.

Statement of Problem and Substantiation for Public Input

The current wording appears confusing when using a reduced voltage motor starter that utilizes an autotransformer. When using an autotransformer for the reduced voltage starting of a motor the autotransformer would be supplying the branch circuit for a short period of time until the bypass contactor is engaged.

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Committee:	NEC-P09

Public Input No. 2591-NFPA 70-2023 [Section No. 235.19(B)]

(B) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons ~~under engineering supervision~~ . Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under ~~engineering~~ supervision of a qualfied person .

(2) Qualified persons with documented training and experience in over 1000-volt ac or 1500-volt dc systems that provide maintenance, monitoring, ~~and servicing~~ or servicing of the system.

Statement of Problem and Substantiation for Public Input

Requiring the utilization of engineering services only increases that cost.

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Submittal Date: Wed Aug 23 15:09:17 EDT 2023
Committee: NEC-P09

Public Input No. 4226-NFPA 70-2023 [Section No. 235.20(C)]

(C) Equipment.

The rating or setting of the overcurrent protective device shall not exceed that specified in the applicable articles referenced in Table ~~240~~ 242 .3 for equipment.

Statement of Problem and Substantiation for Public Input

The correct reference for 235.20(C) is 242.3 for voltages higher than 1000 volt. The current reference is for overcurrent protection for not more than 1000 volt nominal.

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Committee: NEC-P09

Public Input No. 1194-NFPA 70-2023 [Sections 235.23(A), 235.23(B), 235.23(C), 235.23(D)]

~~**Sections 235.23(A), 235.23(B), 235.23(C), 235.23(D)**~~

~~**(A)** 15- and 20-Ampere Branch Circuits.~~

~~A 15- or 20-ampere branch circuit shall be permitted to supply lighting outlets, lighting units, or other utilization equipment, or any combination of them, and shall comply with 235.23(A)(1) and (A)(2).~~

~~**(1)** Cord-and-Plug-Connected Equipment Not Fastened in Place.~~

~~The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(2)** Utilization Equipment Fastened in Place.~~

~~The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.~~

~~**(B)** 30-Ampere Branch Circuits.~~

~~A 30-ampere branch circuit shall be permitted to supply fixed lighting units with heavy-duty lampholders in other than a dwelling unit(s) or utilization equipment in any occupancy. The rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.~~

~~**(C)** 40- and 50-Ampere Branch Circuits.~~

~~A 40- or 50-ampere branch circuit shall be permitted to supply cooking appliances that are fastened in place in any occupancy. In other than dwelling units, such circuits shall be permitted to supply fixed lighting units with heavy-duty lampholders, infrared heating units, or other utilization equipment.~~

~~**(D)** Branch Circuits Larger Than 50 Amperes.~~

~~Branch circuits larger than 50 amperes shall supply only nonlighting outlet loads.~~

Statement of Problem and Substantiation for Public Input

Delete these sections that are not related to over 1000 volts AC.

Submitter Information Verification

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Submittal Date:	Thu Jun 22 21:06:09 EDT 2023
Committee:	NEC-P09

Public Input No. 435-NFPA 70-2023 [Section No. 235.23 [Excluding any Sub-Sections]]

A branch circuit supplying two or more outlets or receptacles shall supply only the loads specified according to its size in accordance with ~~210~~ 235 .23(A) through (~~E~~ D) and ~~as summarized~~ in ~~210.24 , and in~~ no case shall the load exceed the branch-circuit ampere rating.

Statement of Problem and Substantiation for Public Input

It appears that the text for 235.23 was a cut and paste from 210.23 for branch circuits. The 210 references need to be changed to the 235 references and drop a reference to 210.24 which is not a part of 235.

Submitter Information Verification

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Submittal Date:	Mon Mar 06 11:12:35 EST 2023
Committee:	NEC-P09

Public Input No. 273-NFPA 70-2023 [Section No. 235.63]

~~**235.63** Equipment Requiring Servicing.~~

~~A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in 210.63(A) and (B).~~

~~Informational Note: See 210.8(E) for requirements on GFCI protection.~~

~~**(A)** Heating, Air-Conditioning, and Refrigeration Equipment.~~

~~The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.~~

~~*Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*~~

~~**(B)** Other Electrical Equipment.~~

~~In other than one- and two-family dwellings, a receptacle outlet shall be located as specified in 210.63(B)(1) and (B)(2).~~

~~**(1)** Indoor Service Equipment.~~

~~The required receptacle outlet shall be located within the same room or area as the service equipment.~~

~~**(2)** Indoor Equipment Requiring Dedicated Equipment Spaces.~~

~~Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E) , the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means.~~

Statement of Problem and Substantiation for Public Input

This section never should have been added to Article 235. Customer-owned substations often consists of shipping containers filled with medium voltage distribution equipment and contain no equipment rated less then 1,000V. This section current requires the customer to install a step down transformer for one receptacle outlet, or it requires a circuit to return to the substation from whatever premises wiring system the substation supplies. That can often mean a circuit that is thousands of feet in length. This requirement is completely unreasonable.

Submitter Information Verification

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Organization: Self-employed

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Submittal Date: Thu Feb 02 13:19:49 EST 2023

Committee: NEC-P09

Public Input No. 4227-NFPA 70-2023 [Section No. 235.63]

235.63 Equipment Requiring Servicing.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location within 7.5 m (25 ft) of the equipment as specified in ~~210~~ 235 .63(A) and (B).

Informational Note: See 210.8(E) for requirements on GFCI protection.

(A) Heating, Air-Conditioning, and Refrigeration Equipment.

The required receptacle outlet shall be located on the same level as the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.

(B) Other Electrical Equipment.

In other than one- and two-family dwellings, a receptacle outlet shall be located as specified in ~~210~~ 235 .63(B)(1) and (B)(2).

(1) Indoor Service Equipment.

The required receptacle outlet shall be located within the same room or area as the service equipment.

(2) Indoor Equipment Requiring Dedicated Equipment Spaces.

Where equipment, other than service equipment, requires dedicated equipment space as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's disconnecting means.

Statement of Problem and Substantiation for Public Input

Corrected reference to 235.63

Submitter Information Verification

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Committee: NEC-P09

Public Input No. 3748-NFPA 70-2023 [Section No. 235.202(C)]

(C) Supervised Installations.

For supervised installations, feeder conductor sizing shall be permitted to be determined by qualified persons under engineering supervision in accordance with 310.14(B) or 315.60(B). Supervised installations are defined as those portions of a facility where all of the following conditions are met:

(1) ~~Conditions of design and installation are provided under engineering supervision.~~

(2)

(3) Qualified persons with documented training and experience in over 1000-volt systems provide maintenance, monitoring, and servicing of the system.

Statement of Problem and Substantiation for Public Input

Sizing the conductors would not be that different than sizing conductors for 1000 volts or less. The requirement for the engineering supervision is not needed.

Submitter Information Verification

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Submittal Date: Tue Sep 05 15:23:03 EDT 2023
Committee: NEC-P09

Public Input No. 436-NFPA 70-2023 [Section No. 235.202 [Excluding any Sub-Sections]]

The ampacity of conductors shall be in accordance with 310.14 and 315.60 as applicable. Where installed, the size of the feeder-circuit grounded conductor shall not be smaller than that required by Table 250.~~122 , except that 250.122(F) shall not apply where grounded conductors are run in parallel~~ 102(C)(1) . Feeder conductors over 1000 volts shall be sized in accordance with 235.202(A), (B), or (C).

Statement of Problem and Substantiation for Public Input

Grounded conductors are covered in Table 102(C)(1). Equipment grounding conductors are in 250.122.

Submitter Information Verification

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Submittal Date:	Mon Mar 06 11:54:47 EST 2023
Committee:	NEC-P09

Public Input No. 3731-NFPA 70-2023 [Section No. 235.205]

235.205 Diagrams of Feeders.

If required by the authority having jurisdiction, a diagram showing feeder details shall be provided prior to the installation of the feeders. Such a diagram shall show the area in square feet of the building or other structure supplied by each feeder, the total calculated load before applying demand factors, the demand factors used, the calculated load after applying demand factors, ~~and~~ the system voltage, and the size and type of conductors to be used.

Statement of Problem and Substantiation for Public Input

The current wording does not require the system voltage to be shown. When reviewing diagrams it is helpful to know the system voltage.

Submitter Information Verification

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Submittal Date: Tue Sep 05 15:03:27 EDT 2023

Committee: NEC-P09

Public Input No. 3974-NFPA 70-2023 [Section No. 235.212(C)(1)]

(1) Feeders Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has feeders ~~supplied from~~ of more than one nominal voltage system, each ungrounded conductor of a feeder over 1000 Vac, 1500 Vdc, nominal, shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 235.212(C)(1)(a) and (C)(1)(b).

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

(b) *Posting of Identification Means.* The method utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

The existing requirement would only apply if the building is supplied by feeders of different voltages; however, if the different voltage is derived within the building, the marking should also apply. These revision corrects this oversight.

Submitter Information Verification

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Submittal Date: Wed Sep 06 11:46:01 EDT 2023
Committee: NEC-P09

Public Input No. 2643-NFPA 70-2023 [Section No. 235.301]

235.301 General.

Part IV covers requirements for outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, that are run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles. Outside branch circuits and feeders over 1000 volts ac or 1500 volts dc, nominal, shall comply with the applicable requirements in Article 225, Parts I and II ~~of Article 225~~ and with Part IV of this article, which supplements or modifies those requirements.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
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City:
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Submittal Date: Wed Aug 23 21:35:15 EDT 2023
Committee: NEC-P09

Public Input No. 2644-NFPA 70-2023 [Section No. 235.339]

235.339 Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Article 220, Parts I and ~~II of Article 220 for~~ II for branch circuits, Article 220, Part III or ~~IV of Article 220 for~~ IV for feeders, or ~~Part V of~~ Article 220 ~~for~~ , Part V for farm loads.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.

4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.

The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee:	NEC-P09

Public Input No. 3745-NFPA 70-2023 [Section No. 235.352(A)]

(A) Location.

A building or structure disconnecting means shall be located in accordance with 225.31(B), or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations ~~under single management~~ , it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.

Statement of Problem and Substantiation for Public Input

The current requirement for under single management is not always the case. You can have multiple owners of a facility, structure or premises each with their own service and documented switching procedures.

Submitter Information Verification

Submitter Full Name: Dennis Querry

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Submittal Date: Tue Sep 05 15:20:44 EDT 2023

Committee: NEC-P09

Public Input No. 2645-NFPA 70-2023 [Section No. 235.401]

235.401 General.

Part V covers requirements for service conductors and equipment used on circuits over 1000 volts ac and 1500 volts dc, nominal, shall comply with all of the applicable requirements in Article 230, Parts I through ~~VII of Article~~ 230 ~~and~~ VII and with Part V of this article, which supplements or modifies those requirements. In no case shall the provisions of Part V apply to equipment on the supply side of the service point.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

The panel needs to determine which part or parts of Article 230 applies. The current reference is to the full article.

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Public Input No. 3737-NFPA 70-2023 [Section No. 235.405(C)]

(C) Remote Control.

For multibuilding, industrial installations ~~under single management~~ , the service disconnecting means shall be permitted to be located at a separate building or structure. In such cases, the service disconnecting means shall be permitted to be electrically operated by a readily accessible, remote-control device.

Statement of Problem and Substantiation for Public Input

The current requirement for under single management is not always the case. You can have multiple owners of a facility, structure or premises each with their own service and documented switching procedures.

Submitter Information Verification

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Submittal Date: Tue Sep 05 15:15:29 EDT 2023

Committee: NEC-P09

Public Input No. 2026-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]

A short-circuit protective device shall be provided on the load side of, or as an integral part of, the service disconnect, and shall protect all ungrounded conductors that it supplies. The protective device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

Overcurrent devices shall conform to 235.408(A) and (B).

Statement of Problem and Substantiation for Public Input

This public input is being submitted on behalf of the Minnesota Department of Labor and Industry. Currently, the Department's inspection staff includes 14-office/field staff, 12-state field inspectors, 2-virtual inspectors and 50 plus contract electrical inspectors that complete over 170,000 electrical inspections annually.

In previous editions of the NEC, it was not clear to the user what "on the load side of" meant. This often led to the short circuit protection device being located hundreds, possibly thousands, of feet downstream on the load side the point of interconnection. The intent is to limit the location of the protective device to an integral part of or immediately adjacent thereto, similar to the requirements in section 230.91, to provide protection for those conductors.

Submitter Information Verification

Submitter Full Name: Dean Hunter

Organization: Minnesota Department of Labor

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 11 09:55:12 EDT 2023

Committee: NEC-P09

Public Input No. 2418-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]

A short-circuit protective device shall be ~~provided on the load side of, or as an integral part of, the service disconnect, and~~ provided and shall protect all ungrounded conductors that it supplies._ The protective device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto. The protective device shall be capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

Overcurrent devices shall conform to 235.408(A) and (B).

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth.

In previous additions of the NEC it was not clear to the user what “on the load side” really meant, and the short circuit protection device was often located thousands of feet on the load side. The intent is to limit the location of the protective device to an integral part of or immediately adjacent thereto. This will align with the requirements already found in 230.91

Submitter Information Verification

Submitter Full Name: Robert Osborne
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Submittal Date: Thu Aug 17 09:08:18 EDT 2023
Committee: NEC-P09

Public Input No. 3797-NFPA 70-2023 [Section No. 235.408 [Excluding any Sub-Sections]]

A short-circuit protective device shall be provided ~~on the load side of, or as an integral part of, the service disconnect,~~ and shall protect all ungrounded conductors that it supplies. The protective device shall be <u>an integral part of the service disconnecting means or shall be located immediately adjacent thereto. The protective device shall be</u> capable of detecting and interrupting all values of current, in excess of its trip setting or melting point, that can occur at its location. A fuse rated in continuous amperes not to exceed three times the ampacity of the conductor, or a circuit breaker with a trip setting of not more than six times the ampacity of the conductors, shall be considered as providing the required short-circuit protection.

Informational Note: See Table 315.60(C)(1) through Table 315.60(C)(20) for ampacities of conductors rated 2001 volts to 35,000 volts.

Overcurrent devices shall conform to 235.408(A) and (B).

Statement of Problem and Substantiation for Public Input

In previous additions of this code, it was not clear to the user or enforcer, what “On the load side of.” really meant and the short circuit protection device was often located thousands of feet on the load side. The intent is to limit the location of the protective device to an integral part of or immediately adjacent thereto.

Submitter Information Verification

Submitter Full Name: Rudy Garza
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Submittal Date: Tue Sep 05 17:00:25 EDT 2023
Committee: NEC-P09

Public Input No. 2646-NFPA 70-2023 [Section No. 235.409]

235.409 Surge Arresters.

Surge arresters installed in accordance with the requirements ~~of~~ of Article 242, Parts II and ~~III of Article~~ 242 ~~shall~~ III shall be permitted on each ungrounded overhead service conductor.

Informational Note: Surge arresters may be referred to as lightning arresters in older documents.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name:	David Williams
Organization:	Delta Charter Township
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Aug 23 21:43:53 EDT 2023
Committee:	NEC-P09

Public Input No. 2647-NFPA 70-2023 [Section No. 235.410]

235.410 Service Equipment — General.

Service equipment, including instrument transformers, shall conform to ~~Part I of~~ Article 495 , Part I .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Wed Aug 23 21:44:58 EDT 2023
Committee:	NEC-P09

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

TITLE OF NEW CONTENT Listing Requirements.

Overcurrent protection for systems rated over 1000 volts AC, 1500 volts DC shall be listed. The listing requirement for this equipment shall be effective January 1, 2029.

Statement of Problem and Substantiation for Public Input

NEC 110.2 requires approval of all conductors and equipment required or permitted by this code (NEC). Generally speaking, few AHJ's will have copies of product standards for this equipment, training to evaluate the equipment, test facilities required for evaluation of the equipment, or time during normal field inspections to perform the evaluation. Many product standards include destructive testing to determine compliance and destructive testing is not practical for field inspections generally performed by AHJs. The only practical means to determine compliance is listing. The only other basis for approval would be field evaluation which is a limited evaluation and an option that should be limited to special equipment, circumstances, and conditions.

Submitter Information Verification

Submitter Full Name: Donald Cook

Organization: Dewberry/Edmonds Engineering

Affiliation: self

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State:

Zip:

Submittal Date: Sun Sep 03 18:09:24 EDT 2023

Committee: NEC-P09

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

245.2 Reconditioned Equipment.

(A) ~~Reconditioned Equipment~~ Permitted.

The following reconditioned equipment shall be permitted:

(1) Medium- and high-voltage circuit breakers

(2) Electromechanical protective relays and current transformers

(B) ~~Reconditioned Equipment~~ Not Permitted.

~~Medium~~ Recondtioned medium -voltage fuseholders and reconditioned medium-voltage nonrenewable fuses shall not be permitted.

Statement of Problem and Substantiation for Public Input

This public input is a part of a series of public inputs that seeks to align the language found across the NEC pertaining to how reconditioned equipment is addressed in the NEC.

The following sections us the language that says "Reconditioned _____ shall not be permitted." 404.16, 406.2, 408.2,410.2, 470.2, 495.2, 495.49,695.2,700.2,701.2,702.2,708.2,

This change suggests the appropriate way to address reconditioned equipment in the NEC. The NEC is an installation code governing the installation of solutions and in many locations throughout the NEC the solution is either permitted or not permitted. This suggested language would bring all references towards reconditioned equipment in alignment.

Submitter Information Verification

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City:

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Submittal Date: Sat Jul 08 11:31:00 EDT 2023

Committee: NEC-P09

Public Input No. 1772-NFPA 70-2023 [Section No. 245.2]

245.2 Reconditioned Equipment.

(A) Reconditioned Equipment Permitted.

The following reconditioned equipment shall be permitted:

(1) Medium- and high-voltage circuit breakers

(2) Electromechanical protective relays and current transformers

(B) Reconditioned Equipment Not Permitted.

Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted.

245.6 Standard Ampere Ratings

The standard ampere ratings for fuses and circuit breakers shall be considered as shown in 245.6. The use of fuses and circuit breakers with nonstandard ampere ratings shall be permitted only under engineering supervision.

Statement of Problem and Substantiation for Public Input

Standard ampere ratings for Medium Voltage fuses and circuit breakers need to be published for the application of the values in Section 315.60 Tables. Currently there isn't a list or table to reference the sizing or to crosscheck the protection devices that are available. This will complement Section 315.60 (A) (1) and (2) when determining what size device to install.

Note: This PI is a new proposed Section 245.6 following 245.2. Please number accordingly per CMP decision.

Submitter Information Verification

Submitter Full Name: Rudy Garza
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Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 01 14:58:14 EDT 2023
Committee: NEC-P09

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

245. ~~2~~ **3** Reconditioned Equipment.

(A) ~~Reconditioned Equipment~~ **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~~ Not Permitted to be Installed .

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

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
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City:
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Zip:
Submittal Date: Wed Aug 23 19:35:20 EDT 2023
Committee: NEC-P09

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

245.

~~2~~

2 Listing Requirements

Circuit breakers protecting branch, feeder and service circuits not exceeding 15,000 volts, nominal, shall be listed.

245.3 Reconditioned Equipment.

(A) Reconditioned Equipment Permitted.

The following reconditioned equipment shall be permitted:

(1) Medium- and high-voltage circuit breakers

(2) Electromechanical protective relays and current transformers

(B) Reconditioned Equipment Not Permitted.

Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted.

Statement of Problem and Substantiation for Public Input

Requiring circuit breakers in the National Electrical Code to be listed provides a basis for Authority Having Jurisdiction to approve these devices. When electrical equipment is not listed, AHJ's must examine the electrical equipment in accordance with Section 110.3(A) as a basis for approval. Due to the inherent design and complexity of these devices, AHJ's do not have the expertise and test equipment to examine non-listed equipment for suitability. As specified under Section 90.2(D), equipment under the exclusive control of an electric utility is not under the purview of the National Electrical Code and a listing requirement under Article 245 would not apply to such equipment.

It is increasingly common for equipment rated over 1000V to be owned and operated by the building owner. The complexity of such equipment and associated hazards do not decrease as voltage increases, and guidance provided to the inspection community may not be consistent or sufficient across all installations. Low voltage circuit breakers are already required to be listed per 240.7. Listed medium voltage equipment is readily available on the market today from many manufacturers. It is acknowledged, however, that above 15kV there may be limited options available for listed equipment. As such, a limit is placed for the listing requirement for circuit breakers used in circuits up to 15kV.

If the panel believes that the listing requirement will result in limited options due to these products not historically requiring a listing, a 3-year future effective date could be considered to allow time for the market to adjust.
The listing requirements should be numbered as 245.2 in accordance with the Style Manual. Additionally, the existing reconditioning requirements of 245.2 should be moved to 245.3.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4055-NFPA 70-2023 [Definition:]	Addition of MV circuit breaker standards to Table A.1(a)
Public Input No. 4055-NFPA 70-2023 [Definition:]	

Submitter Information Verification

Submitter Full Name:	Danish Zia
Organization:	UL Solutions
Street Address:	
City:	
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Zip:	
Submittal Date:	Wed Sep 06 14:43:54 EDT 2023
Committee:	NEC-P09

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

<u>**245.**</u>

~~2~~
<u>**2 Listing Requirements**</u>

<u>Fuses protecting branch, feeder and service circuits not exceeding 15,000 volts, nominal, shall be listed.</u>

<u>**245.3**</u> Reconditioned Equipment.

(A) Reconditioned Equipment Permitted.

The following reconditioned equipment shall be permitted:

(1) Medium- and high-voltage circuit breakers

(2) Electromechanical protective relays and current transformers

(B) Reconditioned Equipment Not Permitted.

Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted.

Statement of Problem and Substantiation for Public Input

Requiring fuses in the National Electrical Code to be listed provides a basis for Authority Having Jurisdiction to approve these devices. When electrical equipment is not listed, AHJ's must examine the electrical equipment in accordance with Section 110.3(A) as a basis for approval. Due to the inherent design and complexity of these devices, AHJ's do not have the expertise and test equipment to examine non-listed equipment for suitability. As specified under Section 90.2(D), equipment under the exclusive control of an electric utility is not under the purview of the National Electrical Code and a listing requirement under Article 245 would not apply to such equipment.

It is increasingly common for equipment rated over 1000V to be owned and operated by the building owner. The complexity of such equipment and associated hazards do not decrease as voltage increases, and guidance provided to the inspection community may not be consistent or sufficient across all installations. Low voltage fuses are already required to be listed per 240.7. Listed high voltage fuses are readily available on the market today. It is acknowledged, however, that above 15kV there may be limited options available for listed equipment. As such, a limit is placed for the listing requirement for fuses used in circuits up to 15kV.

If the panel believes that the listing requirement will result in limited options due to these products not historically requiring a listing, a 3-year future effective date could be considered to allow time for the market to adjust.
The listing requirements should be numbered as 245.2 in accordance with the Style Manual. Additionally, the existing reconditioning requirements of 245.2 should be moved to 245.3.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4046-NFPA 70-2023 [Definition:]	Addition of HV fuse standards to Annex A.1(a)
Public Input No. 4046-NFPA 70-2023 [Definition:]	

Submitter Information Verification

Submitter Full Name:	Danish Zia
Organization:	UL Solutions
Street Address:	
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State:	
Zip:	
Submittal Date:	Wed Sep 06 14:52:29 EDT 2023
Committee:	NEC-P09

Public Input No. 1887-NFPA 70-2023 [New Section after 245.2(B)]

TITLE OF NEW CONTENT

Type your content here .

2026 Public Input Form

Name: Eric Simmon	2023 NEC Section Number: Article 245	Proposed NEW Section Number: 245.6
Type of Change: (New, revision, etc.) New section to Article 245		
Proposed Code Language: The standard ampere ratings for fuses and circuit breakers shall be considered as shown in 245.6. The use of fuses and circuit breakers with nonstandard ampere ratings shall be permitted only under engineering supervision.		
Substantiation for Change: Standard ampere ratings for Medium Voltage fuses and circuit breakers need to be published for the application of the values in Section 315.60 Tables. Currently there isn't a list or table to reference the sizing or to crosscheck the protection devices that are available. This will complement Section 315.60 (A) (1) and (2) when determining what size device to install.		
Notes:		

..

Statement of Problem and Substantiation for Public Input

Standard ampere ratings for Medium Voltage fuses and circuit breakers need to be published for the application of the values in Section 315.60 Tables. Currently there isn't a list or table to reference the sizing or to crosscheck the protection devices that are available. This will complement Section 315.60 (A) (1) and (2) when determining what size device to install.

Submitter Information Verification

Submitter Full Name: Eric Simmon
Organization: Michigan State University
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Submittal Date: Mon Aug 07 10:49:07 EDT 2023
Committee: NEC-P09

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

(B) Reconditioned Equipment Not Permitted.

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

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

This PI proposed that 245.2(B) and 245.21(B)(7) be modified to make referencing medium voltage equipment consistent across articles. Currently, 245.2(B), 245.21(B)(7), and 691.4 use either medium voltage, high voltage, or both in reference equipment classes. This PI change would update medium voltage references to also use the term "high voltage" (i.e. "medium-and/or high-voltage") for all references, making the use across articles consistent.

"Medium voltage"is not formally defined in Article 100. However, the definition for "High voltage" does provide an information note for the use of the term "medium voltage":

Voltage, High. (High Voltage)
A potential difference of more than 1000 volts, nominal. (CMP-9)

Informational Note: Circuits and equipment rated at potential differences of more than 1000 volts and up to 52 kV are also commonly referred to as medium voltage.

The existing NEC-2023 use of the term medium voltage in 245 is shown in the proposed text change. Also, included for reference below is the use of "medium voltage" in 691.4:

691.4 Special Requirements for Large-Scale PV Electric Supply Stations.
Large-scale PV electric supply stations shall be accessible only to authorized personnel and comply with the following:
(3) The connection between the PV electric supply station and the system operated by a utility for the transfer of electrical energy shall be through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose shall be to interconnect the two systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3961-NFPA 70-2023 [Section No. 245.21(B)(7)]	Similar Change to Adjust Terminology
Public Input No. 3961-NFPA 70-2023 [Section No. 245.21(B)(7)]	

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
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Submittal Date:	Wed Sep 06 11:19:33 EDT 2023
Committee:	NEC-P09

Public Input No. 3961-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

This PI proposed that 245.2(B) and 245.21(B)(7) be modified to make referencing medium voltage equipment consistent across articles. Currently, 245.2(B), 245.21(B)(7), and 691.4 use either medium voltage, high voltage, or both in reference equipment classes. This PI change would update medium voltage references to also use the term “high voltage” (i.e. “medium-and/or high-voltage”) for all references, making the use across articles consistent.

“Medium voltage”is not formally defined in Article 100. However, the definition for “High voltage” does provide an information note for the use of the term “medium voltage”:

Voltage, High. (High Voltage)
A potential difference of more than 1000 volts, nominal. (CMP-9)

Informational Note: Circuits and equipment rated at potential differences of more than 1000 volts and up to 52 kV are also commonly referred to as medium voltage.

The existing NEC-2023 use of the term medium voltage in 245 is shown in the proposed text change. Also, included for reference below is the use of “medium voltage” in 691.4:

691.4 Special Requirements for Large-Scale PV Electric Supply Stations.
Large-scale PV electric supply stations shall be accessible only to authorized personnel and comply with the following:
(3) The connection between the PV electric supply station and the system operated by a utility for the transfer of electrical energy shall be through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose shall be to interconnect the two systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3957-NFPA 70-2023 [Section No. 245.2(B)]	Similar Change to Adjust Terminology

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

Submitter Information Verification

Submitter Full Name:	Robert Osborne
Organization:	UL Solutions
Street Address:	
City:	
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Submittal Date:	Wed Sep 06 11:23:35 EDT 2023
Committee:	NEC-P09

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, an approved means shall be ~~installed to~~ available 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.

Exception: This requirement shall not apply to installations where access to unqualified persons is prohibited by lock or location, and where documented switching procedures and tooling exists to operate the cutouts under load.

Additional Proposed Changes

File Name	Description	Approved
PC_2089_CMP_9.pdf	NEC-PC 2089	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 2089 of the (A2022) Second Draft Report for NFPA 70 and per the Regs. at 4.4.8.3.1.

Switching of cutouts under load frequently is not needed, save for single phase laterals -- a type of circuit that may be uncommon on other than utility owned networks that aren't regulated by the NEC. In other than utility installations, a load break means is normally provided separate of the cutout, such that opening of a cutout under load would be a rarely needed event. For those times where non-load break rated cutouts need to be operated under load, proven tooling exists to allow for them to be switched under load in some circumstances. Requiring the means to be AVAILABLE, rather than INSTALLED would make a more clear allowance for for an employer who has the training and plans in place to use these, to do so without the need to purchase load break rated cutouts. See examples in links at the end of this statement.

For most employers who would have people operating medium voltage equipment, sufficient training exists to ensure that workers know not to switch a cutout under load. Additionally, interlocks for cutouts may not always be available, as cutouts are very basic devices. It seems thus that we should not burden competent facility operators with this requirement. Hence, the request for an exception.

Loadbreak tooling:
https://www.sandc.com/en/products--services/products/loadbuster-tool/
https://www.utilitysolutionsinc.com/products/load-ranger-xlt-load-break-t l/

Submitter Information Verification

Submitter Full Name: CMP ON NEC-P09
Organization: Code-Making Panel 9
Street Address:
City:
State:
Zip:

Submittal Date:	Wed Sep 06 11:37:50 EDT 2023
Committee:	NEC-P09

Public Comment No. 2089-NFPA 70-2021 [Section No. 245.21(C)(2)]

(2) Operation.

Where fused cutouts are not suitable to interrupt the circuit manually while carrying full load, an approved means shall be ~~installed~~ available 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.

Exception: This requirement shall not apply to installations where access to unqualified persons is prohibited by lock or location, and where documented switching procedures and tooling exists to operate the cutouts under load.

Statement of Problem and Substantiation for Public Comment

Switching of cutouts under load frequently is not needed, save for single phase laterals -- a type of circuit that may be uncommon on other than utility owned networks that aren't regulated by the NEC. In other than utility installations, a load break means is normally provided separate of the cutout, such that opening of a cutout under load would be a rarely needed event. For those times where non-load break rated cutouts need to be operated under load, proven tooling exists to allow for them to be switched under load in some circumstances. Requiring the means to be AVAILABLE, rather than INSTALLED would make a more clear allowance for for an employer who has the training and plans in place to use these, to do so without the need to purchase load break rated cutouts. See examples in links at the end of this statement.

For most employers who would have people operating medium voltage equipment, sufficient training exists to ensure that workers know not to switch a cutout under load. Additionally, interlocks for cutouts may not always be available, as cutouts are very basic devices. It seems thus that we should not burden competent facility operators with this requirement. Hence, the request for an exception.

Loadbreak tooling:
https://www.sandc.com/en/products--services/products/loadbuster-tool/
https://www.utilitysolutionsinc.com/products/load-ranger-xlt-load-break-tool/

Related Item

• First Correlating Revision No. 387-NFPA 70-2021 [Global Input]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 11:30:52 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Rejected but held

Action:

Resolution: The Public Comment introduces material that was not included at the First Draft stage of the process. Additionally, it is unclear when the exception would not apply, as equipment should be located in areas accessible only to qualified personnel. Refer to 110.31(B) and (C).

Copyright Assignment

I, Josh Weaver, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Josh Weaver, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

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

(E) Load Interrupters.

Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt available fault currents. Where these devices are used in combination or as an integral assembly , they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating.

Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a warning sign identifying the presence of more than one source. Each warning sign or label shall comply with 110.21.

(1) Continuous Current Rating.

The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.

(2) Voltage Rating.

The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.

(3) Identification.

Interrupter switches shall have a permanent and legible nameplate, including the following information: manufacturer's type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.

(4) Load Interrupters with Adjustable Settings

Installations having Load Interrupters with integral Fault Interruption and software to adjust the fault settings shall indicate the equipment is capable of adjustment and shall have the following.

(1) Restricted Access to the software and equipment field settings.

(2) Changes made to the settings shall be done in accordance with the manufacturer's instructions and with engineering supervision.

(3) Permanent reidentification shall be applied to the equipment with the new settings.

(4) Reidentification labels shall be of sufficient durability to withstand the environment installed.

(5) Documentation of changes shall be made available when requested by the AHJ.

(5) Switching of Conductors.

The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.

(~~5~~ 6) Stored Energy for Opening.

The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

(~~6~~ 7) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure, or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

Statement of Problem and Substantiation for Public Input

New technology has been developed since the last code cycle that incorporates Load Interrupters and Fault Interrupters within the same unit using a dielectric liquid instead of gas. This same equipment has also incorporated control and management software to adjust the settings to the user requirements and applications, the settings can be adjusted in the field and remotely if required. The 2023 code addresses the use of Load Interrupters but requires that use of fuses or circuit breakers to interrupt available fault currents. New wording for the use of this equipment that incorporates the Load and Fault Interrupters needs to be introduced. With the use of software to adjust the settings, new provisions need to be made to require documentation on those changes and a record on the equipment of what the new settings are as well as when they were made. Labels on the equipment need to be weather resistant and durable. A requirement for restricted access, the changes are made according to the manufacturers' specifications and with engineering supervision should be added to ensure a safe installation and operation. Documentation of current settings and any changes to the settings needs to be made available at the request of the AHJ.

Note: The list items appearing under "(4) Load Interrupters with Adjustable Settings" heading should be (a) through (e) respectively instead of (1) through (5).

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Committee: NEC-P09

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

(E) Load Interrupters.

Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt available fault currents. Where these devices are used in combination or as an integral assembly , they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating.

Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a warning sign identifying the presence of more than one source. Each warning sign or label shall comply with 110.21.

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The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.

(2) Voltage Rating.

The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.

(3) Identification.

(4) **Load Interrupters with Adjustable Settings**

Installations having Load Interrupters with integral Fault Interruption and software to adjust the fault settings shall indicate the equipment is capable of adjustment and shall have the following.

(1) Restricted Access to the software and equipment field settings.

(2) Changes made to the settings shall be done in accordance with the manufacturer's instructions and with engineering supervision.

(3) Permanent reidentification shall be applied to the equipment with the new settings.

(4) Reidentification labels shall be of sufficient durability to withstand the environment installed.

(5) Documentation of changes shall be made available when requested by the AHJ.

Interrupter switches shall have a permanent and legible nameplate, including the following information: manufacturer's type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.

(4) Switching of Conductors.

The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.

(5) Stored Energy for Opening.

The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

(6) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure, or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

Statement of Problem and Substantiation for Public Input

New technology has been developed since the last code cycle that incorporates Load Interrupters and Fault Interrupters within the same unit using a dielectric liquid instead of gas. This same equipment has also incorporated control and management software to adjust the settings to the user requirements and applications, the settings can be adjusted in the field and remotely if required. The 2023 code addresses the use of Load Interrupters but requires that use of fuses or circuit breakers to interrupt available fault currents. New wording for the use of this equipment that incorporates the Load and Fault Interrupters needs to be introduced. With the use of software to adjust the settings, new provisions need to be made to require documentation on those changes and a record on the equipment of what the new settings are as well as when they were made. Labels on the equipment need to be weather resistant and durable. A requirement for restricted access, the changes are made according to the manufacturers' specifications and with engineering supervision should be added to ensure a safe installation and operation. Documentation of current settings and any changes to the settings needs to be made available at the request of the AHJ.

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Public Input No. 513-NFPA 70-2023 [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) ~~or~~ (1) an(A)(2)~~.~~

Statement of Problem and Substantiation for Public Input

The references to 250.184 (B) or (A)(2) are incorrect. The reference should be 245.26(A)(1) & (2)

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Committee:	NEC-P09

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

245.7 Listing Requirements.

Overcurrent protective devices protetcing branch, feeder and service circuits not exceeding 15,000 volts, nominal, shall be listed.

Additional Proposed Changes

File Name	Description	Approved
.1694013989841	NEC_PC1054	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as “Reject but Hold” in Public Comment No. 1054 of the (A2022) Second Draft Report for NFPA 70 and per the Regs. at 4.4.8.3.1.

As specified under Section 90.2(8), equipment under the exclusive control of an electric utility is not under the purview of the National Electrical Code and a listing requirement under Article 245 would not apply to such equipment. However, it is increasingly common for equipment rated over 1000V to be owned and operated by the building owner, for traditional installations as well as renewable energy equipment. The complexity of such equipment and associated hazards do not decrease
above 1000V, and guidance provided to the inspection community may not be consistent or sufficient across all installations. Listed medium voltage equipment is readily available on the market today from many manufacturers. It is acknowledged, however, that above 15kV there may be limited options available for listed equipment. As such, this public comment seeks to revise the original public input by placing a limit for the listing
requirement for overcurrent protective devices used in circuits up to 15kV.

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Submittal Date: Wed Sep 06 11:16:24 EDT 2023

Committee: NEC-P09

Public Comment No. 1054-NFPA 70-2021 [New Section after 245.1]

245.7 Listing Requirements.

Overcurrent protective devices protecting branch, feeder and service circuits not exceeding 15,000 volts, nominal, shall be listed.

Statement of Problem and Substantiation for Public Comment

As specified under Section 90.2(B), equipment under the exclusive control of an electric utility is not under the purview of the National Electrical Code and a listing requirement under Article 245 would not apply to such equipment. However, it is increasingly common for equipment rated over 1000V to be owned and operated by the building owner, for traditional installations as well as renewable energy equipment. The complexity of such equipment and associated hazards do not decrease above 1000V, and guidance provided to the inspection community may not be consistent or sufficient across all installations. Listed medium voltage equipment is readily available on the market today from many manufacturers. It is acknowledged, however, that above 15kV there may be limited options available for listed equipment. As such, this public comment seeks to revise the original public input by placing a limit for the listing requirement for overcurrent protective devices used in circuits up to 15kV.

Related Item

- Public Input No. 3365

Submitter Information Verification

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Submittal Date: Fri Aug 06 10:53:54 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but held

Resolution: CMP 9 sees merit in the concept of requiring listings for these devices. However, the panel needs to determine the scope of the requirement with respect to the extent of other similar protective devices. In addition, it is not clear if the future effective date is sufficient for manufacturers and certification organizations to comply. The panel is holding this comment for reconsideration in the next cycle.

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I, Danish Zia, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

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

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

~~**305.1** Scope.~~

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

~~**305.3** Other Articles.~~

~~Conductors shall be permitted to be installed in accordance with any of the wiring methods identified in Table 305.3 .~~

~~Table 305.3 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 Reference Pull and junction boxes, conduit bodies, and handhole enclosures Over 1000 Article 314, Part IV Metal-clad cable (Type MC) 1000–35,000 Article 330 Type P cable 1000–2000 Article 337 Intermediate metal conduit (IMC) Over 1000 Article 342 Rigid metal conduit (RMC) Over 1000 Article 344 Rigid polyvinyl chloride conduit (PVC) Over 1000 Article 352 Reinforced thermosetting resin conduit (RTRC) Over 1000 Article 355 Electrical metallic tubing (EMT) Over 1000 Article 358 Auxiliary gutters Over 1000 Article 366 Busway Over 1000 Article 368, Part IV Cablebus 1000–35,000 Article 370 Cable trays 1000–35,000 Article 392 Messenger-supported wiring 1000–35,000 Article 396 Outdoor overhead conductors Over 1000 Article 395 Insulated bus pipe (IBP) 1000–35,000 ac Article 369~~

~~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.~~

~~**305.4** 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 enclosure, cable, or raceway.~~

~~**305.5** 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.~~

~~**305.6** Protection Against Induction Heating.~~

~~Metallic raceways and associated conductors shall be arranged to avoid heating of the raceway in accordance with 300.20 .~~

~~**305.7** 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.~~

~~**305.8** 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.~~

~~**305.9** 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.~~

~~**305.10** 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.~~

~~**305.11** 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.~~

~~**305.12** 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~~

~~**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. Underground cables 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~~

~~- General Conditions (not otherwise specified) Special Conditions (use if applicable) - Column 1 Column 2 Column 3 Column 4 Column 5 Column 6 - Direct-Buried Cables [1] Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit [2] Rigid Metal Conduit and Intermediate Metal Conduit Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness [3] Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas Circuit Voltage mm in. mm in. mm in. mm in. mm in. mm in. Over 1000 V ac, 1500 V dc, through 22 kV 750 30 450 18 150 6 100 4 450 18 600 24 Over 22 kV through 40 kV 900 36 600 24 150 6 100 4 450 18 600 24 Over 40 kV 1000 42 750 30 150 6 100 4 450 18 600 24~~

~~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. In industrial establishments, 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] Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.~~

~~[2] Listed by a qualified testing agency 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.~~

~~[3] The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above 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 approved 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.~~

~~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.~~

~~Replace with Attached Word document (which shows changes to Article 305 in legislative format)~~

Additional Proposed Changes

File Name	Description	Approved
Article305.docx	Proposed Changes for Article 305	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Article 305 is new to the 2023 NEC® and was created to locate requirements for systems operating at over 1000 Vac, 1500 Vdc (referred to as “Medium Voltage” (MV)) from Article 300. This restructuring allows for an improved focus on MV requirements. With this improved focus, it is clear that additional work is needed to ensure requirements are written to address the needs specific to MV installations.

The TG recommendation is to make all MV requirements in 305 ‘standalone’, so the user does not have to determine what LV requirements are applicable. This PI identifies the relevant requirements from Article 300, and add them (either directly, or with modifications to reflect MV requirements) into Article 305. Below is a summary of the changes:

• 305.1 (Scope) is expanded to include additional requirements found in 300.1
• 305.3 is renamed “Limitations” to align with 300.3. Voltage is covered by (A), and Temperature by (B). The Table is expanded to cover NUCC and HDPE, as those systems are not limited to low voltage.
Cablebus and MV cable are limited to 2001-2500 Vdc. The column referencing Articles is deleted to avoid references to entire Articles.
• 305.3 (Conductors) is added from 300.3. 305.4 is integrated into this new Section, and “Column-Width Panelboard Enclosures” from 300.3 does not apply to MV, and is not included in this revised section.
• 305.4 (Protection Against Physical Damage) is from 300.4, with requirements for different ‘cable’ types removed, as these do not apply to MV installations.
• 305.5 is relocated from 305.15 to align with the location for the section on “Underground Installations” used in Article 300 (Section 300.5).
• Requirements for “Induction Heating” are expanded to include requirements from 300.20 and relocated to 305.36.
• 305.14 (Protection Against Corrosion and Deterioration) is from 300.6.
• 305.16 (Raceways Exposed to Different Temperatures) is from 300.7.

• 305.18 (Installation of Conductors With Other Systems) is from 300.8.
• 305.20 (Electrical Continuity of Metal Raceways, Cable Armor, and Enclosures) is from 300.10
• 305.22 (Securing and Supporting) from 300.11 – with 300.11(C) removed, as it doesn't apply to MV installations.
• 305.24 (Mechanical Continuity – Raceways and Cables) is from 300.12.
• 305.26 (Mechanical and Electrical Continuity – Conductors) is from 300.13.
• 305.28 (Boxes, Conduit Bodies, or Fittings – Where Required) is from 300.15 with wiring methods that do not apply to MV installations removed.
• 305.30 (Number and Size of Conductors and Cables in Raceway) is from 300.17.
• 305.32 (Raceway Installations) is from 300.18.
• 305.34 (Supporting Conductors in Vertical Raceways) is from 300.19.
• 305.38 (Spread of Fire or Products of Combustion) is from 300.21.
• 305.40 (Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums) is from 300.22.
• 305.42 (Panels Designed to Allow Access) is from 300.23.
• 305.44 (Exit Enclosures (Stair Towers)) is from 300.25.

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Submittal Date: Wed Sep 06 11:32:39 EDT 2023
Committee: NEC-P09

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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.

305.3 Limitations~~Other Articles~~.

(A) Voltage.

Wiring methods, as specified in Table 305.3(A), shall be permitted as identified in the table.~~Conductors shall be permitted to be installed in accordance with any of the wiring methods identified in Table 305.3.~~

Table 305.3(A) Wiring Methods Permitted for Use in Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

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Wiring Methods Permitted for Use Above 1000 Volts ac, 1500 Volts dc Voltage Levels		~~Reference~~
Pull and junction boxes, conduit bodies, and handhole enclosures	Over 1000	~~Article 314, Part IV~~
Metal-clad cable (Type MC)	1000–35,000	~~Article 330~~
Type MV Cable, MV Cable Joints, MV cable Terminations	2001- 35,000 AC 2001-2500 DC	~~Article 337~~
Type P cable	1000–2000	
Intermediate metal conduit (IMC)	Over 1000	~~Article 342~~
Nonmetallic underground conduit with conductors (NUCC)	Over 1000	
High density polyethylene conduit (HDPE)	Over 1000	~~Article 344~~
Rigid metal conduit (RMC)	Over 1000	
Rigid polyvinyl chloride conduit (PVC)	Over 1000	~~Article 352~~
Reinforced thermosetting resin conduit (RTRC)	Over 1000	~~Article 355~~
Electrical metallic tubing (EMT)	Over 1000	~~Article 358~~
Auxiliary gutters	Over 1000	~~Article 366~~
Busway	Over 1000	~~Article 368, Part IV~~
Cablebus	1000–35,000 AC 2001 – 2500 DC	~~Article 370~~
Cable trays	1000–35,000	~~Article 392~~
Messenger-supported wiring	1000–35,000	~~Article 396~~
Outdoor overhead conductors	Over 1000	~~Article 395~~
Insulated bus pipe (IBP)	1000–35,000 ac	~~Article 369~~

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.

Temperature limitations of conductors shall be in accordance with 310.14(A)(3).

305.3 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.

Conductors shall be permitted to be run in parallel in accordance with 310.10(G). 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. 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).

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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)~~305.4~~ 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 enclosure, cable, or raceway.

305.4 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.

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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 4 AWG or larger 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

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(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.

305.5 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. Underground cables shall be installed in accordance with 305.5(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 305.5(A).

Table 305.5(A) Minimum Cover Requirements

	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	Direct-Buried Cables[1]		Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit[2]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[3]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**
Over 1000 V ac, 1500 V dc, through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

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.

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4. In industrial establishments, 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]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.
[2]Listed by a qualified testing agency 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.
[3]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above 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.

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.

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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.

305.6~~5~~ 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.

~~**305.6 Protection Against Induction Heating.**~~
~~Metallic raceways and associated conductors shall be arranged to avoid heating of the raceway in accordance with 300.20.~~

305.7 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.

305.8 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.

305.9 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.

305.10 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.

305.11 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.

305.12 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

305.14 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

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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.

305.16 Raceways Exposed to Different Temperatures.

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(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.

305.20 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.

305.22 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.

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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.

305.24 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.

305.26 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.

305.28 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.

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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.

305.30 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.

305.32 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*.

305.34 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 305.34(A) Spacings for Conductor Supports

Conductor Size	**Support of Conductors in Vertical Raceways**	**Conductors: Aluminum or Copper-Clad Aluminum**		**Conductors: 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).

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(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.

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

(A) 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.

Exception: A single conductor shall be permitted to be installed in a ferromagnetic enclosure and used for skin-effect heating in accordance with 426.42 and 427.47.

(B) Individual Conductors.

Where a single 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.

Exception: In the case of circuits supplying vacuum or electric-discharge lighting systems or signs or X-ray apparatus, the currents carried by the conductors are so small that the inductive heating effect can be ignored where these conductors are placed in metal enclosures or pass through metal.

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.

305.38 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.

305.40 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).

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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.

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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.

305.42 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.

305.44 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.

~~**305.15 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. Underground cables 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**~~

-	~~General Conditions (not otherwise specified)~~						~~Special Conditions (use if applicable)~~					
-	~~Column 1~~		~~Column 2~~		~~Column 3~~		~~Column 4~~		~~Column 5~~		~~Column 6~~	
-	~~Direct-Buried Cables[1]~~		~~Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit[2]~~		~~Rigid Metal Conduit and Intermediate Metal Conduit~~		~~Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[3]~~		~~Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited~~		~~Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas~~	
~~Circuit Voltage~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~
~~Over 1000 V ac, 1500 V dc,~~	~~750~~	~~30~~	~~450~~	~~18~~	~~150~~	~~6~~	~~100~~	~~4~~	~~450~~	~~18~~	~~600~~	~~24~~

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~~-~~	~~General Conditions (not otherwise specified)~~						~~Special Conditions (use if applicable)~~					
~~-~~	~~Column 1~~		~~Column 2~~		~~Column 3~~		~~Column 4~~		~~Column 5~~		~~Column 6~~	
~~-~~	~~Direct-Buried Cables[1]~~		~~Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit[2]~~		~~Rigid Metal Conduit and Intermediate Metal Conduit~~		~~Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[3]~~		~~Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited~~		~~Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas~~	
~~Circuit Voltage~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~
~~through 22 kV~~												
~~Over 22 kV through 40 kV~~	~~900~~	~~36~~	~~600~~	~~24~~	~~150~~	~~6~~	~~100~~	~~4~~	~~450~~	~~18~~	~~600~~	~~24~~
~~Over 40 kV~~	~~1000~~	~~42~~	~~750~~	~~30~~	~~150~~	~~6~~	~~100~~	~~4~~	~~450~~	~~18~~	~~600~~	~~24~~

~~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. In industrial establishments, 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]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.~~
~~[2]Listed by a qualified testing agency 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.~~
~~[3]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above 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 approved 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~~

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~~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.**~~

~~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.~~

Public Input No. 3357-NFPA 70-2023 [New Article after 305]

305.13 Protection Against Physical Damage

Where cables, conduits and raceways are encased or embedded in concrete or masonry hoistway walls, pit floor and machine room floor the location shall be indicated by permanent markers set in the walls or floors at intervals of not more than 914mm (3ft.).

Informational Note: The marking should be designed to draw attention to the location and nature of the embedded equipment; it also should be indelible and easily legible through the use of such materials as metal markers and dye markings.

Statement of Problem and Substantiation for Public Input

Incidents have occurred where elevator mechanics have drilled into hoistway walls and machine room floors and struck live unmarked conductors. Fortunately, there were no injuries. In the hoistway, it is a common procedure to drill into the concrete to install anchors for rail brackets. The added proposed language adds a requirement to ensure that conductors, cables and other types of wiring methods get marked to avoid being damaged or personal injury.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3361-NFPA 70-2023 [New Section after 620.21(A)(1)]	

Submitter Information Verification

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Submittal Date: Fri Sep 01 14:27:01 EDT 2023

Committee: NEC-P09

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

305.3 ~~Other Articles.~~

~~Conductors shall be permitted to be installed in accordance with any of the wiring methods identified in Table 305.3 .~~

~~Table 305.3 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 Reference Pull and junction boxes, conduit bodies, and handhole enclosures Over 1000 Article 314, Part IV Metal-clad cable (Type MC) 1000–35,000 Article 330 Type P cable 1000–2000 Article 337~~

3 Wiring Methods .

Wiring methods permitted for use in systems rated over 1000V AC, 1500V DC shall be in accordance with 305.3(A) through (C), as applicable

(A). One of the following general wiring methods

1. Type MC cable

2. Type P cable

3. Intermediate metal conduit (IMC)

~~Over 1000 Article 342~~

4. Rigid metal conduit (RMC)

~~Over 1000 Article 344~~

5. Rigid polyvinyl chloride conduit (PVC)

~~Over 1000 Article 352~~

6. Reinforced thermosetting resin conduit (RTRC)

~~Over 1000 Article 355~~

7. Electrical metallic tubing (EMT)

~~Over 1000 Article 358~~

8. Auxiliary gutters

~~Over 1000 Article 366 Busway Over 1000 Article 368, Part IV Cablebus 1000–35,000 Article 370 Cable trays 1000–35,000 Article 392~~

~~,~~

~~9. Busways~~

~~10. Cablebus~~

~~11. Cable trays~~

~~12. Messenger-supported wiring~~

~~1000–35,000 Article 396~~

~~13. Outdoor overhead conductors~~

~~Over 1000 Article 395~~

~~14. Insulated bus pipe (IBP)~~

~~1000–35,000 ac Article 369~~

~~15. Pull and junction boxes, conduit bodies, and handhole enclosures in accordance with Article 314, Part IV~~

~~(B) 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:~~

~~(C) - 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~~

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

Additional Proposed Changes

File Name	Description	Approved
305_3_Conversion_to_List_Form.docx	Legislative Text is displaying horribly in Terra so I've displayed it without legislative text and saved it here to show how it is intended to display for the panel's benefit.	

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style manual prohibits reference to entire articles except Article 100 or where required for context. As such, it is recommended to convert the list of approved wiring methods into a list form, similar to how wiring methods are described elsewhere in the code, such as in 501.10. The intent here is not to change the content, but format the section in a usable manner compliant with the style manual. The table of contents and/or index found in this code can easily identify the article for the user as required.

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

305.3 Wiring Methods.

Wiring methods permitted for use in systems rated over 1000V AC, 1500V DC shall be in accordance with 305.3(A) through (C), as applicable

(A). One of the following general wiring methods

1. Type MC cable
2. Type P cable
3. Intermediate metal conduit (IMC)
4. Rigid metal conduit (RMC)
5. Rigid polyvinyl chloride conduit (PVC)
6. Reinforced thermosetting resin conduit (RTRC)
7. Electrical metallic tubing (EMT)
8. Auxiliary gutters,
9. Busways
10. Cablebus
11. Cable trays
12. Messenger-supported wiring
13. Outdoor overhead conductors
14. Insulated bus pipe (IBP)
15. Pull and junction boxes, conduit bodies, and handhole enclosures in accordance with Article 314, Part IV

(B) 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.

(C) Airfield lighting cable used in series circuits that are powered by regulators and installed in restricted airport lighting vaults 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.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style manual prohibits reference to entire articles except Article 100 or where required for context. As such, it is recommended to convert the list of approved wiring methods into a list form, similar to how wiring methods are described elsewhere in the code, such as in 501.10. The intent here is not to change the content, but format the section in a usable manner compliant with the style manual. The table of contents and/or index found in this code can easily identify the article for the user as required.

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

305.4 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 enclosure, cable, or raceway unless functionally associated .

Statement of Problem and Substantiation for Public Input

Many time manufactures of pule width modulation drives and reduced voltage starters for medium voltage application s utilize a non shielded cable and also require that conductors of 1000 volts or less be installed in the same enclosure for controls.

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Public Input No. 1282-NFPA 70-2023 [New Section after 305.10]

Insulation Voltage Rating

Conductors shall be insulated for the maximum phase to phase, phase to neutral, and phase to ground operating voltages that may be experienced based on the installation.

Statement of Problem and Substantiation for Public Input

Shielded MV cables are rated based on a phase-to-ground voltage gradient from the core of the cable to the outer shield. When applied on a high-resistance type Impedance Grounding System, as described in 250.187, the intent is to not interrupt power to the system until the fault can be located or safely shut down. However, during that time the phase-to-ground potential has been increased to the full phase-to-phase voltage of the system. This results in voltage stress on the cable insulation of a line-voltage rated cable and a need for increased voltage insulation to be used to account for this risk. The insulation classes of 100%, 133%, and 173% are built to cover the range of applications described above, but the code doesn't presently identify a specific requirement to adjust to the 173% class in the scenario described.

Submitter Information Verification

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City:	
State:	
Zip:	
Submittal Date:	Wed Jul 05 18:15:06 EDT 2023
Committee:	NEC-P09

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

~~**(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. Underground cables shall be installed in accordance with 305.15(A) through (

~~1~~

D)

~~,~~

.

(A)

~~(2), or (A)(3), and the installation shall meet the depth requirements of Table~~

Minimum Cover Requirements.

Direct burial cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of 305.15(A)

~~.~~

~~Table 305.15(A) Minimum Cover Requirements~~

~~General Conditions (not otherwise specified) Special Conditions (use if applicable) Column 1 Column 2 Column 3 Column 4 Column 5 Column 6 Direct-Buried Cables [1] Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit [2]~~

~~(1) through (A)(5).~~

~~**(1) Rigid Metal Conduit and Intermediate Metal Conduit .** Wiring installations covered by Article 305 installed underground, in rigid metal conduit and intermediate metal conduit installed underground shall have a minimum cover not less than 150 mm (6in.).~~

~~**(2) Raceways Under Buildings or Exterior Concrete Slabs**~~

~~, 100 mm (4 in.) Minimum Thickness [3] Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas Circuit Voltage mm in. mm in. mm in. mm in. mm in. mm in. Over 1000 V ac, 1500 V dc, through 22 kV 750 30 450 18 150 6 100 4 450 18 600 24 Over 22 kV through 40 kV 900 36 600 24 150 6 100 4 450 18 600 24 Over 40 kV 1000 42 750 30 150 6 100 4 450 18 600 24~~

~~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.~~

~~. Wiring installations covered by Article 305, installed in a raceway under a building or exterior concrete slabs at least 100 mm (4 in.) thick, shall have a minimum cover not less than 100 mm (4in.). The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.~~

~~**(3) Cables Installed In or Under Airport Runways or Adjacent Areas.** Wiring installations covered by Article 305, installed in or under airport runways or adjacent areas where trespass is prohibited, shall have a minimum cover not less than 450 mm (18 in.).~~

~~**(4) Areas Subject to Vehicular Traffic.** Wiring installations covered by Article 305, installed underground in areas subject to vehicular traffic such as thoroughfares and commercial parking areas shall have a minimum cover not less than 600 mm (24 in.)~~

~~**(5) All Other Areas.** Wiring installations covered by Article 305, installed underground, in all other areas not specified in 305.15(A)(1)-(4), shall meet the minimum cover requirements in Table 305.15(A)(5).~~

~~*Exception to 305.15(A)(1)-(5) No. 1: Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.*~~

~~3.~~

~~Exception to 305.15(A)(1)-(5) No. 2: Where solid rock prevents compliance with the cover depths specified in~~

~~this table~~

~~305.15(A)(1)-(5) , the~~

~~wiring shall~~

~~wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The~~

~~raceways~~

~~raceway shall be covered by a minimum of~~

~~50 mm~~

~~50 mm (~~

~~2 in~~

~~2 in .) of concrete extending down to the rock.~~

~~4.~~

~~Exception to 305.15(A)(1)-(5) No. 3: In industrial establishments, 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~~

~~to 150 mm (6 in .) for each~~

~~50 mm~~

~~50 mm (~~

~~2 in~~

~~2 in .) of concrete or equivalent~~

~~placed entirely~~

~~placed entirely within the trench over the underground installation.~~

~~Informational Note No. 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.~~

Table 305.15(A)(5) Minimum Cover Requirements, Over 1000 Volts ac, 1500 Volts dc, Nominal Burial Depths in Millimeters (Inches).

Circuit Voltage	Column 1 Direct-Buried Cables [1] mm	Column 1 Direct-Buried Cables [1] in.	Column 2 Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit [2] mm	Column 2 Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit [2] in.
Over 1000 V ac, 1500 V dc, through 22 kV	750	30	450	18
Over 22 kV through 40 kV	900	36	600	24
Over 40 kV	1000	42	750	30

[1] Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[2] Listed by a qualified testing agency 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.

~~[3] The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.~~

~~(1)~~ (B) 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~~ C) 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~~ D) 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.

Additional Proposed Changes

File Name	Description	Approved
305.15_A_-_D_.png	305.15(A)-(D)	
Table_305.15_A_5_.png	Table 305.15(A)(5)	

Statement of Problem and Substantiation for Public Input

Similarly, to Section 300.5 and Table 300.5(A), Section 305.15 and Table 305.15 should be revised for consistency. Additionally, where rules for cover are the exact same, there is not necessarily a need for a table. See revised Table 305.15(A) below. Notes and references1 to Table 305.15(A) have been incorporated using exceptions or information notes as appropriate in Section 305.15(A)(1)-(5).

Terra butchered the formatting of the revised table and structure of 305.15(A)-(D) so I uploaded pictures of what both should look like.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1616-NFPA 70-2023 [Section No. 300.5(A)]	
Public Input No. 1616-NFPA 70-2023 [Section No. 300.5(A)]	

Submitter Information Verification

Submitter Full Name:	Kyle Krueger
Organization:	NECA
Affiliation:	NECA
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Submittal Date:	Thu Jul 27 13:34:33 EDT 2023
Committee:	NEC-P09

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. Underground cables shall be installed in accordance with 305.15(A) through (D).~~(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 305.15(A)~~

(A) Minimum Cover Requirements.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of 305.15(A)(1) through (A)(5):

(1) **Rigid Metal Conduit and Intermediate Metal Conduit.** Wiring installations covered by Article 305 installed underground, in Rigid metal conduit and intermediate metal conduit installed underground shall have a minimum cover not less than 150 mm, (6 in.).

(2) **Raceways Under Buildings or Exterior Concrete Slabs.** Wiring installations covered by Article 305, installed in a raceway under a building or exterior concrete slabs at least 100 mm (4 in.) thick, shall have a minimum cover not less than 100 mm (4 in.). The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

(3) **Cables Installed In or Under Airport Runways or Adjacent Areas.** Wiring installations covered by Article 305, installed In or Under airport runways or adjacent areas where trespass is prohibited, shall have a minimum cover not less than 450 mm (18 in.).

(4) **Areas Subject to Vehicular Traffic.** Wiring installations covered by Article 305, installed underground in areas subject to vehicular traffic such as thoroughfares and commercial parking areas shall have a minimum cover not less than 600 mm (24 in.).

(5) **All Other Areas.** Wiring installations covered by Article 305, installed unground, in all other areas not specified in 305.15(A)(1)-(4), shall meet the minimum cover requirements in Table 305.15(A)(5).

Exception to 305.15(A)(1)-(5) No. 1: Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

Exception to 305.15(A)(1)-(5) No. 2: Where solid rock prevents compliance with the cover depths specified in 305.15(A)(1)-(5), 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.

Exception to 305.15(A)(1)-(5) No. 3: In industrial establishments, 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.

Informational Note No.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.

~~(1)~~(B) Shielded Cables and Nonshielded Cables in Metal-Shealthed 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)~~(C) 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.

~~(A)~~ (D) Other Nonshielded Cables.
Other nonshielded cables not cover 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.

Table 305.15(A)(5) Minimum Cover Requirements, Over 1000 V ac, 1500 V dc, Nominal Burial in Millimeters (Inches)

	~~General Conditions (not otherwise specified)~~						~~Special Conditions (use if applicable~~				
	Column 1		Column 2		~~Column 3~~		~~Column 4~~		~~Column 5~~		~~Col~~
	Direct-Buried Cables[1]		Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit[2]		~~Rigid Metal Conduit and Intermediate Conduit~~		~~Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[3]~~		~~Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited~~		~~Areas Subje Traffic, Such and Comm A~~
'oltage	mm	in.	mm	in.	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~	~~in.~~	~~mm~~
c, 1500 V kV	750	30	450	18	~~150~~	6	~~100~~	4	~~450~~	~~18~~	~~600~~
rough 40 kV	900	36	600	24	~~150~~	6	~~100~~	4	~~450~~	~~18~~	~~600~~
	1000	42	750	30	~~150~~	6	~~100~~	4	~~450~~	~~18~~	~~600~~

~~all 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 raceways and the top surface of fi or similar cover.~~

~~pths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.~~

~~lid 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 (2 in.) of concrete extending down to rock.~~

~~rial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements for other than rigid metal conduit nduit 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.~~

rect-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the tre above the cables.

lified testing agency 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

~~xtend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installati~~

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

(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. ~~Underground cables~~ 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

~~- General Conditions (not otherwise specified) Special Conditions (use if applicable) - Column 1 Column 2 Column 3 Column 4 Column 5 Column 6 - Direct-Buried Cables 1 Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit 2 Rigid Metal Conduit and Intermediate Metal Conduit Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness 3 Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas Circuit Voltage mm in. mm in. mm in. mm in. mm in. mm in. Over 1000 V ac, 1500 V dc, through 22 kV 750 30 450 18 150 6 100 4 450 18 600 24 Over 22 kV through 40 kV 900 36 600 24 150 6 100 4 450 18 600 24 Over 40 kV 1000 42 750 30 150 6 100 4 450 18 600 24~~

~~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. In industrial establishments, 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] Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.~~

~~[2] Listed by a qualified testing agency 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.~~

~~[3] The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.~~

~~(1)~~

for Buried Cables, Conductors, and Raceways

REPLACE TABLE 305.15(A) WITH TABLE ATTACHED TO THIS PUBLIC INPUT

(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.

Additional Proposed Changes

File Name	Description	Approved
PI_-_Table_305.15_Revisions_.docx	Word Version of Public Input - with Replacement Table for 305.15(A)	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth.

The current layout of the table is confusing. The first 3 columns, while being identified as “General Conditions” are actually wiring methods, while columns 4-6 are “special conditions”, but does not details wiring methods. This Public Input resolves this inconsistency by reformatting the table to have the column and row headings resemble the layout in Table 300.5(A) (for “Minimum Cover Requirements, 0 – 1000 Volts ac, 1500 Volts dc, Nominal”). Row descriptions from 300.5(A) were applied, then updated as follows:

- Rather than having the specification of concrete limited to “exterior slab(s)”, the 102 mm (4 in.) requirement is revised to be generic to all concrete.
- Areas subject to “Vehicular Traffic” (i.e., Column 6 from Table 305.15(A)) is revised to the row description from 300.5(A) (i.e. “Under streets, highways…”), but it is also added that these surfaces are to be “paved” as a gravel or dirt surface doesn’t afford the same level of protection as one that is paved.
- Similarly, the wording regarding “runways” is adopted from 300.5(A), with the term “paved” added.
- Next, the fact that “Notes” are numbered, as are the superscripted “footnotes”, results in confusion. Similar to Table 300.5(A), the “footnotes” are relocated to appear above the notes. A heading is added, and the “footnotes” are re-identified with alphabetical superscripts.

Requirements for a warning ribbon are expanded to apply to all direct-buried cables that are not encased or protected by concrete, as direct-buried cables with voltages above 1000 volts represent a significant hazard if exposed to damage while excavating.

The phrase “by a qualified testing agency” is considered unnecessary in the second footnote, and is therefore deleted.

In the existing table, conductors of any voltage, so long as they are installed in rigid metal conduit or intermediate metal conduit, were permitted to be installed 150 mm (6 in.) below grade. Based on the hazards of these voltages, the graduated approach used for other conduit systems is more logical;

therefore, the rigid metal conduit and intermediate metal conduit is modified to reflect the greater depths. There is, however, a provision added that allows the addition of 50 mm (2 in.) of concrete to reduce the burial depth requirements. This provision is similar to others where the addition of 50 mm (2 in.) of concrete is used to reduce depth.

Lastly, the requirements in 305.15(A) should not apply to inground, but not buried, installations such as precast cable trenches, tunnels, etc. This public input revises the language in 305.15(A), as well as the title to the table, to reflect the fact that these requirements only apply to buried cables, conductors, and raceways.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 17 08:54:16 EDT 2023
Committee: NEC-P09

(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 ~~Underground~~ 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

REPLACE TABLE 305.15(A) WITH THE FOLLOWING TABLE (Attachment to the Public Input):

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, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24	600	24
In or under paved airport runways, including adjacent areas where trespass is prohibited.	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. In industrial establishments, 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.

Rationale:

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth.

The current layout of the table is confusing. The first 3 columns, while being identified as “General Conditions” are actually wiring methods, while columns 4-6 are “special conditions”, but does not details wiring methods. This Public Input resolves this inconsistency by reformatting the table to have the column and row headings resemble the layout in Table 300.5(A) (for “Minimum Cover Requirements, 0 – 1000 Volts ac, 1500 Volts dc, Nominal”). Row descriptions from 300.5(A) were applied, then updated as follows:

- Rather than having the specification of concrete limited to “exterior slab(s)”, the 102 mm (4 in.) requirement is revised to be generic to all concrete.
- Areas subject to “Vehicular Traffic” (i.e., Column 6 from Table 305.15(A)) is revised to the row description from 300.5(A) (i.e. “Under streets, highways…”), but it is also added that these surfaces are to be “paved” as a gravel or dirt surface doesn’t afford the same level of protection as one that is paved.
- Similarly, the wording regarding “runways” is adopted from 300.5(A), with the term “paved” added.
- Next, the fact that “Notes” are numbered, as are the superscripted “footnotes”, results in confusion. Similar to Table 300.5(A), the “footnotes” are relocated to appear above the notes. A heading is added, and the “footnotes” are re-identified with alphabetical superscripts.

Requirements for a warning ribbon are expanded to apply to all direct-buried cables that are not encased or protected by concrete, as direct-buried cables with voltages above 1000 volts represent a significant hazard if exposed to damage while excavating.

The phrase “by a qualified testing agency” is considered unnecessary in the second footnote, and is therefore deleted.

In the existing table, conductors of any voltage, so long as they are installed in rigid metal conduit or intermediate metal conduit, were permitted to be installed 150 mm (6 in.) below grade. Based on the hazards of these voltages, the graduated approach used for other conduit systems is more logical; therefore, the rigid metal conduit and intermediate metal conduit is modified to reflect the greater depths. There is, however, a provision added that allows the addition of 50 mm (2 in.) of concrete to reduce the burial depth requirements. This provision is similar to others where the addition of 50 mm (2 in.) of concrete is used to reduce depth.

Lastly, the requirements in 305.15(A) should not apply to inground, but not buried, installations such as precast cable trenches, tunnels, etc. This public input revises the language in 305.15(A), as well as the title to the table, to reflect the fact that these requirements only apply to buried cables, conductors, and raceways.

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

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. Underground cables 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

	-	General Conditions (not otherwise specified)						Special Conditions (use if applicable)				
	-	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6
	-	Direct-Buried Cables[1]		Electrical Metallic Tubing, RTRC, PVC, and HDPE Conduit[2]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[3]		Cables in Airport Runways or Adjacent Areas Where ~~Trespass Is Prohibited~~ The Likelihood of Trespassing Is Reduced by Signs and Barriers		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V ac, 1500 V dc, through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

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. In industrial establishments, 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]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[2]Listed by a qualified testing agency 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.

[3]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth.

It is unclear how trespassing is prohibited, or when trespassing is permitted. This public input revises the text to improve clarity by requiring signs and barriers for these installations.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name:	Robert Osborne
Organization:	UL Solutions
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City:	
State:	
Zip:	
Submittal Date:	Thu Aug 17 09:03:17 EDT 2023
Committee:	NEC-P09

Public Input No. 198-NFPA 70-2023 [Section No. 305.15(C)]

(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)~~ 18 inches below grade 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.

Statement of Problem and Substantiation for Public Input

This rule used to apply to conduits on poles an (which are almost always subject to physical damage from vehicles, etc) and then then was changed to apply to all medium voltage stub ups. This requirement as now written would require use of schedule 80 90's, including stub ups in large fenced in substations where possibly not subject to truck traffic. Such seems unnecessary. It would seem more appropriate to expect medium/high voltage facility owners to have the competence to assess their needs.

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 20 04:11:04 EST 2023
Committee: NEC-P09

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

315.2 Reconditioned Equipment

MV Cable and Conductors shall not be reconditioned.

Statement of Problem and Substantiation for Public Input

MV Cable and Conductor, Fixture Wires, Cablebus, Cables, Raceways, Conduits, Tubings, Flexible Cords, Flexible Cables, Cable Trays, MV Cables, Wireways, etc. etc. are not permitted to be reconditioned per the NEMA Technical Position on Reconditioned Equipment (NEMA CS 100-2020, Appendix B.1)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 624-NFPA 70-2023 [New Section after 388.1]	

Submitter Information Verification

Submitter Full Name:	Russ Leblanc
Organization:	Leblanc Consulting Services
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Apr 16 08:43:11 EDT 2023
Committee:	NEC-P09

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

315.6 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 .

Statement of Problem and Substantiation for Public Input

The listing requirement for MV Cable joints and terminations was introduced during the last code cycle. The future effective date has been determined to be too short to allow the industry to obtain certification of these products by 2026. A future effective date is being proposed of 2029 to fully allow manufacturers who want to offer a certified product to do so and work down current inventory of non listed products.

Submitter Information Verification

Submitter Full Name: Paul Knapp

Organization: UL LLC.

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 30 09:48:51 EDT 2023

Committee: NEC-P09

Public Input No. 3419-NFPA 70-2023 [Section No. 315.6]

315.~~6~~ 6 Identification and 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, type MV cable terminations ~~,~~ and connectors shall be ~~effective January 1, 2026~~ identified .

Statement of Problem and Substantiation for Public Input

Presently, there is no UL Standard for which to list these products. The best indication of product safety is product history. MV cable joints, MV cable terminations and MV connectors have an outstanding service history. For decades, that history of service has been accomplished by identification of the products. Presently, these products are designed and manufactured to meet specific IEEE standards. Continued identification of these products in compliance to IEEE standards will continue the history of safe installations in this industry. The listing requirement added in the 2023 NEC adds no additional level of safety that is not already present for MV cable joints, MV cable terminations and connectors.

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:

Submittal Date: Sat Sep 02 18:33:53 EDT 2023
Committee: NEC-P09

Public Input No. 3502-NFPA 70-2023 [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.~~

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. A new section is added to comply with the NEC Style Manual Section 2.2.1 regarding Listing Requirements.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.
The post dated provision has been removed.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 04 17:08:08 EDT 2023
Committee: NEC-P09

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

(2) 133 Percent Insulation Level.

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~~ .

Additional Proposed Changes

File Name	Description	Approved
Memo_Style_McCabe_1_.pdf		

Statement of Problem and Substantiation for Public Input

The NEC style manual was misapplied to this section of code during Second Revision No. 7574-NFPA 70-2018. That revision read:
Also, the Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation is desirable.
With the committee statement reading: “This is an editorial activity . . . in accordance with the style manual . . . “

In the original wording before the revision, it was permitted when someone desired to increase the insulation level. Since use of the words “desires/desirable” is discouraged by the style manual, the revisers were correct in their intention to revise. However, after implementing the style manual's guideline, the logic of the statement now reads that better insulation is “permitted . . . where required” instead of simply that better insulation is “permitted.”

When we sought clarification, Mike McCabe, an NFPA Staff, replied that “[t]he hierarchy of the MV cables is good, better and best, and good cannot be used for better and best, but better and best can be used for good” as seen in the attached email record.

Submitter Information Verification

Submitter Full Name: Michael Lee
Organization: PEC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 01 19:01:40 EDT 2023
Committee: NEC-P09

Michael Lee

From: Shawn Schrader, PE
Sent: Wednesday, December 23, 2020 9:12 AM
To: Michael Lee
Cc: Rick Whitehill
Subject: FW: NFPA Technical Question Response ref# [ref:_00D5077Vx._5001T1RpKox:ref]

Follow Up Flag: Follow up
Flag Status: Flagged

From: NFPA Electrical
Sent: Wednesday, December 23, 2020 9:11 AM
To: Shawn Schrader, PE
Subject: NFPA Technical Question Response ref# [ref:_00D5077Vx._5001T1RpKox:ref]

NFPA
TECHNICAL QUESTIONS

Shawn to provide a little more detail to my previous response, in the context of your inquiry on 311.10(C)(2) It is not prohibited and the user would be not only NEC compliant but putting in cable with an insulation that exceeds the minimum Code requirement. The hierarchy of the MV cables is good, better and best, and good cannot be used for better and best, but better and best can be used for good.

Hope this helps,

Mike McCabe
NFPA Staff

Important Notice: Any opinion expressed in this correspondence is the personal opinion of the author and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should it be relied upon, to provide professional consultation or services.

If you have a follow-up question directly related to this inquiry, please reply to this email. If you have another question on either a separate topic or different document please return to the document information pages and submit your new question by clicking on the "Technical Questions" tab.

Contact: Shawn Schrader
Create Date: 12/22/2020

Document Number: 70
Edition: Use
Section: 311.10(C)
Subject: MV Cable Insultation Level Selection
Question for NFPA: My question regards the following sentence from 311.10(C)(2) [similar to (C)(3) as well]: “Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation.” Does this sentence preclude an engineer from specifying 133% in any way when 100% level category conditions are met?

--------------- Original Message ---------------
From: NFPA Electrical
Sent: 12/23/2020 7:47 AM
To:
Subject: NFPA Technical Question Response ref# [ref:_00D5077Vx._5001T1RpKox:ref]

NFPA
TECHNICAL QUESTIONS

Thank you for your inquiry on the 2020 NEC®

Compliance with the requirements of the National Electrical Code® is determined by the *authority having jurisdiction*. I am happy to answer your specific questions on 2020 NEC® requirements.

The *Code* does not contain requirements that provide permission to exceed the minimum requirements.

If any follow-up questions, call (800) 344-3555 to facilitate discussion.

Mike McCabe
NFPA Staff

Important Notice: Any opinion expressed in this correspondence is the personal opinion of the author and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should it be relied upon, to provide professional consultation or services.

If you have a follow-up question directly related to this inquiry, please reply to this email. If you have another question on either a separate topic or different document please return to the document information pages and submit your new question by clicking on the "Technical Questions" tab.

Contact: Shawn Schrader
Create Date: 12/22/2020

Document Number: 70
Edition: Use
Section: 311.10(C)
Subject: MV Cable Insultation Level Selection
Question for NFPA: My question regards the following sentence from 311.10(C)(2) [similar to (C)(3) as well]: “Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation.” Does this sentence preclude an engineer from specifying 133% in any way when 100% level category conditions are met?

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

(3) 173 Percent Insulation Level.

Cables shall be permitted to be applied under all of the following conditions:

(1) In industrial establishments where the conditions of maintenance and supervision ensure only qualified persons service the installation

(2) Where the fault clearing time requirements of the 133 percent level category cannot be met

(3) Where an orderly shutdown is required to protect equipment and personnel

(4) 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.

Informational Note: See UL 1072, *Medium-Voltage Power Cable*, ANSI/ICEA S-93-639, *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, *Standard for Concentric Neutral Cables Rated 5 through 46 kV for Medium Voltage Cables*.

Cables with 100 percent or 133 percent insulation level at a higher voltage rating meeting the Table 315.10(C) 173 percent insulation thickness requirements shall be permitted.

Statement of Problem and Substantiation for Public Input

Sections 315.10(C)(1)-(3) do not allow substitution of a higher voltage class of cable with lower % thickness even if the actual cable thickness is equivalent or higher. The problem is that the clearing time requirements are tied only to the percentage and not the voltage range or actual cable thickness. For example, in a 5kV high resistance grounded system, a 15kV 100% or 133% cable would have a greater insulation thickness than that of a 5kV 173% cable but would still be subject to the clearing time limits in (1) or (2) even though the insulation would be more than adequate to operate until an orderly shutdown could be safely accomplished.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Greg Wheeler
Organization: Marathon PEtroleum Co
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 31 14:18:44 EDT 2023
Committee: NEC-P09

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

(3) 173 Percent Insulation Level.

Cables shall be permitted to be applied under all of the following conditions:

(1) In industrial establishments where the conditions of maintenance and supervision ensure only qualified persons service the installation

(2) Where the fault clearing time requirements of the 133 percent level category cannot be met

(3) Where an orderly shutdown is required to protect equipment and personnel

(4) 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.~~

<u>(5) In 100 percent insulation level applications</u>

<u>(6) In 133 percent insulation level applications</u>

Informational Note: See UL 1072, *Medium-Voltage Power Cable*, ANSI/ICEA S-93-639, *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, *Standard for Concentric Neutral Cables Rated 5 through 46 kV for Medium Voltage Cables*.

Statement of Problem and Substantiation for Public Input

The NEC style manual was misapplied to this section of code during Second Revision No. 7574-NFPA 70 for the 2020 NEC cycle. That revision read:
"[Cable] shall be permitted to be used in 100 percent insulation level applications where additional insulation strength is desirable."
The committee statement changed from this original wording for the following reason: “editorial activity . . . in accordance with the style manual . . . "
Since the words “desires/desirable” is discouraged by the style manual as being unenforceable, the revisers were correct in their intention to revise. However, after implementing the style manual's guideline, the logic of the statement now reads that better insulation is “permitted . . . where required” instead of simply that better insulation is “permitted.”

When we sought clarification, Mike McCabe, an NFPA Staff, replied that “[t]he hierarchy of the MV cables is good, better and best, and good cannot be used for better and best, but better and best can be used for good” as seen in the attached email record.

With this public input submission, I believe the application of "best" (173%) cable is permitted in "better" (133%) or "good" (100%) cable applications as originally intended and complies with NEC style manual.

Submitter Information Verification

Submitter Full Name: Michael Lee
Organization: PEC
Street Address:
City:
State:

Zip:
Submittal Date: Fri Sep 01 19:32:48 EDT 2023
Committee: NEC-P09

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

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).

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

_

000 Volts

(Please add columns for 133% and 173% to 2001 - 5000 Volts section)

Conductor Size (AWG or kcmil)	2001–5000 Volts 100 Percent Insulation Level		-	5001–8000 Volts 100 Percent Insulation Level		-	133 Percent Insulation Level		-	173 Percent Insulation Level		-	8001–15,000 Volts 100 Percent Insulation Level		-	1 Per Insul Le
	mm	mils	-	mm	mils	-	mm	mils	-	mm	mils	-	mm	mils	-	mm
8	2.29	90	-	—	—	-	—	—	-	—	—	-	—	—	-	—
6–4	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	—	—	-	—
2	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	4.45	175	-	5.59
1	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	4.45	175	-	5.59
1/0–2000	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	4.45	175	-	5.59

Conductor Size (AWG or kcmil)	-	25,001–28,000 Volts 100 Percent Insulation Level		-	133 Percent Insulation Level		-	173 Percent Insulation Level		-	28,001–35,000 Volts 100 Percent Insulation Level		-	133 Percent Insulation Level		-	P In
	-	mm	mils	-	mm	mils	-	mm	mils	-	mm	mils	-	mm	mils	-	m
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

Statement of Problem and Substantiation for Public Input

Resistance grounding (high or low) is a common design for 2.4KV and 4.16KV systems. A longer tripping time than what is allowed in 315.10(C)(1) would be technically possible and often desirable in those applications. Adding 133% and 173% columns would provide guidance for the nominal thickness needed to achieve longer tripping times in applications where is technically possible.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3284-NFPA 70-2023 [Section No. 315.10(C)(3)]	

Submitter Information Verification

Submitter Full Name:	Greg Wheeler
Organization:	Marathon Petroleum Co
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Aug 31 13:29:23 EDT 2023
Committee:	NEC-P09

Public Input No. 4456-NFPA 70-2023 [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, *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.

Statement of Problem and Substantiation for Public Input

Removed date from referenced ANSI approved standards in informational note No.1 to maintain shelf life of the reference indicating the reference is to the most recent version on the publication.

Submitter Information Verification

Submitter Full Name: Kyle Krueger
Organization: NECA
Affiliation: NECA
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 15:43:47 EDT 2023
Committee: NEC-P09

Public Input No. 2660-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:

Submittal Date: Thu Aug 24 08:08:44 EDT 2023
Committee: NEC-P09

Public Input No. 4343-NFPA 70-2023 [Sections 315.32(A), 315.32(B)]

Sections 315.32(A), 315.32(B)

(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). <u>When installed in cable tray type MV cable shall be securely fastend with the use of listed cable cleats.</u>

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

(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.

(B) Type MV Cable Joints and Terminations.

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

(1) Type MV cable joints and terminations, used where exposed to direct sunlight, shall be identified for the use.

(2) Direct buried.

(3) Where used intermittently or continuously submerged in water at a depth not exceeding 7 m (23 ft) type MV cable joints and terminations shall be identified for the use.

(4) The environmental operating temperature range shall be identified.

(5) Where used in one or more of the following conditions Type MV cable joints and terminations shall be identified for the use:

   (6) Underground chambers

   (7) Tunnels

   (8) Conduits

   (9) Manholes

   (10) Vaults

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

(12) In cable trays, where identified for 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. When installed in cable tray type MV cable shall be securely fastend with the use of listed cable cleats.

Informational Note No. 1: The “uses permitted” is not an all-inclusive list.

Informational Note No. 2: See IEEE-404, *IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5kV to 500kV*, for more information on cable joints. Cable joints are often referred to as splices. However, the term *splice* includes many other applications not included in the definition of a cable joint.

Informational Note No. 3: See IEEE-48, *IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV*, for information on terminations. Type MV cable terminations include terminations used to connect directly to equipment or insulators.

Informational Note No. 4: See IEEE-386, *IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5kV through 35 kV*, and IEEE-1215, *IEEE Guide for the Application of Separable Insulated Connectors*, for more information on separable insulated connectors. Type MV cable terminations also include separable insulated connectors, which are a type of pluggable cable termination and can be used for connection to equipment, such as switchgear or transformers. A separable connector has a matching interface that the separable connector plugs into on the equipment, such as switchgear or transformers. Separable connectors can also be ganged together to form a distribution junction using specialized junction brackets.

Statement of Problem and Substantiation for Public Input

When you get into medium voltage cables standard tray fastening with cable ties or small clamps will not hold the cable in place if a fault happens. Arcing or fault situations with these cables will jump and break ordinary fasteners. Cable cleats will hold the cable in pace during a fault and stop it from jumping out of the tray and potentially causing a hazard. There are many videos that show what happens in a fault situation with cable ties compared to using cleats. Please look at the following video.

https://youtu.be/_i2L-CCJoDI

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4349-NFPA 70-2023 [Section No. 392.30(B)]	

Submitter Information Verification

Submitter Full Name:	Raymond Horner
Organization:	Atkore
Affiliation:	Atkore
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 12:12:24 EDT 2023
Committee:	NEC-P09

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).

[315.60(D)(1)]

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

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

R_s = Resistance of the conductor shield μΩ /inch

X_m = Mutual reactance between the conductor and cable shield in μΩ /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.

Statement of Problem and Substantiation for Public Input

This change provides a means for 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).

An explanation is given under PI 3088 as an addition to Annex B.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3088-NFPA 70-2023 [New Section after B.7]	Annex B Referenced in Informational Note.
Public Input No. 3088-NFPA 70-2023 [New Section after B.7]	

Submitter Information Verification

Submitter Full Name:	Robert Osborne
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Submittal Date:	Tue Aug 29 11:04:39 EDT 2023
Committee:	NEC-P09

Public Input No. 2420-NFPA 70-2023 [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 ~~300.50~~ . 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 derating factor from 315.60(D)(2) is applied. ~~.~~

Additional Proposed Changes

File Name	Description	Approved
Revise_Figure_315.60_D_3_.docx	PI with content of Figure being revised	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Section 300.50 from the 2020 NEC was relocated to New 305.15. The reference in the Note needs to be corrected. It should refer to 305.15. In addition, a reference is added to 315.60(D)(2), which allows deeper depths if a derating factor is applied. This reference is needed for clarity.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Robert Osborne
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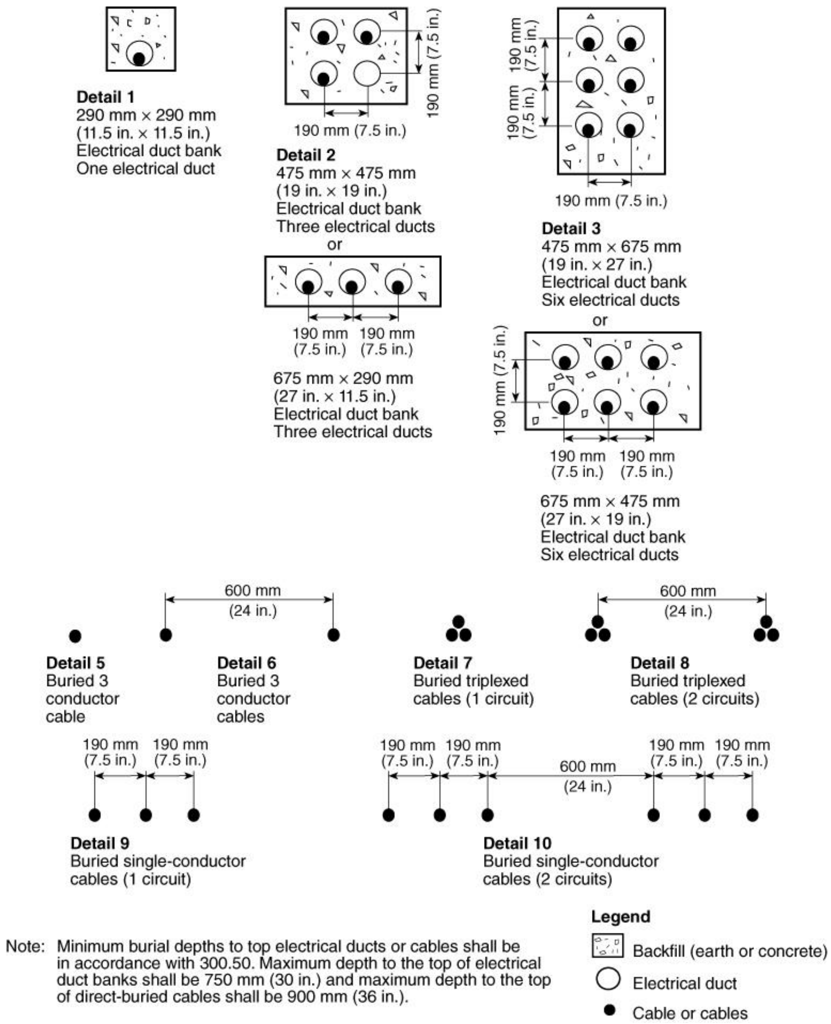
Submittal Date: Thu Aug 17 09:18:58 EDT 2023
Committee: NEC-P09

Proposal – Revise Note to Figure 315.60(D)(3):



Note: Minimum burial depths to top electrical ducts or cables shall be in accordance with 305.15~~300.50~~. 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 derating factor from 315.60(D)(2) is applied.~~.~~

Rationale:

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Section 300.50 from the 2020 NEC was relocated to New 305.15. The reference in the Note needs to be corrected. It should refer to 305.15. In addition, a reference is added to 315.60(D)(2), which allows deeper depths if a derating factor is applied. This reference is needed for clarity.

Public Input No. 957-NFPA 70-2023 [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).

Statement of Problem and Substantiation for Public Input

The note to "Figure 315.60(D)(3)" references section 300.50. This is incorrect and should reference 305.15. Article 305 is over 1000 V AC, 1500 V DC which is what this figure is referencing.

Submitter Information Verification

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Submittal Date: Tue Jun 06 14:09:02 EDT 2023
Committee: NEC-P09

Public Input No. 2421-NFPA 70-2023 [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 amapcity derating factor from 315 .60(D)(2) is applied.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

A reference is added to 315.60(D)(2), which allows deeper depths if a derating factor is applied. This reference is needed for clarity.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Robert Osborne

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Submittal Date: Thu Aug 17 09:23:20 EDT 2023

Committee: NEC-P09

Public Input No. 199-NFPA 70-2023 [Section No. 395.30(B)]

(B) Structures.

Structures ~~of wood, metal, or concrete, or combinations of those materials,~~ shall be ~~provided for support of overhead conductors over 1000 volts, nominal~~ of substantial strength . 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

Statement of Problem and Substantiation for Public Input

It would seem unnecessary to require that pole structures be designed by a licensed professional engineer, only to tell the engineer they can only use wood, concrete, or metal. There are other products available (such as fiberglass poles) and we should trust engineering professionals to make the assessments on what available base materials are suitable.

Submitter Information Verification

Submitter Full Name: Josh Weaver
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Submittal Date: Fri Jan 20 04:16:00 EST 2023
Committee: NEC-P09

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

~~**Article 404** Switches~~

~~Part I~~

~~.~~

~~– General~~

~~**404.1** Scope.~~

~~This article covers all switches, switching devices, and circuit breakers used as switches operating at 1000 volts and below, unless specifically referenced elsewhere in this *Code* for higher voltages.~~

~~This article does not cover wireless control equipment to which circuit conductors are not connected.~~

~~Informational Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted control devices.~~

~~**404.2** Switch Connections.~~

~~**(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.~~

~~**404.3** Enclosure.~~

~~**(A)** General.~~

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

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

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

~~**(B)** Used as a Raceway.~~

~~Enclosures shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices, unless the enclosure complies with 312.8 .~~

~~**404.4** Damp or Wet Locations.~~

~~**(A)** Surface-Mounted Switch or Circuit Breaker.~~

~~A surface-mounted switch or circuit breaker shall be enclosed in a weatherproof enclosure or cabinet that complies with 312.2 .~~

~~**(B)** Flush-Mounted Switch or Circuit Breaker.~~

~~A flush-mounted switch or circuit breaker shall be equipped with a weatherproof cover.~~

~~**(C)** Switches in Tub or Shower Spaces.~~

~~Switches shall not be installed within tub or shower spaces unless installed as part of a listed tub or shower assembly.~~

~~**404.5** Time Switches, Flashers, and Similar Devices.~~

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

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

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

~~**(A)** Single-Throw Knife Switches.~~

~~Single-throw knife switches shall be placed so that gravity will not tend to close them. Single-throw knife switches, approved for use in the inverted position, shall be provided with an integral mechanical means that ensures that the blades remain in the open position when so set.~~

~~**(B)** Double-Throw Knife Switches.~~

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

~~**(C)** Connection of Switches.~~

~~Single-throw knife switches and switches with butt contacts shall be connected such that their blades are de-energized when the switch is in the open position. Bolted pressure contact switches shall have barriers that prevent inadvertent contact with energized blades. 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) .*~~

~~**404.7** Indicating.~~

~~General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in an enclosure as described in 404.3 , shall 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.*~~

~~**404.8** Accessibility and Grouping.~~

~~**(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.~~

~~**(B)** Voltage Between Adjacent Devices.~~

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

~~**(C)** Multipole Snap Switches.~~

~~A multipole, general-use snap switch shall not be 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.~~

~~**(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.~~

~~**(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.~~

~~Except as covered in 404.9(B) , Exception No. 1, nonmetallic boxes for switches shall be installed with a wiring method that provides or includes an equipment grounding conductor.~~

~~**404.13** Knife Switches.~~

~~**(A)** Isolating Switches.~~

~~Knife switches rated at over 1200 amperes at 250 volts or less, and at over 1000 amperes at 251 to 1000 volts, shall be used only as isolating switches and shall not be opened under load.~~

~~**(B)** To Interrupt Currents.~~

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

~~**(C)** General-Use Switches.~~

~~Knife switches of ratings less than specified in 404.13(A) and (B) shall be considered general-use switches.~~

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

~~**404.14** Rating and Use of Switches.~~

~~Switches shall be listed and 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.~~

~~**(A)** Alternating-Current General-Use Snap Switch.~~

~~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.~~

~~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.~~

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

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

~~**(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) ~~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.~~

~~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.~~

~~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.~~

~~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.*~~

~~**404.16** 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.~~

~~**(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.~~

~~**404.22** 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 404.2(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 404.3 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.~~

Additional Proposed Changes

File Name	Description	Approved
Article_404_7-24-2023.docx	Re-written Article 404	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee established Task Group consisting of Bryan Tatum (Co-Chair), Chuck Kurten (Co-Chair), Paul Costello, Frank Tse, Nick Malouf, Doug Smith, Diane Lynch, and Randy Dollar.

The present scope of Article 404 address all switches, switching devices and circuit breakers used as switches operating at 1000 volts and below unless specifically referenced elsewhere in this Code for higher voltages.

The intent of this Public Input is to modify the scope of Article 404 to only cover general-use switches, motor-circuit switches, isolating switches, circuit breakers used as switches, and molded case switches. Other types of switches that fit outside of the modified scope of Article 404, i.e., general-use snap switch, pendant switch, surface switch, dimmer, and electronic control switches, and lighting control switches are relocated to Article 406. This relocation is logical as these types of switches (also referred to as 'wiring devices') are installed similar to how receptacles are installed. It should also be noted that the Standard for Electrical Equipment Maintenance, NFPA 70B, currently has "Wiring Devices" in Chapter 24 and "Switches" in Chapter 17. This PI would create a similar alignment of requirements.

This Public Input, along with another companion Public Input, was developed with the goal of improving usability of Article 404 Switches and facilitate the reassignment of switches to CMP's with the right focus for the equipment (namely, CMP-18 for ‘wiring devices’ and CMP-10 for larger switches).

Additionally, operating at voltages not over 1000 volts ac, 1500 volts dc, nominal was introduced to clarify what is meant by unless specifically referenced elsewhere in this code for higher voltages and for consistency with other parts of the code where 1500 volts dc is used.

Related Public Input No. 1544-NFPA 70-2026 [Revised Article 406]
1543 -NFPA 70-2026 [Revised Article 404]
1529 - NFPA 70 -2026 [New Definition – Wiring Device]
1528 - NFPA 70 -2026 [Revised Definitions Switch, General-Use. (General-Use Switch); Switch, General-Use Snap. (General-Use Snap Switch); and Switch, Isolating. (Isolating Switch)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1529-NFPA 70-2023 [New Definition after Definition: Wireways, Nonmetallic. (No...]	1544,1543,1529 and 1528
Public Input No. 1528-NFPA 70-2023 [Definitions (100): Switch, Gen... to Switch, Iso...]	1544,1543,1529 and 1528
Public Input No. 1544-NFPA 70-2023 [Article 406]	

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Article 404 Switches

Part I. General

404.1 Scope.

(A) Covered

This article covers the installation of the following:

~~This article **covers** all switches, switching devices, and circuit breakers used as switches operating at 1000 volts and below, unless specifically referenced elsewhere in this *Code* for higher voltages.~~

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.~~ unless specifically referenced elsewhere in this Code for higher voltages~~.

(B) Not Covered:

This article does not cover the installation of the following:

1) ~~w~~Wireless control equipment to which circuit conductors are not connected.

2) Wiring devices.

Informational Note: See 406.1 for wiring devices.

~~Informational Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted 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.

404.3 Reconditioned Equipment.

(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.

(B) Not Permitted to be Installed.

Reconditioned molded-case switches shall not be permitted to be installed.

404.~~2~~4 ~~Switch Connections.~~

~~**(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.

Commented [TBL1]: Scope modified to remove general-use snap switch, pendant switch, surface switch, dimmer, and electronic control switches and lighting control switches which are relocated to Article 406.

Commented [TBL2]: Added 1500 volts DC to be consistent with nominal limitations assumed in the code. Removed the "unless specifically referenced elsewhere in this Code for higher voltages" since this was considered to be redundant.

Formatted: Strikethrough

Commented [TBL3]: Scope updated to remove general-use snap switch, pendant switch, surface switch, dimmer, and electronic control switches and lighting control switches which are relocated to Article 406. Reference provided to section 406.1 for additional user guidance.

Commented [TBL4]: Relocated and retitled 404.14 to 404.2 to comply with 2.2.1 of the style manual. Removed the statement on marking that is already covered in 404.20 "Markings". Legacy 404.2 renumbered as 404.4 with additional comments in this area.

Commented [TBL5]: 404.16 was relocated to 404.3 and modified based upon 2.2.1 of the style manual. Legacy 404.3 information renumbered as 404.5.

Commented [TBL6]: 404.2 renumbered to 404.4

Commented [TBL7]: 404.2(A) relocated to 406.30(A).

Commented [TBL8]: Renamed from Switch Connections to Grounded Conductors.

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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.**~~

Commented [TBL9]: 404.2(C) relocated to 406.30(C)

~~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.~~3~~ 5 Enclosure.

Commented [TBL10]: 404.3 renumbered to 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 k~~Knife switches mounted on an open-face switchboard or panelboard shall be permitted without enclosures.

Commented [TBL11]: Pendant- and surface type snap switches relocated to 406.32.

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~~4~~ Damp or Wet Locations.

Commented [TBL12]: 404.4 renumbered to 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.

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Switches shall not be installed within tub or shower spaces unless installed as part of a listed tub or shower assembly.

404.~~7~~5 ~~Time Switches, Flashers, and Similar Devices.~~Adjustable Switches or Circuit Breakers

~~Time switches, flashers, and similar devices~~ 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~~6 Position and Connection of Switches.

(A) Single-Throw Knife Switches.

Single-throw knife switches shall be placed so that gravity will not tend to close them. Single-throw knife switches, approved for use in the inverted position, shall be provided with an integral mechanical means that ensures that the blades remain in the open position when so set.

(B) Double-Throw Knife Switches.

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

(C) Connection of Switches.

Single-throw knife switches and switches with butt contacts shall be connected such that their blades are de-energized when the switch is in the open position. Bolted pressure contact switches shall have barriers that prevent inadvertent contact with energized blades. 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~~7 Indicating.

General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in an enclosure as described in 404.~~3~~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~~8 Accessibility~~ and Grouping~~.

~~**(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:

Commented [TBL13]: 404.5 renumbered to 404.7.

Commented [TBL14]: Time Switches, Flashers, and Similar Devices title moved to 406.34. Title changed to Adjustable Switches or Circuit Breakers to be reflective of devices covered.

Commented [TBL15]: Time Switches, Flashers, and Similar Devices products moved to 406.34. Revised to Adjustable switches or circuit breakers to be reflective of devices covered.

Commented [TBL16]: 404.6 renumbered to 404.8.

Commented [TBL17]: 404.7 renumbered to 404.9.

Commented [TBL18]: 404.3 reference changed to 404.5.

Commented [TBL19]: 404.8 renumbered to 404.10.

Commented [TBL20]: Removed (A) to comply with style manual. The Legacy part (A) did not address Grouping, term was removed. 240.24(A) is written as “Accessibility” and this standardizes the heading.

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(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.

~~**(B) Voltage Between Adjacent Devices.**~~

Commented [TBL21]: Relocated to 406.38

~~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.**~~

Commented [TBL22]: Relocated to 406.38

~~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.**~~

Commented [TBL23]: Relocated to 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~~

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~~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.~~
~~(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.

~~Except as covered in 404.9(B), Exception No. 1, n~~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. ~~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.

Commented [TBL24]: Relocated to 406.42

Commented [TBL25]: Reference to 404.9(B), Exception No. 1 relocated to 406.44.

Commented [TBL26]: 404.14 modified and (A) through (F) relocated to 406.46.

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~~**(A) Alternating-Current General-Use Snap Switch.**~~

~~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.**~~

~~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.~~

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

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

~~**(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) 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.**~~

~~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.~~

Commented [TBL27]: 404.14(A) through (F) relocated to 406.46.

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~~(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.~~

~~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.~~

~~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.~~

~~404.16 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.~~

~~(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.

~~404.22 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 404.2(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.

Commented [TBL28]: 4040.16(C) and 404.16(D) relocated to 404.3 per 2.2.1 in the style manual.

Commented [TBL29]: 404.16(A) relocated to 406.3.

Commented [TBL30]: 404.16(B) relocated to 406.3.

Commented [TBL31]: 404.16(C) renumbered to 404.16(A)

Commented [TBL32]: 404.16(D) renumbered to 404.16(B)

Commented [TBL33]: Relocated to 406.50

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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~~3~~ shall meet Table 312.6(B)(2) spacings to the enclosure wall opposite the line and load terminals.

Commented [TBL34]: 404.3 reference changed to 404.5.

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.

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

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches operating at not over 1000 volts ~~and below, unless specifically referenced elsewhere in this~~ ~~*Code* for higher voltages~~ ac, 1500 volts dc, nominal .

This article does not cover wireless control equipment to which circuit conductors are not connected.

Informational Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted control devices.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Requirements are revised to include the same voltage demarcation used in many places throughout the Code.

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
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Submittal Date: Thu Aug 17 09:55:05 EDT 2023
Committee: NEC-P09

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

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches operating at 1000 volts ac, 1500 volts dc, and below, unless specifically referenced elsewhere in this *Code* for higher voltages.

This article does not cover wireless control equipment to which circuit conductors are not connected.

Informational Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted control devices.

Statement of Problem and Substantiation for Public Input

Modifying language to be consistent with language added in Article 300 [300.2(A) and 300.3(C)] and Article 495 to address PV system installations that include disconnect switches for 1500 Vdc systems. Article 690 requires switches to be "readily accessible" but the definition doesn't note the 6'-7" maximum height for being readily accessible. 404.8(A) makes this clear and adjusting the scope language similar to other articles closes a gap in language and will eliminate arguments as to whether a 1500 Vdc disconnect can be mounted with the operating handle above the 6'-7" mounting height because the current scope notes this article applies to 1000 V and below.

The Solar and Storage Industry Forum (SSIF) is a coalition of individuals and organizations convened by the Solar Energy Industry Association (SEIA) to organize, support, and mentor renewable energy industry professionals in codes and standards development. Our objective is to submit industry consensus-based recommendations for changes to the National Electrical Code. We believe that this effort improves the Code-making process by consolidating multiple industry member's points of view into fewer, common proposals.
SSIF members are dedicated to continually improving the installation safety of PV and storage systems in the U.S. A list of members can be found here:
https://www.seia.org/industry-forum

Submitter Information Verification

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Submittal Date: Wed Sep 06 20:33:45 EDT 2023
Committee: NEC-P09

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

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches operating at 1000 volts ac, 1500 volts dc, and below, unless specifically referenced elsewhere in this *Code* for higher voltages.

This article does not cover wireless control equipment to which circuit conductors are not connected.

Informational Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted control devices.

Statement of Problem and Substantiation for Public Input

Modifying language to be consistent with language added in article 300.3(C) and article 495 to address PV installations that include disconnects switches for 1500V dc systems. Article 690 notes switches to be "readily accessible" but the definition doesn't note the 6'-7" max height for readily accessible. 404.8(A) makes this clear and adjusting the scope language similar to other articles closes a gap in language and will eliminate arguments as to whether a 1500Vdc disconnect can be mounted with the operating handle above the 6'-7" mounting height because the current scope notes this article applies to 1000V and below.

Submitter Information Verification

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Submittal Date: Wed Apr 05 10:46:16 EDT 2023
Committee: NEC-P09

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

404.~~2~~ XX Switch Connections.

(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.

Statement of Problem and Substantiation for Public Input

The section needs to be relocated for compliance with the NEC Style Manual Section 2.2.1.

Submitter Information Verification

Submitter Full Name:	Derrick Atkins
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Submittal Date:	Tue Sep 05 14:25:22 EDT 2023
Committee:	NEC-P09

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

404.

~~2 Switch Connections.~~

~~**(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.~~

2 Listing Requirements

Switches shall be listed

Statement of Problem and Substantiation for Public Input

The changes requested here started as an attempt to reorganize the article to align with the Parallel Numbering suggestion in 2.4.1 of the NEC style manual.

The delete items were added to 404.15 in a related PI to comply with NEC style manual section 2.4.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3768-NFPA 70-2023 [New Section after 404.14]	
Public Input No. 3768-NFPA 70-2023 [New Section after 404.14]	

Submitter Information Verification

Submitter Full Name: Steve Chutka
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Submittal Date: Tue Sep 05 15:40:27 EDT 2023
Committee: NEC-P09

Public Input No. 2157-NFPA 70-2023 [Section No. 404.2(C)]

(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.

Statement of Problem and Substantiation for Public Input

404.22 requires new devices that require power to be connected to the neutral instead of the equipment grounding conductor. The cost of running a neutral to all switch locations is negligible and it would be easier to simply run the neutral to these locations then to figure out the allowances of the Code.

Submitter Information Verification

Submitter Full Name: Eric Stromberg

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Affiliation: Self

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Submittal Date:	Sun Aug 13 20:42:28 EDT 2023
Committee:	NEC-P09

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

~~404.3~~ XX Enclosure.

(A) General.

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

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

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

(B) Used as a Raceway.

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

Statement of Problem and Substantiation for Public Input

The Section should be moved for compliance with the NEC Style Manual Section 2.2.1.

Submitter Information Verification

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Submittal Date: Tue Sep 05 14:26:45 EDT 2023

Committee: NEC-P09

Public Input No. 3163-NFPA 70-2023 [Section No. 404.3(B)]

(B) Used as a Raceway.

~~Enclosures~~ Cabinets, cutout boxes, and enclosures for switches or overcurrent devices 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.

Statement of Problem and Substantiation for Public Input

The term 'enclosures' is way too vague, the way the requirement is worded, you could not use an outlet box for snap switches, unless you comply with 312.8. But 312.8 only applies to Cabinets and Cutout Boxes, not outlet boxes. Adding cabinets and cutout boxes improves clarity with the intent of this requirement for Code users.

Submitter Information Verification

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Submittal Date: Tue Aug 29 20:32:02 EDT 2023
Committee: NEC-P09

Public Input No. 332-NFPA 70-2023 [Section No. 404.3(B)]

(B)– **Not** 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.

Statement of Problem and Substantiation for Public Input

The header implies that it could be "Used as a raceway" however the text clearly states that it can not be used as raceway. To reduce ambiguity and improve document coherence the intent of the paragraph should match the intend of the header.

Submitter Information Verification

Submitter Full Name: Richard Starke

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Submittal Date: Fri Feb 10 21:15:27 EST 2023

Committee: NEC-P09

Public Input No. 3740-NFPA 70-2023 [Section No. 404.6]

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

~~**(A)** Single-Throw Knife Switches.~~

~~Single-throw knife switches shall be placed so that gravity will not tend to close them. Single-throw knife switches, approved for use in the inverted position, shall be provided with an integral mechanical means that ensures that the blades remain in the open position when so set.~~

~~**(B)** Double-Throw Knife Switches.~~

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

~~**(C)** Connection of Switches.~~

~~Single-throw knife switches and switches with butt contacts shall be connected such that their blades are de-energized when the switch is in the open position. Bolted pressure contact switches shall have barriers that prevent inadvertent contact with energized blades. 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) .*~~

Statement of Problem and Substantiation for Public Input

The changes requested here started as an attempt to reorganize the article to align with the Parallel Numbering suggestion in 2.4.1 of the NEC style manual.
The delete items were split and added 404.13(B) and 404.15(B) in a related PI's to further reorganize the article and group items

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3742-NFPA 70-2023 [Section No. 404.13]	
Public Input No. 3768-NFPA 70-2023 [New Section after 404.14]	
Public Input No. 3742-NFPA 70-2023 [Section No. 404.13]	

Submitter Information Verification

Submitter Full Name: Steve Chutka
Organization: Siemens
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State:

Zip:	
Submittal Date:	Tue Sep 05 15:17:37 EDT 2023
Committee:	NEC-P09

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

(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, walking surface 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.

Statement of Problem and Substantiation for Public Input

Many switches or circuit breakers are mounted outdoors, for example on the side of a building, a house, etc. and the surface below the switch or circuit breaker is grass, a flower bed or a sidewalk for example. Current code language could be hard to enforce when the switch or circuit breaker is mounted above something other than a “floor or working platform”. This change is intended to eliminate ambiguity and leaving code language subject to interpretation.

Submitter Information Verification

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Submittal Date: Thu Aug 24 12:53:29 EDT 2023

Committee: NEC-P09

Public Input No. 3164-NFPA 70-2023 [Section No. 404.8(A)]

(A) Location.

All switches and circuit breakers used as ~~switches shall~~ the required disconnecting means 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.

Statement of Problem and Substantiation for Public Input

The revised language is intended for general-use as well as maintenance bypass switches to not be readily accessible. The rule is intended to apply to switches used as a disconnecting means, not general-use or maintenance bypass switches. The revised language will bring clarity to Code users.

Submitter Information Verification

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Submittal Date: Tue Aug 29 20:34:37 EDT 2023
Committee: NEC-P09

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

(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 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.

Statement of Problem and Substantiation for Public Input

Breaking up 404.8(A) into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Submittal Date: Wed Sep 06 16:42:11 EDT 2023
Committee: NEC-P09

Public Input No. 2246-NFPA 70-2023 [Section No. 404.8(B)]

(B) Voltage Between Adjacent Devices.

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

Exception: Barriers shall not be required between devices having no exposed conductor terminals. Terminals for connections of equipment grounding conductors shall be permitted to be exposed.

Additional Proposed Changes

File Name	Description	Approved
IMG_1671.jpeg	No exposed terminals	
IMG_1668.jpeg	no exposed terminals	
IMG_1667.jpeg	no exposed terminals	
IMG_1666.jpeg	no exposed terminals	
IMG_6602.jpeg	no exposed terminals	
IMG_6601.jpeg	no exposed terminals	
IMG_6600.jpeg	no exposed terminals	

Statement of Problem and Substantiation for Public Input

Finger-safe devices with no exposed terminals effectively have “barriers” built-in as part of the design of the device. These types of devices pose virtually no shock hazard compared to devices having exposed energized terminals. The risk of an arc between devices is also greatly reduced since there are no exposed terminals. Barriers should not be required where these types of devices are installed. If a device needs to be replaced, installers will need to continue to use these finger-safe type of devices in order to maintain a Code-compliant installation if no barrier is installed. See photo examples of devices with no exposed terminals provided.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2253-NFPA 70-2023 [Section No. 406.5(J)]	no barriers needed between devices with no exposed terminals
Public Input No. 2253-NFPA 70-2023 [Section No. 406.5(J)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
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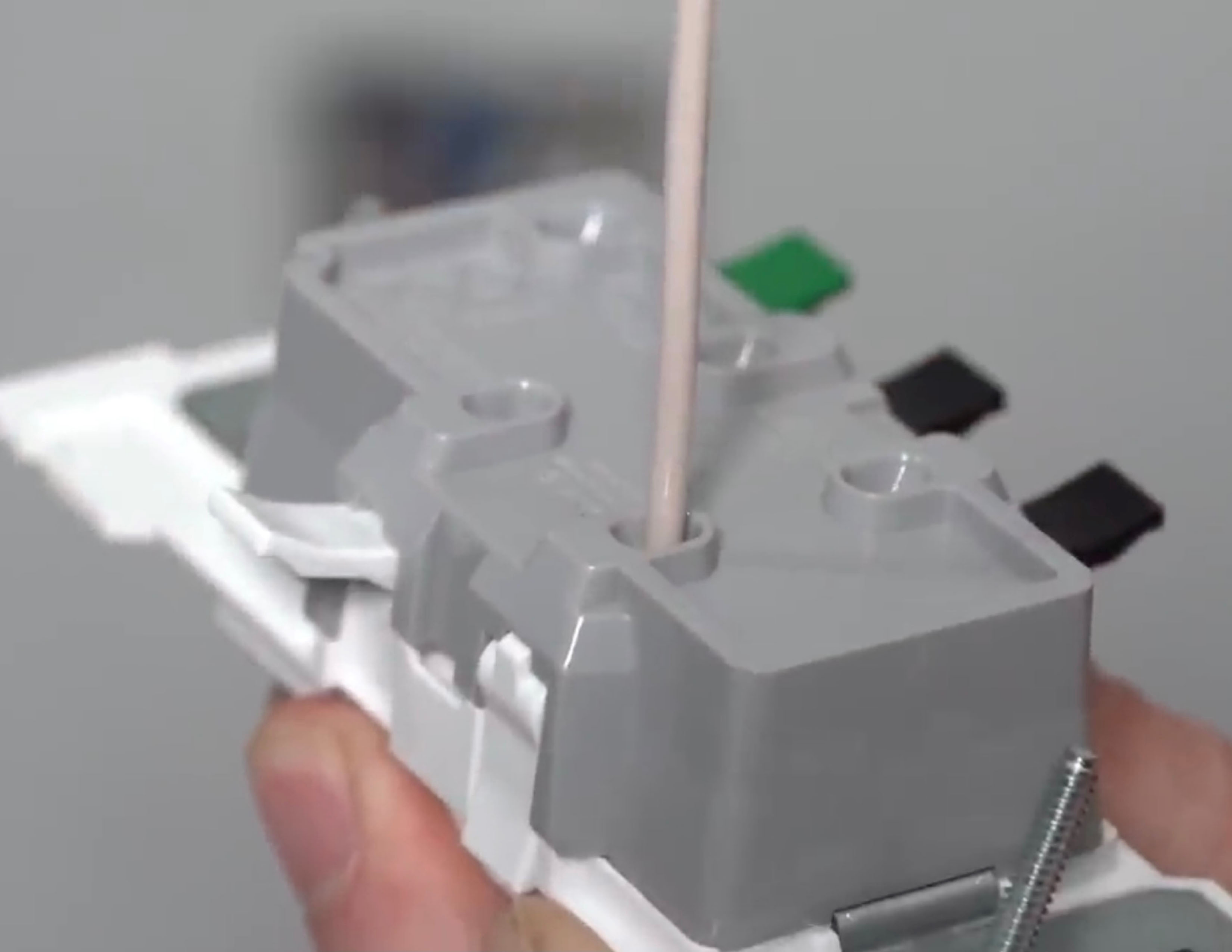
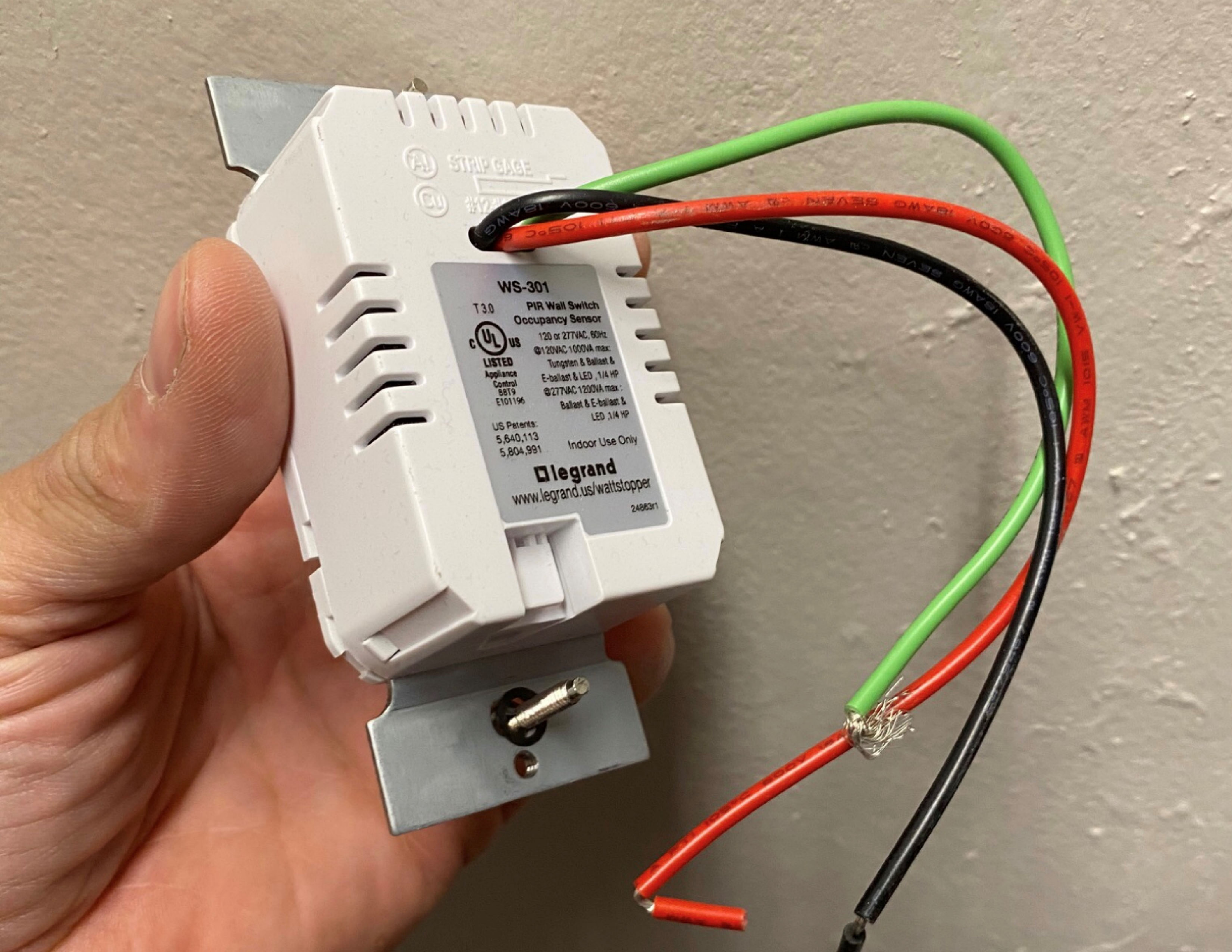
City:
State:

Zip:	
Submittal Date:	Tue Aug 15 13:22:43 EDT 2023
Committee:	NEC-P09





STRIP GAGE
WS-301
T 3.0
PIR Wall Switch
Occupancy Sensor
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LISTED
Appliance
Control
88T9
E101196
120 or 277VAC, 60Hz
@120VAC 1000VA max:
Tungsten & Ballast &
E-ballast & LED ,1/4 HP
@277VAC 1200VA max :
Ballast & E-ballast &
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US Patents:
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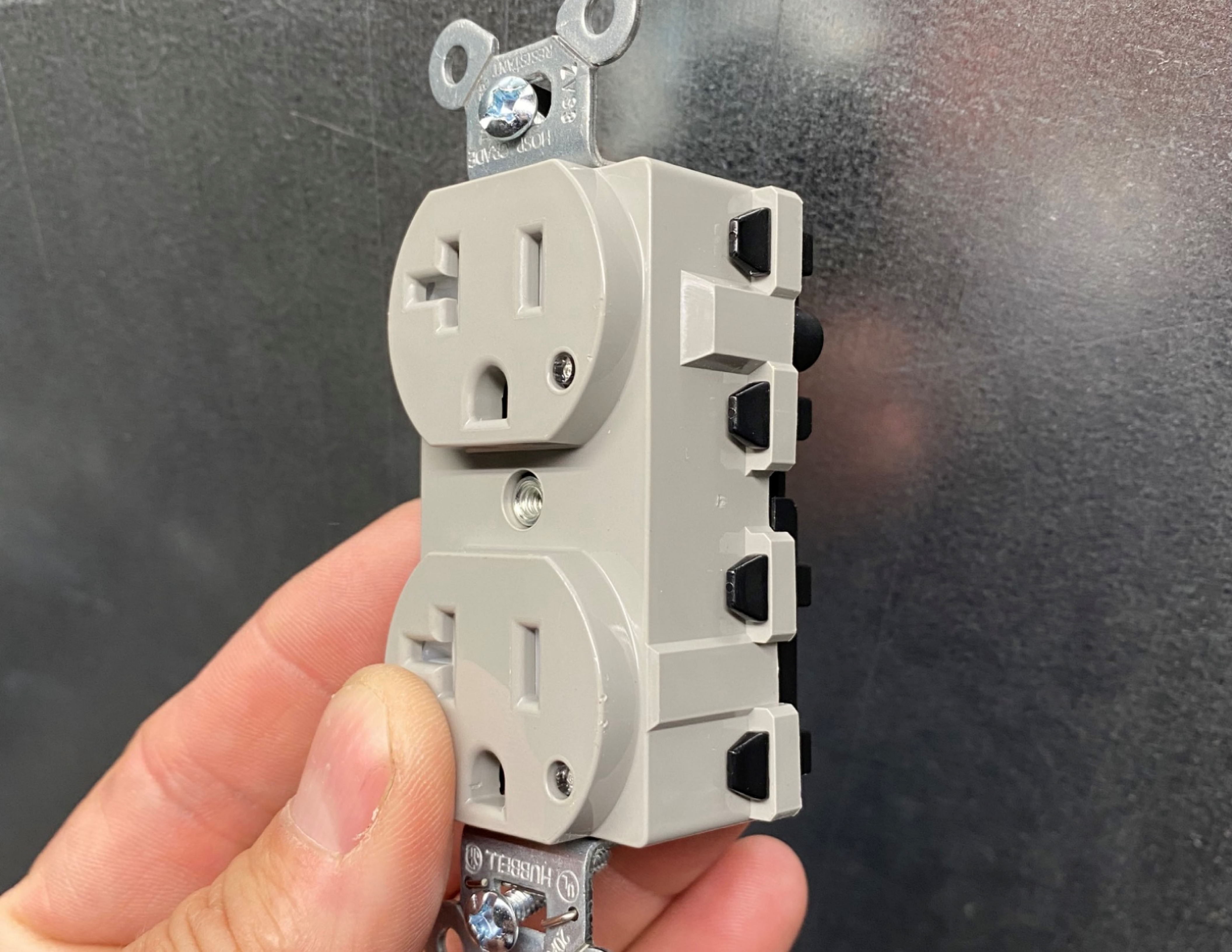
Indoor Use Only
legrand
www.legrand.us/wattstopper
24863r1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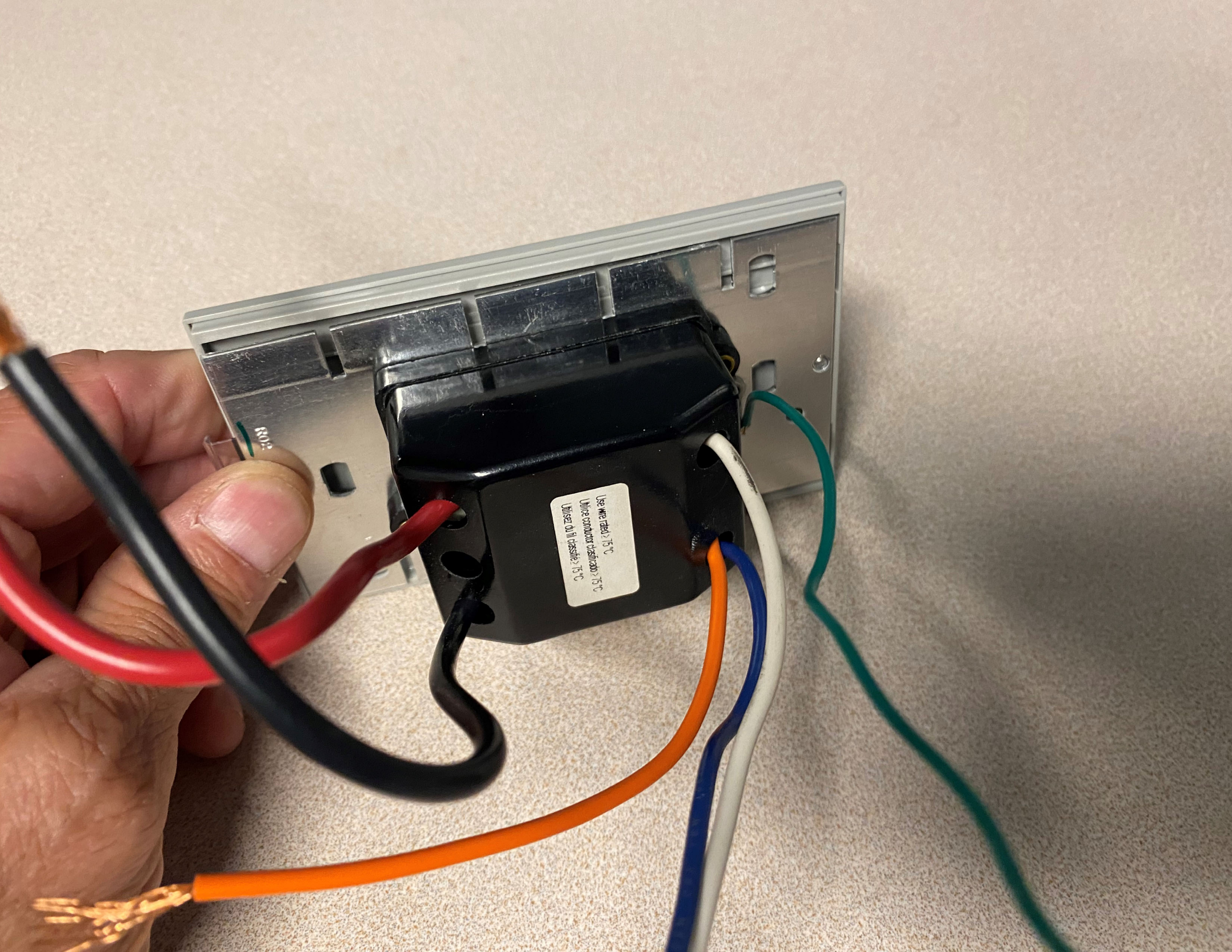
HUBBELL


90C 600V OR 1032 90C 1000V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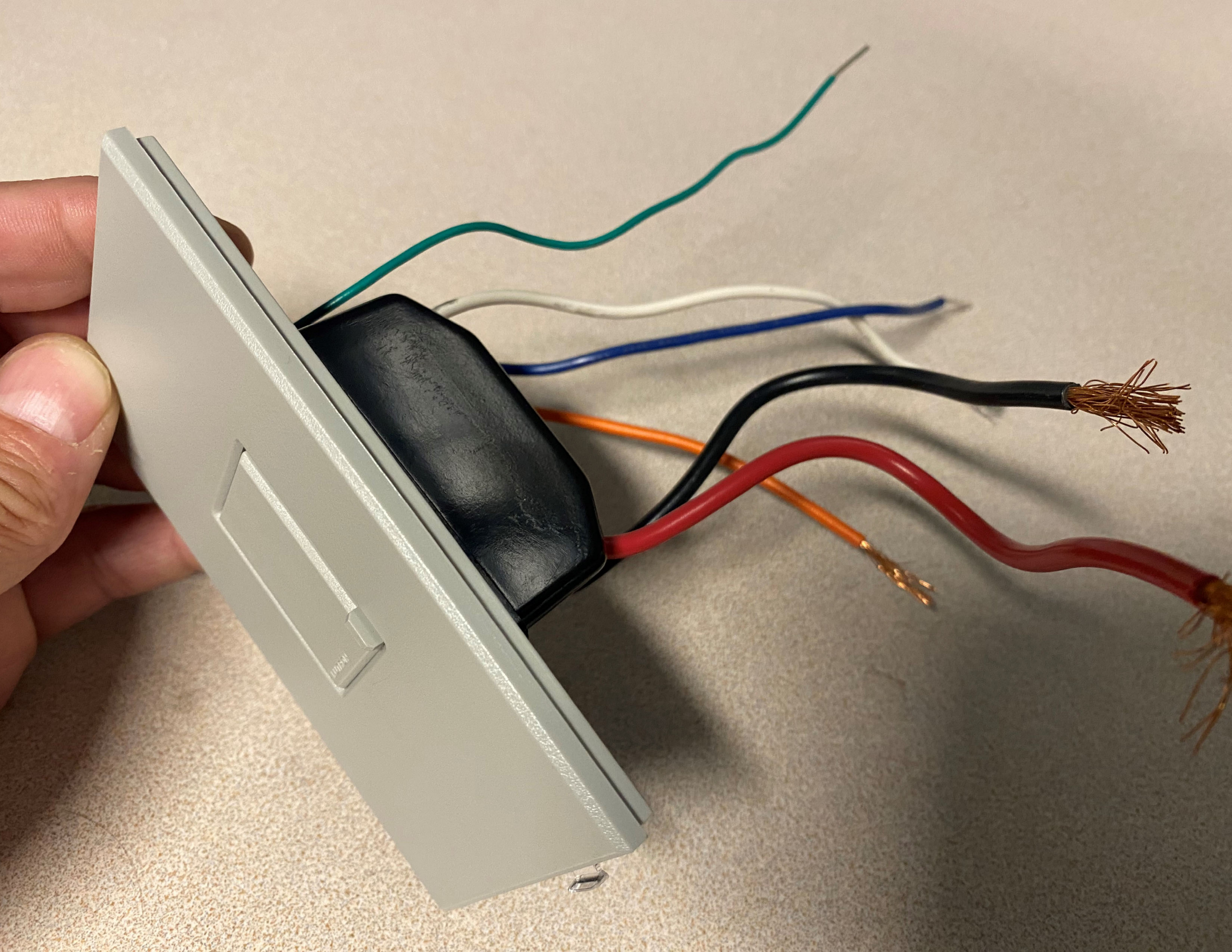
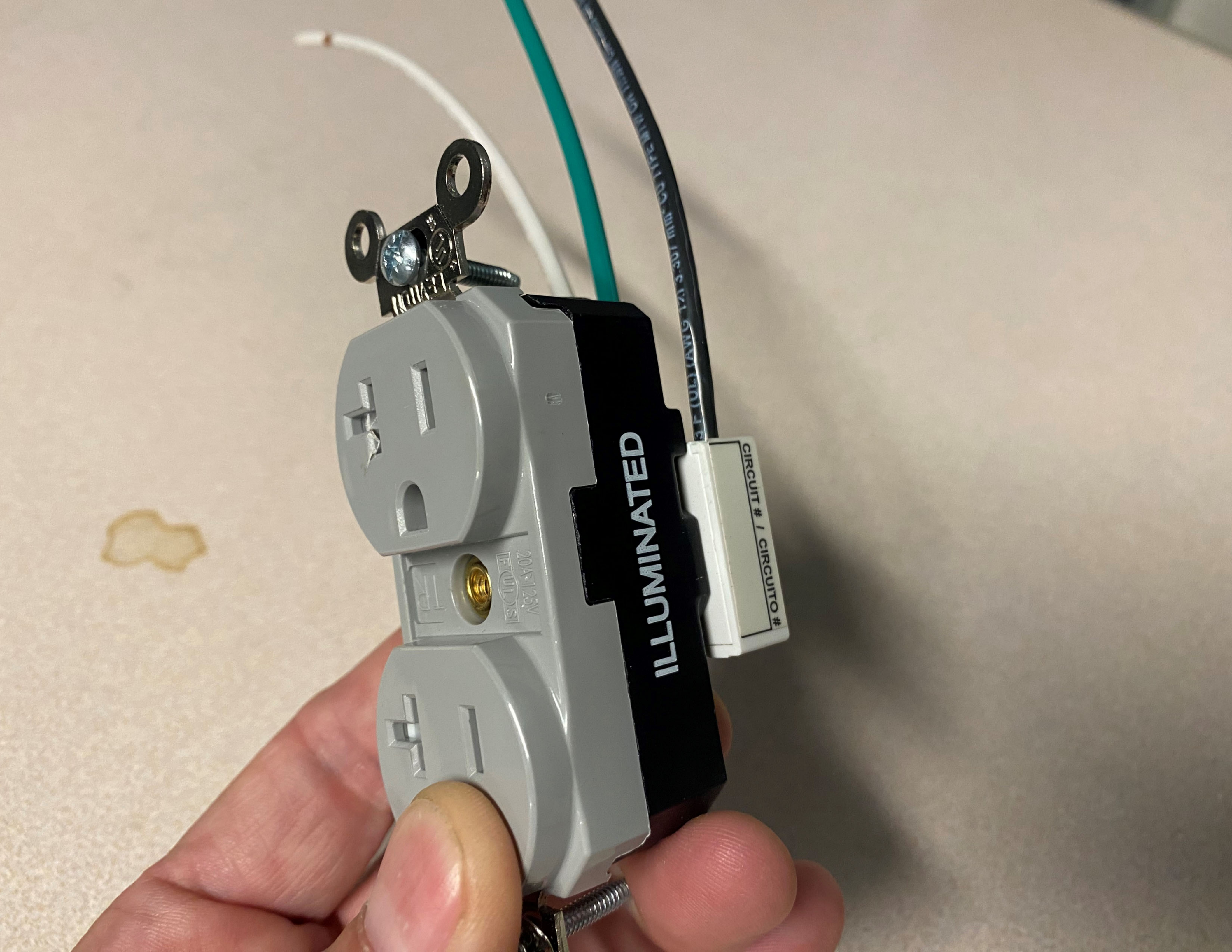
Utilice conductor clasificado ≥ 75°C
Utilisez du fil classifié ≥ 75°C




ILLUMINATED
CIRCUIT # / CIRCUITO #
20A 125V
TR

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

404. ~~9~~ **9 Faceplates (Cover Plates) for** General-Use Snap Switches, Dimmers, and Control Switches.

Faceplates (~~A) Faceplates~~ cover plates) that are also 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,with 406.9.

(A) 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.

(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** 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.

Statement of Problem and Substantiation for Public Input

To improve usability of the Code.

.

Section 404.9 addresses the installation (and provisions for installation) of faceplates for snap switches, dimmers, and control switches rather than the snap switches, dimmers, and control switches themselves. By contrast, Article 406 for receptacles clearly identifies in the Section title that 406.6 addresses the requirements specific to the faceplates (cover plates) used with receptacles, as differentiated from the receptacles themselves.

.

Further, faceplates for flush-mounted switches may be in common with and mounted with adjacent gangs of the same multigang faceplates for receptacles. Further yet, switch faceplates for other than toggle-type switches, i.e., for decorator-style switches and for duplex combination switches/receptacles, in fact are often the very same faceplates as the faceplates for decorator-style receptacles and for duplex receptacles.

Submitter Information Verification

Submitter Full Name: Brian Rock

Organization: Hubbell Incorporated

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 30 10:29:32 EDT 2023

Committee: NEC-P09

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

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

~~Faceplates provided for~~ For snap switches, dimmers, and control switches mounted in boxes and in other enclosures, faceplates (cover plates) shall be installed ~~so as~~ to ~~completely~~ cover the ~~opening~~ openings completely and, where the switch is flush mounted, to seat against the finished surface.

Statement of Problem and Substantiation for Public Input

This Public Input will align requirements for faceplates and cover plates for snap switches, dimmers, and control switches with Section 406.6 for receptacle faceplates and cover plates, and will clarify the mounting requirements of switch faceplates and cover plates as the same requirements apply to both.

Submitter Information Verification

Submitter Full Name: David Linder

Organization: Hubbell Incorporated

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 11:31:16 EDT 2023

Committee: NEC-P09

Public Input No. 2304-NFPA 70-2023 [Section No. 404.9(B)]

(B)– **Connection to Equipment** Grounding Conductor .

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.

Statement of Problem and Substantiation for Public Input

Changing the title would make the text technically correct. This requirement is about connecting the equipment grounding conductor to switches and metal faceplates, not about grounding. In accordance with NEC style manual section 2.1.3.2 the title must be descriptive and concise with the intent of the requirement.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:	
Zip:	
Submittal Date:	Tue Aug 15 18:28:17 EDT 2023
Committee:	NEC-P09

Public Input No. 2308-NFPA 70-2023 [Section No. 404.9(B)]

(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 <u>by means of metal mounting screws securing the faceplate to a metal yoke of a device or to a metal outlet box</u> . 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.

Statement of Problem and Substantiation for Public Input

Replace text with similar language from 517.13(B) for consistency on the method a metal cover is considered bonded to the equipment grounding conductor. This proposed revision will bring clarity for Code users.

Submitter Information Verification

Submitter Full Name: Mike Holt
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City:

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Submittal Date:	Tue Aug 15 18:41:59 EDT 2023
Committee:	NEC-P09

Public Input No. 2281-NFPA 70-2023 [Section No. 404.10(B)]

(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.

Exception: Flush-type general-use sanp switches, dimmers, and control switches are permitted to be seated against wall plate spacers if mounted on noncombustible materials in accordance with 314.20.

Additional Proposed Changes

File Name	Description	Approved
Ideal_Wall_plate_spacer.png		
Gardener_Bender_Wall_plate_spacer.png		

Statement of Problem and Substantiation for Public Input

Adding wall plate spacers would allow installers an easy inexpensive solution no different than plastic extenders to mount devices where the box is not flush with the finished surface. Both ideal and gardener bender have this product available. See website and photos.

Website: Gardner Bender 4-Pack 0.75-in W x 4-in L Green Plastic Wall Plate Spacers in the Wall Plate Spacers department at Lowes.com
Website: IDEAL 10-Pack 1-in W x 0.5-in L Plastic Wall Plate Spacer in the Wall Plate Spacers department at Lowes.com

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 15 15:31:56 EDT 2023
Committee: NEC-P09

Public Input No. 2678-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 24 09:31:22 EDT 2023
Committee: NEC-P09

Public Input No. 2835-NFPA 70-2023 [Section No. 404.12]

404.~~12~~ 12 Equipment Grounding ~~of~~ Connection to 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.

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.

Statement of Problem and Substantiation for Public Input

The section title must be revised to match the technical requirement. In accordance with NEC style manual section 2.1.3.2 the title must be descriptive and concise with the intent of the requirement. See 215.6 Feeder Equipment Grounding Conductor, 320.108 Equipment Grounding Conductor, 330.108 Equipment Grounding Conductor, 334.108 Equipment Grounding Conductor, 410.182 Equipment Grounding Conductor, 547.27 Separate Equipment Grounding Conductor, 555.37 Equipment Grounding Conductor, and 690.45 Size of Equipment Grounding Conductors.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Fri Aug 25 14:24:45 EDT 2023
Committee: NEC-P09

Public Input No. 3742-NFPA 70-2023 [Section No. 404.13]

404.13 Knife Switches.

A. Uses

(~~A~~ 1) 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~~ 2) 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~~ 3) 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~~ 4) 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*.

B. Orientation.

(1) **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.

(2) 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.

Statement of Problem and Substantiation for Public Input

Section 404.6 is almost entirely concerned with knife switches, except that subdivision (C) is more general. Section 404.13 is titled "Knife Switches" and has requirements for knife switches. Section 404.2 has a similar title to 404.6(C), but is more general w.r.t. to the topic of switch connections. This

PI attempts to consolidate requirements related solely to knife switches. The subdivision on connections is combined with the text of 404.2 in a related PI.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3740-NFPA 70-2023 [Section No. 404.6]	
Public Input No. 3735-NFPA 70-2023 [Section No. 404.2]	
Public Input No. 3740-NFPA 70-2023 [Section No. 404.6]	

Submitter Information Verification

Submitter Full Name: Steve Chutka
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 15:19:21 EDT 2023
Committee: NEC-P09

Public Input No. 2434-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

Requirements are revised to include the same voltage demarcation used in many places throughout the Code.

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 17 09:56:51 EDT 2023
Committee: NEC-P09

Public Input No. 910-NFPA 70-2023 [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.

Labeling requirements for presence of aluminum branch wiring. All CO/ALR devices must be labeled on the surrounding surface facing out, and on the backside of the switchplate cover, making the presence of aluminum branch wiring know to anyone who attemps to access this connection for future maintenance or repairs.

Additional Proposed Changes

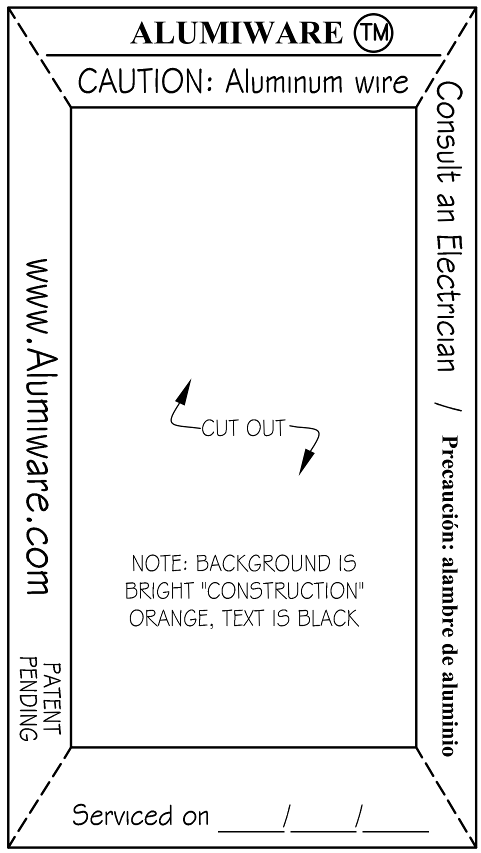
File Name	Description	Approved
Alumiware_12_4_18_sticker_drawing_with_spanish_12.4.18.pdf	example of a label to notify of the presence of aluminum wiring	
Alumiware_lable_on_switch.jpg	picture of label in use at switch location	

Statement of Problem and Substantiation for Public Input

This proposed addition to the code will help warn of and possibly prevent improper handling of aluminum wiring, when nonprofessionals access this location in an attempt to make repairs or upgrades. Aluminum wiring conditions and proper handling is largely unknown to the general public, but they do attempt "do it yourself" repairs often as advertised on TV. This label will add one more layer of precaution before a homeowner attempts to make repairs on their own.

Submitter Information Verification

Submitter Full Name: Matthew Kirvan
Organization: Matthew Kirvan
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 30 13:01:28 EDT 2023
Committee: NEC-P09



SCALE: 1:1

ALUMIWARE LABEL FOR ALUMINUM WIRING DEVICES
PATENT PENDING

DATE: 12/4/18

Matthew Kirvan, 4515 Roxbury Dr., Bethesda, MD 20814, 301-512-8928

Public Input No. 2164-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) ~~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.~~

Additional Proposed Changes

File Name	Description	Approved
NEC_article_404.14_D_snap_switch_PI.docx	PI for Snap Switches 404.14(D)	

Statement of Problem and Substantiation for Public Input

Substantiation: (1) and (2) were reversed for clarity to the reader. For (1): "terminated directly" was added to clarify that a switch terminal can be in direct contact with any of the identified conductor types. (2) was also revised to clarify that switches not marked CO/ALR are not intended for direct connection to aluminum conductor. (2) was also revised for clarity and consistency with NEC 110.3(B) manufacturers' instruction. (3) was revised for consistency with the product listing standard. "Informational Note" was added to match that in Article 406.3(D) for Receptacles in UL 498.

Submitter Information Verification

Submitter Full Name: Ralph Baldwin
Organization: Legrand
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 14 10:25:51 EDT 2023
Committee: NEC-P09

404.14 (D) Snap Switch Terminations.

Snap switch terminations shall be in accordance with the following:

(1) ~~(2)~~
A Snap switch ~~Terminals~~ marked CO/ALR shall be permitted to terminate directly to ~~be used with~~ aluminum, copper, or ~~and~~ copper-clad aluminum conductors in accordance with the branch circuit conductor size (AWG) identified by the manufacturers' instruction.

(2) ~~(1)~~
~~Terminals of~~ ~~15-ampere and 20-ampere~~ A snap switch~~es~~ not marked CO/ALR shall not be permitted to terminate directly to ~~be used with copper and copper-clad~~ aluminum conductors. ~~only~~. These terminals shall be permitted to terminate directly to conductors other than aluminum in accordance with the branch circuit conductor size (AWG) and type identified by the manufacturers' instruction.

(3)

Snap switches installed using screwless terminals of the conductor push-in type construction (also known as *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, *General-Use Snap Switch*, for information regarding screwless terminals of various 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).

Public Input No. 2194-NFPA 70-2023 [Section No. 404.14(D)]

(D) Snap Switch Terminations.

Snap switch terminations shall be in accordance with the following:

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

Additional Proposed Changes

File Name	Description	Approved
NEC_Proposal_to_404.14_D_LUTZ.docx	NEC proposal to Article 404.14(D)	

Statement of Problem and Substantiation for Public Input

The intent of 404.14(D) is to clarify that aluminum conductors may NOT be used unless the device is marked CO/ALR. The current paragraph uses confusing reverse language stating that if not marked CO/ALR they may only be used with copper and copper-clad wiring. Unfortunately this is being misinterpreted in the field that copper and copper-clad wire may be used interchangeably. The intent of the code was to address the use of aluminum wire. Proposed revision uses a clear positive statement Many manufacturers mark their devices copper wire only and many also mark copper and copper-clad. There are many factors manufacturers consider in making this determination including type of termination, solid or stranded wire, etc. Any device MUST be used in accordance with the manufacturer's markings and instructions to assure safe use and compliance with this code.
(1) and (2) were reversed to improve clarity to the reader. For (1): terminated directly was added to clarify that a switch terminal can be in direct contact with any of the identified conductor types. (2) was revised to clarify that receptacles not marked CO/ALR are prohibited from direct connection to aluminum conductor. (1) and (2) were further revised for clarity and consistency with Article 110.3(B) that requires equipment installation to be in accordance with manufacturers' instruction. (3) was revised for consistency with the product listing standard and informational note added for consistency with 406.3(D) (3).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2189-NFPA 70-2023 [Section No. 406.3(D)]	
Public Input No. 2189-NFPA 70-2023 [Section No. 406.3(D)]	

Submitter Information Verification

Submitter Full Name: David Lutz
Organization: Hubbell
Street Address:

City:
State:
Zip:
Submittal Date: Mon Aug 14 13:50:26 EDT 2023
Committee: NEC-P09

NEC proposal to article 404.14(D) **D Lutz** 8/14/2023

Submitted by deleting Items (1), (2), and (3) and submitting below as " Additional Proposed Change"
TerraView would not allow proper editing

PROPOSED REVISION

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

(1) ~~(2)~~ A Snap switch ~~Terminals~~ marked CO/ALR shall be permitted to terminate directly to ~~be used with~~ aluminum, copper, or ~~and~~ copper-clad aluminum conductors in accordance with the branch circuit conductor size (AWG) identified by the manufacturers' instruction.

(2) ~~(1)~~ ~~Terminals of 15-ampere and 20-ampere~~ A snap switch~~es~~ not marked CO/ALR shall not be permitted to terminate directly to ~~be used with copper and copper-clad~~ aluminum conductors. ~~only~~. These terminals shall be permitted to terminate directly to conductors other than aluminum in accordance with the branch circuit conductor size (AWG) and type identified by the manufacturers' instruction.

(3) Snap switches installed using screwless terminals of the conductor push-in type construction (also known as *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, General-Use Snap Switch, for information regarding screwless terminals of various 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).

SUBSTANTIATION

(1) and (2) were reversed to improve clarity to the reader. For (1): terminated directly was added to clarify that a switch terminal can be in direct contact with any of the identified conductor types. (2) was revised to clarify that receptacles not marked CO/ALR are prohibited from direct connection to aluminum conductor. (1) and (2) were further revised for clarity and consistency with Article 110.3(B) that requires equipment installation to be in accordance with manufacturers' instruction. (3) was revised for consistency with the product listing standard and informational note added for consistency with 406.3(D) (3).

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Public Input No. 366-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) 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 with or without locking levers (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.

Statement of Problem and Substantiation for Public Input

New devices are coming to market with 'locking levers' to fasten or bind conductor to the push-in terminals. Adding 'with or without locking levers' closes the loop for a potential loophole when installers are terminating these devices. They can't say, "locking lever type isn't in the code" so I can 'backstab' all these devices with 12 gauge stranded if I want to.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 365-NFPA 70-2023 [Section No. 406.3(D)]	

Submitter Information Verification

Submitter Full Name: Jacob Riddle
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Feb 21 17:09:35 EST 2023
Committee: NEC-P09

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~~ general-use snap switches, dimmers, and control switches that are rated 20 amperes or less and that are not marked CO/ALR shall be ~~used~~ connected with copper and copper-clad aluminum conductors only. Wire-binding screw terminals of 30-ampere general-use snap switches that are not marked as CO/ALR shall be connected with copper conductors only unless listed and marked for other conductor materials. Conductors of dissimilar metals shall not be intermixed in an individual terminal where physical contact occurs between dissimilar conductors unless the terminal is identified as suitable for intermixing of dissimilar metals and for the conditions of use.

(2) Terminals marked CO/ALR shall be permitted to be used with copper, aluminum, and copper-clad aluminum conductors. Conductors of dissimilar metals shall not be intermixed in an individual terminal where physical contact occurs between dissimilar conductors unless the terminal is identified as suitable for intermixing of dissimilar metals and for the conditions of use.

(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~~ materials or sizes of conductors.

Informational Note: See UL 20, *General-Use Snap Switches* , for information regarding screwless terminals of various 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).

Statement of Problem and Substantiation for Public Input

• The terminals themselves of general-use snap switches, dimmers, and control switches are very similar to those employed in general-use receptacles. 2023 new subsection 404.14(D) is essentially identical to 2023 new subsection 406.3(D) except for the absence of an Informational Note similar to the Informational Note added with new subsection 406.3(D) to explain that PUSH-IN TYPE screwless terminals do NOT encompass SEPARABLE-ASSEMBLY TYPE, SPRING-ACTION-CLAMP TYPE, and INSULATION-DISPLACEMENT TYPE screwless terminals. Inclusion of a parallel Informational Note here will preclude misinterpretation of this recently-added requirement.
• General-use snap switches rated for 30 amperes employing wire-binding screw terminals have been manufactured and listed to UL Standard UL 20 for at least 7 decades. In correlation with 240.4(D)(8), as footnoted in Tables 310.16 and 310.17, 10 AWG copper conductor has been connected to 30-ampere general-use snap switches for control and disconnect of catadromous branch circuits and loads for that same at least 7 decades.
• 2023 new subsection 404.14(D) for individual terminals may permit correctly a multiplicity of conductor materials to be terminated but fails to address the INTERMIXING of dissimilar-metal conductors at the same terminals. While 110.14 does address identification of such suitability, 110.14 is clearly focused upon pressure terminals, pressure-splicing connectors and soldering lug terminals, and not upon wire-binding screw terminals. For consistency, the issue of intermixing of dissimilar-metal conductors in direct contact must therefore be additionally addressed explicitly in 404.14(D) as well to preclude misapplication and misinterpretation. [A separate Public Input will similarly address this issue for 2026 406.3(D).]

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Committee:	NEC-P09

Public Input No. 917-NFPA 70-2023 [Section No. 404.14(G)]

(G) Cord- and-Plug-Connected Loads.

Where a snap switch or control device is used to control cord-and-plug-connected equipment on a general-purpose branch circuit, each snap switch or control device controlling receptacle outlets or cord connectors that are supplied by permanently connected cord pendants shall be rated at not less than the ~~rating of the maximum permitted~~ ampere rating or setting of the overcurrent device protecting the receptacles or cord connectors~~, as provided in 210~~ . ~~21(B).~~

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

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

Statement of Problem and Substantiation for Public Input

As currently written, a 15A duplex receptacle on a 15A branch circuit would require a 20A-rated switch because 15A receptacles are permitted on 20A circuits. This is not defensible.

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Public Input No. 3698-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Committee: NEC-P09

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

404.~~16~~ 2 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.

(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.

Statement of Problem and Substantiation for Public Input

Relocated Reconditioned Equipment to 404.2 to keep consistency with the NEC Style Manual. The Correlating Committee may need to move each subsequent article to properly organize the Article.

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

404. ~~16~~ **3** Reconditioned Equipment.

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

~~Reconditioned~~

(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.~~

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)~~

B) Not Permitted to be Installed.

The following reconditioned equipment shall not be installed.

(1) Lighting, dimmer, and electronic control switches.

(2) Snap switches of any type.

(3) Molded-Case Switches.

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

Additional Proposed Changes

File Name	Description	Approved
404.3_Reconditioned_Equipment.pdf	Clean copy of revised text	

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee:	NEC-P09

404.3 Reconditioned Equipment.

(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.

(B) Not Permitted to be Installed.

The following reconditioned equipment shall not be permitted to be installed.

(1) Lighting, dimmer, and electronic control switches.

(2) Snap switches of any type.

(3) Molded-Case Switches.

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

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.

(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.

Statement of Problem and Substantiation for Public Input

The section should be relocated to 404.3 for compliance with the NEC Style Manual Section 2.2.1.

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Committee: NEC-P09

Public Input No. 3699-NFPA 70-2023 [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 404.2(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.

Statement of Problem and Substantiation for Public Input

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

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

450.~~2~~ XX 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.

Statement of Problem and Substantiation for Public Input

The requirement should be relocated for compliance with the NEC Style Manual Section 2.2.1.

Submitter Information Verification

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Submittal Date: Tue Sep 05 15:26:24 EDT 2023
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Public Input No. 3751-NFPA 70-2023 [Section No. 450.3]

450.~~3~~ XX Overcurrent Protection.

Overcurrent protection of transformers shall comply with 450.3(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, *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(A).

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

Overcurrent protection shall be provided in accordance with Table 450.3(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(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		Secondary Protection[2] 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 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(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 protection	125%[1]	167%	300%	-	Not required	Not required
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, 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.

Statement of Problem and Substantiation for Public Input

The requirement should be relocated for compliance with the NEC Style Manual Section 2.2.1.

Submitter Information Verification

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

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

Overcurrent protection shall be provided in accordance with Table 450.3(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(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~~ peimitted 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(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 protection	125%[1]	167%	300%	-	Not required	Not required
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.

Statement of Problem and Substantiation for Public Input

Adding the location makes it easy for the electrician to go to the correct table to find the correct size overcurrent protection device. This is already located in some sections in the code such as in article 630.12 and 32, as well as in 430.52 (C)(1)(a). This would keep things looking the same in the code for all locations where this is written in the code.

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

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

Overcurrent protection shall be provided in accordance with Table 450.3(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(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 as found in 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(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 protection	125%[1]	167%	300%	-	Not required	Not required
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, as found in 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.

Statement of Problem and Substantiation for Public Input

Adding the location makes it easy for the electrician to go to the correct table to find the correct size overcurrent protection device. This is already located in some sections in the code such as in article 630.12 and 32, as well as in 430.52 (C)(1)(a). This would keep things looking the same in the code for all locations where this is written in the code.

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Submittal Date: Thu Feb 16 10:39:17 EST 2023
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Public Input No. 4118-NFPA 70-2023 [Section No. 450.4(A)]

(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~~ ungrounded conductor. Overcurrent protection shall be provided in accordance with Table 450.4. 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(A).

Figure 450.4(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.

Table 450.4 Maximum Rating or Setting of Overcurrent Protection for Autotransformers 1000 Volts and Less (as a Percentage of Autotransformer-Rated Current)

	Primary Protection			**Secondary Protection** *(See Note 2.)*	
Protection Method	**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 protection	*125% (See Note 1.)*	*167%*	*300%*	*Not required*	*Not required*
Primary and secondary protection	*250% (See Note 3.)*	*250% (See Note 3.)*	*250% (See Note 3.)*	*125% (See Note 1.)*	*167%*

[1] Where 125 percent of this current does not correspond to a standard rating of a fuse or

nonadjustable circuit breaker, a higher rating described in 240.6 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.

Statement of Problem and Substantiation for Public Input

When a transformer is first energized or reenergized after a short interruption, the transformer may draw inrush current from the system, as much as ten times the transformer's full-load current. Providing both the primary and secondary protection will minimize the nuisance trips.

REFERENCES:

(1) NFPA-70 (2023 Edition):

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

Reference for the percentages in the proposal Table 450.4 is from Table 450.3(B).

(2) CSA C22.1:21 (2021 edition):

26-254 Overcurrent protection for dry-type transformer circuits rated 750 V or less (see Appendix B)
1) Except as permitted in Subrule 2), each ungrounded conductor of the transformer feeder or branch circuit supplying the transformer shall be provided with overcurrent protection rated or set at not more than 125% of the rated primary current of the transformer, and this primary overcurrent device shall be considered as protecting secondary conductors rated at 125% or more of the rated secondary current.
2) Notwithstanding Subrule 1), a transformer having an overcurrent device on the secondary side set at not more than 125% of the rated secondary current of the transformer shall not be required to have an individual overcurrent device on the primary side, provided that the primary feeder overcurrent device is set at not more than 300% of the rated primary current of the transformer.
3) Where a value not exceeding 125% of the rated primary current of the transformer as specified in Subrule 1) does not correspond to the standard rating of the overcurrent device, the next higher standard rating shall be permitted.

(3) A17.5-2019/CSAB44.1:19:

13.2 Control circuit transformer protection
13.2.1
A control circuit transformer shall be provided with one or more of the following types of overcurrent protection:
a) individual overcurrent devices located in the primary circuit that are rated or set as specified in Table 7;
b) secondary circuit protection rated or set at not more than 125% of the rated secondary current of the

transformer, with the protection of the primary feeder circuit rated or set at not more than 250% of the rated primary current of the transformer; or
c) coordinated thermal overload protection arranged to interrupt the primary circuit, provided that the primary circuit overcurrent device is rated or set at a current of not more than
i) six times the rated current of the transformer for transformers having not more than 6% impedance; or
ii) four times the rated current of the transformer for transformers having more than 6% but less than 10% impedance.

13.2.3
Notwithstanding Clause 13.2.1 b), if the rated secondary current of the transformer is 2 A or more, the current rating of the secondary overcurrent device may be as indicated in line 2 or 3 of Table 7, as applicable.
13.2.4
If the rated primary current of the transformer is 9 A or more and 125% of this current does not correspond to a standard rating of a fuse or non-adjustable circuit breaker, the next higher standard rating of protective device shall be used.

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Committee:	NEC-P09

Public Input No. 3042-NFPA 70-2023 [Section No. 450.5]

450.5 Grounding ~~Autotransformers~~ Transformers .

Grounding ~~autotransformers~~ transformers covered in this section are zigzag, grounded wye/delta, 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 current in a grounding autotransformer is one-third the neutral current.

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

A grounding ~~autotransformer~~ transformer used to create a 3-phase, 4-wire distribution system from a 3-phase, 3-wire ungrounded system shall conform to 450.5(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(A)(1) to open if the load on the ~~autotransformer~~ transformer 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~~ transformer 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~~ transformer 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(B)(1) and (B)(2).

(1) Rating.

The ~~autotransformer~~ transformer 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(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~~ transformer continuous per-phase current rating or 42 percent of the continuous-current rating of any series-connected devices in the ~~autotransformer~~ transformer 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~~ transformer 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~~ transformer 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~~ transformer used to limit transitory overvoltages shall be of suitable rating and connected in accordance with 450.5(A)(1).

Statement of Problem and Substantiation for Public Input

Grounded wye/delta transformers and zigzag autotransformers are both commonly used as grounding transformers. In the case of a grounded wye/delta transformer the grounded wye winding is connected to the system and no connection is made on the delta winding. As NEC 450.5 is currently written, only autotransformers are covered. Grounded wye/delta grounding transformers are not currently covered by this section. This change includes them in the NEC 450.5, making it clear the requirements apply to both autotransformers and two winding transformers.

Reference: IEEE 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems sections 1.5.1, 1.5.2, and 1.5.3.

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Committee:	NEC-P09

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

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~~ three times the phase current.

Additional Proposed Changes

File Name	Description	Approved
Photo_Mar_05_1_22_00_PM.jpg	Thermal damage on overloaded grounding transformer neutral.	

Statement of Problem and Substantiation for Public Input

Although the two versions are mathematically the same, the recommended emphasizes the fact that the neutral current will be higher than the phase currents. The neutral conductor should therefore be larger. We have seen several cases where the neutral is not properly sized and there is resulting thermal damage.

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Committee: NEC-P09

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

450.6 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 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(A)(1) and 450.6(A)(2), the overcurrent protection shall be permitted to be in accordance with 450.6(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(A)(4).

(3) Tie Circuit Protection.

Under the conditions described in 450.6(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(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(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(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.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Submittal Date:	Thu Aug 24 19:03:49 EDT 2023
Committee:	NEC-P09

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

450.9 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) Ventilating 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.~~

Statement of Problem and Substantiation for Public Input

Breaking up 450.9 into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Committee: NEC-P09

Public Input No. 959-NFPA 70-2023 [Section No. 450.9]

450.9 Ventilation.

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, use as a keydrop, use as an incubator or egg cooking surface, use as an aromatherapy heat source, use as a chair in a makeshift office, use as a drug paraphernalia hideaway, or use as a loveseat .

Statement of Problem and Substantiation for Public Input

If we are going to be concerned about every improper act that may exist around a dry type xfmr, then we need to make sure we are comprehensive on it. Or, maybe we could just make this rule only apply if the xfmr is not located in dedicated space. "Readily accessible" means that it would apply even in a locked electrical room.

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Committee: NEC-P09

Public Input No. 2225-NFPA 70-2023 [Section No. 450.10(A)]

(A) Dry-Type Transformer Enclosures.

Where separate equipment grounding conductors and supply-side bonding jumpers are installed, a terminal bar(s) for all grounding and bonding conductor connections shall be secured inside the transformer enclosure. The terminal bar(s) 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.

Statement of Problem and Substantiation for Public Input

Adding an (s) at the end of terminal bar would make an installation with multiple terminal bars Code compliant. In installations with multiple sets of feeders for both the primary and secondary circuits it's not practical to have just one terminal bar at the transformer enclosure to terminate all grounding and bonding conductors.

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Committee: NEC-P09

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

(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~~ .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 631-NFPA 70-2023 [New Section after 450.14]

450.15 Reconditioned Equipment

Cast Resin, Control, Dry-Type, and Liquid-Filled Transformers shall not be reconditioned

Statement of Problem and Substantiation for Public Input

These items are not permitted to be reconditioned per the NEMA Technical Position on Reconditioned Equipment (NEMA CS 100-2020, Appendix B.1)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 634-NFPA 70-2023 [New Section after 692.1]	

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Committee:	NEC-P09

Public Input No. 2348-NFPA 70-2023 [Section No. 450.14]

450.14 Disconnecting Means.

Transformers, other than Class 2 or Class 3 transformers, shall have a disconnecting means that is readily accessible from the transformer and 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. The disconnecting means shall meet the working space requirements of 110.26(A).

Statement of Problem and Substantiation for Public Input

Adding language to make it clear the disconnecting means for the transformer must be readily accessible as required in accordance with 408.4(A). Adding same language of 440.14 to 450.14 because it relieves the AHJ from interpreting that the transformer disconnecting means must have the required working space in 110.26(A). This increases safety for the safe operation and maintenance of such equipment.

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Submittal Date: Wed Aug 16 13:54:41 EDT 2023
Committee: NEC-P09

Public Input No. 2612-NFPA 70-2023 [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~~ be installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
The requirement in 495.49 Reconditioned Switchgear was relocated to 495.3(A)
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee:	NEC-P09

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

495.~~2~~ 3 Reconditioned Equipment.

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

Exception: 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.

Statement of Problem and Substantiation for Public Input

The section has been revised for compliance with the NEC Style Manual Section 2.2.1 with the requirement of 495.49 relocated.

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Submittal Date: Tue Sep 05 16:10:13 EDT 2023

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

TITLE OF NEW CONTENT 495.6 Listing Required.

All equipment operating at more than 1,000 volts AC, 1,500 volts DC shall be listed. The listing requirement for this equipment shall be effective January 1, 2029.

Statement of Problem and Substantiation for Public Input

NEC 110.2 requires approval of all conductors and equipment required or permitted by this code (NEC). Generally speaking, few AHJ's will have copies of product standards for this equipment, training to evaluate the equipment, test facilities required for evaluation of the equipment, or time during normal field inspections to perform the evaluation. Many product standards include destructive testing to determine compliance and destructive testing is not practical for field inspections generally performed by AHJs. The only practical means to determine compliance is listing. The only other basis for approval would be field evaluation which is a limited evaluation and an option that should be limited to special equipment, circumstances, and conditions.

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Committee:	NEC-P09

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

~~**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 .~~

~~**(B)** Enclosures in Damp or Wet Locations.~~

~~Enclosures in damp or wet locations shall meet the requirements of 312.2 .~~

Statement of Problem and Substantiation for Public Input

The section should be removed as it is redundant as the other NEC requirements are already applicable. The section should be removed for compliance with the NEC Style Manual Section 2.2.1.

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Submittal Date: Tue Sep 05 16:07:34 EDT 2023

Committee: NEC-P09

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

(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 Article 450, Parts II and III ~~of Article~~ ~~450~~ .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Submittal Date: Thu Aug 24 19:08:17 EDT 2023
Committee: NEC-P09

Public Input No. 2419-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.

~~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.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, and Larry Wildermuth.

The purpose of the change is to improve clarity of requirements for non-load break isolation switches. Substantiation from Public Comment No. 485-NFPA 70-2021 included comment that an isolating switch could be either load-break or non-load break rated. The public comment was rejected but held. The proposed verbiage is intended to be more specific about requirements to prevent non-load break isolation switches from being operated under load.

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Committee: NEC-P09

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. 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~~ Non-load break 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).

Load break isolating switches shall be interlocked with an approved circuit interrupting device.

An identified fuseholder and fuse shall be permitted as an isolating switch.

Additional Proposed Changes

File Name	Description	Approved
PC_485_CMP_9.pdf	NEC-PC 485	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as “Reject but Hold” in Public Comment No. 485 of the (A2022) Second Draft Report for NFPA 70 and per the Regs. at 4.4.8.3.1.

Isolating switches can be load break or non-load break. The term isolating switch is used somewhat generically here.

Submitter Information Verification

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Committee: NEC-P09

Public Comment No. 485-NFPA 70-2021 [Section No. 495.22]

495.22 Isolating Means.

Means shall be provided to completely isolate an item of equipment from all ungrounded conductors. 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~~ Non-load break 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).

Load break isolating switches shall be interlocked with an approved circuit interrupting device.

An identified fuseholder and fuse shall be permitted as an isolating switch.

Statement of Problem and Substantiation for Public Comment

Isolating switches can be load break or non-load break. The term isolating switch is used somewhat generically here.

Related Item

- FR 7491

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Submittal Date:	Wed Jul 28 12:10:14 EDT 2021
Committee:	NEC-P09

Committee Statement

Committee Action:	Rejected but held
Resolution:	The Public Comment introduces material that was not included at the First Draft stage of the process. The change from “Isolating” to “Non-load break isolating” seems to have merit; however, it should be noted that non-load break isolating switches are not always required to be interlocked with an interrupting device.

Copyright Assignment

I, Dennis Querry, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Dennis Querry, and I agree to be legally bound by the above Copyright Assignment

and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

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

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

(1) **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 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.

(1) **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.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

This proposed addition would establish minimum requirements for safety in applying grounding switches. Grounding switches are becoming more prevalent in medium-voltage equipment, however these are not currently addressed in the NEC. While they perform a safety function in grounding equipment and cables, they must be applied with caution due to the risk of inadvertently closing a source of power into a grounding switch that is in the grounded position or closing a grounding switch into a live source of power.

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Public Input No. 377-NFPA 70-2023 [Section No. 495.25]

495.25 Backfeed.

Installations where the possibility of backfeed exists shall comply with 495.25(A) and (B), or (C) .

(A) Sign.

A permanent sign in accordance with 110.21(B) shall be installed on the disconnecting means enclosure or immediately adjacent to open disconnecting means with the following words or equivalent:

DANGER — CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.

(B) Diagram.

A permanent and legible single-line diagram of the local switching arrangement, clearly identifying each point of connection to the high-voltage section, shall be provided within sight of each point of connection.

(B) Large Installations.

In supervised industrial installations, a sign placed at the entrance to the electrical room or area, warning of the possibility of backfed circuits and noting the location of the single line diagram.

Statement of Problem and Substantiation for Public Input

This requirement may in some cases just add to a labeling scheme which could become so redundant that it isn't even paid attention to. We have customer owned generation step up substations currently that resemble utility substations in voltage, complexity, and size. This rule could require placement of a warning label and placard at each and every gang switch, hookstick switch, cutout, or breaker in such a facility.

Trained professionals working in these types of facilities are required to identify possible points of backfeed during review of onelines and during physical inspections performed as part of pre-work planning. It is believed that safety would be better implemented if we reserved signage in these types of installations for those truly unusual installation characteristics rather than for something that is common in some installations.

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Committee: NEC-P09

Public Input No. 3070-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

In a PI creating Article 238 for Services Over 1000 Vac, 1500 Vdc, Nominal, Section 235.411 is proposed to be deleted, as this requirement should not be limited to switchgear used as service equipment. This PI adds this requirement to Part III of Article 495, so that it applies to all switchgear operating at over 1000 Vac, 1500 Vdc.

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Submittal Date: Tue Aug 29 10:53:38 EDT 2023
Committee: NEC-P09

Public Input No. 2563-NFPA 70-2023 [Section No. 495.46]

495.46 Circuit Breaker Locking.

Circuit breakers shall be capable of being locked in the open position or, if they are installed in a draw-out mechanism, that mechanism shall be capable of being locked in such a position that the mechanism cannot be moved into the connected position. In either case, ~~the provision for locking shall~~ shall be lockable open in accordance with 110.25.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when a disconnecting means is required to be lockable open elsewhere in the code. The text is revised to comply with the NEC Style Manual. The NEC Style Manual Section 3.2.5 Consistent Application of Terms, 3.2.5.3 Lockable Open. Where a requirement specifies that a disconnecting means be capable of being locked in the open position, the phrase lockable open in accordance with 110.25 shall be used.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee: NEC-P09

Public Input No. 1636-NFPA 70-2023 [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~~ being put into service.

Statement of Problem and Substantiation for Public Input

The word “returned” suggests the equipment was taken out of service. Reconditioned equipment is not necessarily taken out of service at the same location as the installation site. The proper wording should be “put into service”.

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Committee: NEC-P09

Public Input No. 3782-NFPA 70-2023 [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.~~

Statement of Problem and Substantiation for Public Input

The section should be relocated to 495.3 for compliance with the NEC Style Manual Section 2.2.1.

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Public Input No. 2717-NFPA 70-2023 [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 ~~and~~ , Part VIII and shall disconnect all ungrounded conductors.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee:	NEC-P09

Public Input No. 2718-NFPA 70-2023 [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~~ X and the flexible cable requirements in ~~Part III of~~ Article 400 , Part III .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee: NEC-P09

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

Informative Annex A Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this *Code*. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the *Code* is in effect.

This informative annex does not form a mandatory part of the requirements of this *Code* but is intended to identify for the *Code* users the standards upon which *Code* requirements have been based.

Table A.1(a) Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement

Article	Standard Number	Standard Title
110	UL 10C	Positive Pressure Fire Tests of Door Assemblies
	UL 305	Panic Hardware
	UL 486D	Sealed Wire Connector Systems
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
210	UL 498	Attachment Plugs and Receptacles
	UL 935	Fluorescent-Lamp Ballasts
	UL 943	Ground Fault Circuit Interrupters
	UL 1029	High-Intensity-Discharge Lamp Ballast
	UL 1699	Arc-Fault Circuit-Interrupters
	UL 1699A	Outlet Branch Circuit AFCIs
225	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
230 UL 6	Electrical Rigid Metal Conduit — Steel
UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
UL 67	Panelboards
UL 98	Enclosed and Dead-Front Switches
UL 218	Fire Pump Controllers
UL 231	Power Outlets
~~UL 347~~	~~Medium-Voltage AC Contactors, Controllers, and Control Centers~~
UL 360	Liquid-Tight Flexible Metal Conduit
UL 414	Meter Sockets
UL 486A-486B	Wire Connectors
UL 486C	Splicing Wire Connectors
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 514B	Conduit, Tubing and Cable Fittings

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 845	Motor Control Centers

UL 857	Busways

UL 869A	Reference Standard for Service Equipment

UL 891	Switchboards

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

~~UL 1008A Transfer Switch Equipment, Over 1000 Volts~~

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 1740	Robots and Robotic Equipment

UL 1953	Power Distribution Blocks

UL 2011	Machinery

UL 2200	Stationary Engine Generator Assemblies

UL 2416	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

UL 2446	Unitary Boiler Room Systems

UL 2565	Industrial Metalworking and Woodworking Machine Tools

UL 2735	Electric Utility Meters

UL 2745	Meter Socket Adapters for Communications Equipment

UL 2876	Remote Racking Devices for Switchgear and Controlgear

UL 4248-1	Fuseholders — Part 1: General Requirements

UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules

	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
240	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 2: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 489I	Solid State Molded-Case Circuit Breakers

UL 943	Ground-Fault Circuit-Interrupters

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

	UL 4248-1	Fuseholders — Part 1: General Requirements
242	UL 1449	Surge Protective Devices
250	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

UL 5	Surface Metal Raceways and Fittings

UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 360	Liquid-Tight Flexible Metal Conduit

	UL 467	Grounding and Bonding Equipment
	UL 486A-486B	Wire Connectors
	UL 486C	Splicing Wire Connectors
	UL 486D	Sealed Wire Connector Systems
	UL 498	Attachment Plugs and Receptacles
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 514A	Metallic Outlet Boxes
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 797	Electrical Metallic Tubing — Steel
	UL 797A	Electrical Metallic Tubing — Aluminum
	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1569	Metal-Clad Cables
	UL 1652	Flexible Metallic Tubing
300	UL 4	Armored Cable
	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables
UL 83A	Fluoropolymer Insulated Wire
UL 263	Fire Tests of Building Construction and Materials
UL 504	Mineral-Insulated, Metal-Sheathed Cable
UL 746C	Polymeric Materials — Use in Electrical Equipment Evaluations
UL 1569	Metal-Clad Cable
UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
UL 2239	Hardware for Support of Conduit, Tubing and Cable
UL 2556	Wire and Cable Test Methods
UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

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UL 44	Thermoset-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables
UL 83A	Fluoropolymer Insulated Wire
UL 224	Extruded Insulating Tubing
UL 1063	Machine-Tool Wires and Cables

	UL 1441	Coated Electrical Sleeving
315	ANSI C119.4	Electric Connectors — Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93ºC and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100ºC

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IEEE 48	IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV

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IEEE 386	IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

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IEEE 404	IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV

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UL 4	Armored Cable

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UL 504	Mineral-Insulated, Metal-Sheathed Cable

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UL 1072	Medium Voltage Power Cables

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	UL 1569	Metal-Clad Cable
312	UL 50	Enclosures for Electrical Equipment

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 916	Energy Management Equipment

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UL 2808	Energy Monitoring Equipment

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	UL 61010-1 and UL 61010-2-030	Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-030: Particular Requirements for Testing and Measuring Circuits
314	UL 50	Enclosures for Electrical Equipment

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 486D	Sealed Wire Connector Systems

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UL 498	Attachment Plugs and Receptacles

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UL 498B	Receptacles with Integral Switching Means

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 514A	Metallic Outlet Boxes

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 514D	Cover Plates for Flush-Mounted Wiring Devices

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	UL 1953	Power Distribution Blocks
320	UL 4	Armored Cable

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UL 44	Thermoset-Insulated Wires and Cables

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	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 83A	Fluoropolymer Insulated Wire
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	UL 1063	Machine-Tool Wires and Cables
	UL 1565	Positioning Devices
	UL 2239	Hardware for the Support of Conduit, Tubing, and Cable
322	UL 486A-486B	Wire Connectors
	UL 498	Attachment Plugs and Receptacles
	UL 514A	Metallic Outlet Boxes
324	UL 486A-486B	Wire Connectors
	UL 498	Attachment Plugs and Receptacles
330	UL 44	Thermoset-Insulated Wires and Cables
	UL 66	Fixture Wire
	UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 514B	Conduit, Tubing, and Cable Fittings

UL 1063	Machine-Tool Wires and Cables

UL 1565	Positioning Devices

UL 1569	Metal-Clad Cables

UL 2225	Cables and Cable-Fittings For Use In Hazardous (Classified) Locations

	UL 2239	Hardware for the Support of Conduit, Tubing, and Cable
332	UL 504	Mineral-Insulated, Metal-Sheathed Cable

	UL 514B	Conduit, Tubing and Cable Fittings
334	UL 719	Nonmetallic-Sheathed Cables

UL 2256	Nonmetallic Sheathed Cable Interconnects

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installations
335	UL 2250	Instrumentation Tray Cable
336	UL 514B	Conduit, Tubing, and Cable Fittings

UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members

	UL 2225	Cables and Cable-Fittings For Use In Hazardous (Classified) Locations
337	UL 1309A	Cable for Use in Mobile Installations
338	UL 514B	Conduit, Tubing, and Cable Fittings

	UL 854	Service-Entrance Cables
340	UL 514B	Conduit, Tubing, and Cable Fittings
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

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342	UL 514B	Conduit, Tubing, and Cable Fittings

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	UL 1242	Electrical Intermediate Metal Conduit — Steel
344	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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	UL 514B	Conduit, Tubing, and Cable Fittings
348	UL 1	Flexible Metal Conduit

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
350	UL 360	Liquid-Tight Flexible Steel Conduit

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UL 514B	Conduit, Tubing, and Cable Fittings

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
352	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
353	UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit
354	UL 1990	Nonmetallic Underground Conduit with Conductors
355	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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	UL 2515A	Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
356	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
358	UL 514B	Conduit, Tubing, and Cable Fittings

	UL 797	Electrical Metallic Tubing — Steel

	UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel
360	UL 514B	Conduit, Tubing, and Cable Fittings

	UL 1652	Flexible Metallic Tubing
362	UL 1653	Electrical Nonmetallic Tubing

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
366	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
368	UL 509	Bus Drop Cable
370	ANSI/CSA C22.2 No. 273	Cablebus
374	UL 209	Cellular Metal Floor Raceways and Fittings

	UL 360	Liquid-Tight Flexible Metal Conduit

	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
376	UL 870	Wireways, Auxiliary Gutters and Associated Fittings

	UL 1953	Power Distribution Blocks
378	UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
382	UL 5A	Nonmetallic Surface Raceways and Fittings

	UL183	Manufactured Wiring Systems

	UL 467	Grounding and Bonding Equipment

	UL 498	Attachment Plugs and Receptacles

	UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 498M	Marine Shore Power Inlets

UL 514D	Cover Plates for Flush-Mounted Wiring Devices

UL 746C	Polymeric Materials — Use in Electrical Equipment Evaluations

UL 943	Ground-Fault Circuit-Interrupters

UL 991	Tests for Safety-Related Controls Employing Solid-State Devices

UL 1077	Supplementary Protectors for Use in Electrical Equipment

UL 1699	Arc-Fault Circuit-Interrupters

	UL 1998	Software in Programmable Components
384	UL 5B	Strut-Type Channel Raceways and Fittings
386	UL 5	Surface Metal Raceways and Fittings
388	UL 5A	Nonmetallic Surface Raceways and Fittings
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UL 1989	Standby Batteries

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UL 2054	Household and Commercial Batteries

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UL 4127	Low Voltage Battery Cable

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UL 4128	Intercell and Intertier Connectors for use in Electrochemical Battery System Applications

~~490 UL 347 Medium-Voltage AC Contactors, Controllers, and Control Centers~~ _ ~~UL 347A Medium Voltage Power Conversion Equipment~~ _ ~~UL 347B Medium Voltage Motor Controllers, Up to 15kV~~ _ ~~UL 347C Medium Voltage Solid State Resistive Load Controllers, Up to 15kV~~ _ ~~UL 1008A Transfer Switch Equipment, Over 1000 Volts~~ _ _ _

500 FM 121303 Guide for Use of Detectors for Flammable Gases

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IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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IEEE 1349	Guide for the Application of Electric Machines in Zone 2 and Class I, Division 2 Hazardous (Classified) Locations

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NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

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NFPA 34	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids

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NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment

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UL 674	Electric Motors and Generators for Use in Hazardous (Classified) Locations
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
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UL 60079-30-1	Explosive Atmospheres — Electrical Resistance Trace Heating — General and Testing Requirements

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UL 122001	General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations

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501	IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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UL 823	Standard for Electric Heaters For Use in Hazardous (Classified) Locations

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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	UL 2305A	Convention Center Cord Sets
520	UL 62	Flexible Cords and Cables
	UL 334	Theater Lighting Distribution and Control Equipment
	UL 1573	Stage and Studio Luminaires and Connector Strips
	UL 1640	Portable Power-Distribution Equipment
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522	UL 13	Power Limited Circuit Cables
	UL 1063	Machine-Tool Wires and Cables
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525	UL 62	Flexible Cords and Cables
	UL 817	Cord Sets and Power-Supply Cords
	UL 943	Ground-Fault Circuit-Interrupters
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UL 6	Electrical Rigid Metal Conduit — Steel

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UL 486D	Sealed Wire Connector Systems

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 676	Underwater Luminaires and Submersible Junction Boxes

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610	UL 62	Flexible Cords and Cables
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UL 2269	Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes

UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use

UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements

UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

645 UL 38 Manual Signaling Boxes for Fire Alarm Systems

UL 268	Smoke Detectors for Fire Alarm Systems

UL 444	Communications Cables

UL 464	Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 497B	Protectors for Data Communications and Fire Alarm Circuits

UL 833	Control Units and Accessories for Fire Alarm Systems

UL 864	Control Units and Accessories for Fire Alarm Systems

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits

UL 1449	Surge Protective Devices

UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories
UL 1638	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 1651	Optical Fiber Cable
UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
UL 1690	Data-Processing Cable
UL 1778	Uninterruptible Power Systems
UL 2024	Cable Routing Assemblies and Communications Raceways
UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements
UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding
UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors
UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment
UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

646 UL 10C Positive Pressure Fire Tests of Door Assemblies

UL 62	Flexible Cords and Cables

UL 67	Panelboards
UL 98	Enclosed and Dead-Front Switches
UL 305	Panic Hardware
UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 508	Industrial Control Equipment
UL 508A	Industrial Control Panels
UL 845	Motor Control Centers
UL 869A	Reference Standard for Service Equipment
UL 891	Switchboards
UL 924	Emergency Lighting and Power Equipment
UL 977	Fused Power-Circuit Devices
UL 1008	Transfer Switch Equipment
UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1655	Community-Antenna Television Cables

UL 1989	Standby Batteries

UL 2755	Modular Data Centers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
647	UL 1598	Luminaires
650	UL 1310	Class 2 Power Units

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
670	ANSI/CSA-C22.2 No. 19085-1	Woodworking machines — Safety — Part 1: Common requirements

UL 508	Industrial Control Equipment

UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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675	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
680	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 20	General Use Snap-Switches

UL 62	Flexible Cords and Cables

UL 360	Liquid-Tight Flexible Metal Conduit

UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires

UL 467	Grounding and Bonding Equipment

UL 486D	Sealed Wire Connector Systems

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 676	Underwater Luminaires and Submersible Junction Boxes

UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment

UL 943	Ground-Fault Circuit-Interrupters
UL 943C	Special Purpose Ground-Fault Circuit-Interrupters
UL 1004-10	Pool Pump Motors
UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
UL 1241	Junction Boxes for Swimming Pool Luminaires
UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1261	Electric Water Heaters for Pools and Tubs
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 1569	Metal-Clad Cables
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 1795	Hydromassage Bathtubs
UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
UL 2452	Electric Swimming Pool and Spa Cover Operators
UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
	UL 2995	Lifts for Swimming Pools and Spas
	UL 60335-2-1000	Household and Similar Electrical Appliances: Particular Requirements for Electrically Powered Pool Lifts
682	UL 486D	Sealed Wire Connector Systems
	UL 1650	Portable Power Cable
	UL 1838	Low Voltage Landscape Lighting Systems
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems
	UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses
	UL 467	Grounding and Bonding Equipment
	UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems
	UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems
	UL 1569	Metal-Clad Cables
	UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection
	UL 1703	Flat-Plate Photovoltaic Modules and Panels
	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

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UL 3001	Distributed Energy Generation and Storage Systems

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UL 3003	Distributed Generation Cables

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UL 3005	Distributed Energy Resource Management Systems

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UL 3703	Solar Trackers

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UL 3730	Photovoltaic Junction Boxes

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UL 3741	Photovoltaic Hazard Control

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UL 4703	Photovoltaic Wire

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UL 6703	Connectors for Use in Photovoltaic Systems

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UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

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UL 8703	Concentrator Photovoltaic Modules and Assemblies

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UL 8801	Photovoltaic Luminaire Systems

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UL 9703	Distributed Generation Wiring Harnesses

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UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction

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	UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing
	UL 62109-1	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
692	UL 2262	Fuel Cell Modules for Use in Portable and Stationary Equipment
	UL 2262A	Borohydride Fuel Cartridges with Integral Fuel Processing for Use with Portable Fuel Cell Power Systems or Similar Equipment
	UL 2265	Fuel Cell Power Units and Fuel Storage Containers for Portable Devices
	UL 2265A	Hand-held or Hand-Transportable Fuel Cell Power Units with Disposable Methanol Fuel Cartridges for use in Original Equipment Manufacturer's Information Technology Equipment
	UL 2265C	Hand-Held or Hand-Transportable Alkaline (Direct Borohydride) Fuel Cell Power Units and Borohydride Fuel Cartridges For Use With Consumer Electronics or Information Technology Equipment
	UL 2266	Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunications Equipment
	UL 2267	Fuel Cell Power Systems for Installation in Industrial Electric Trucks
694	UL 467	Grounding and Bonding Equipment
	UL 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2227	Flexible Motor Supply Cable and Wind Turbine Tray Cable

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UL 2736	Single Pole Separable Interconnecting Cable Connectors for Use with Wind Turbine Generating Systems

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UL 4143	Wind Turbine Generator — Life Time Extension (LTE)

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 6142	Wind Turbine Generating Systems — Small

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695	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 218	Fire Pump Controllers

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UL 448	Centrifugal Stationary Pumps for Fire-Protection Service

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UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes

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UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 1004-5	Fire Pump Motors

	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1569	Metal-Clad Cables
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
700	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1449	Surge Protective Devices
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2200	Stationary Engine Generator Assemblies
701	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment

	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
702	UL 98	Enclosed and Dead-Front Switches

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UL 1008	Transfer Switch Equipment

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UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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UL 1008M	Meter-Mounted Transfer Switches

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	UL 1008S	Solid-State Transfer Switches
705	UL 62	Flexible Cords and Cables

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UL 98	Enclosed and Dead-Front Switches

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

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UL 1429	Pullout Switches

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2200	Stationary Engine Generator Assemblies

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UL 3003	Distributed Generation Cables

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UL 6141 Wind Turbines Permitting Entry of Personnel

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UL 6142 Small Wind Turbine Systems

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UL 9540 Energy Storage Systems and Equipment

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UL 62109-2 Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

706 UL 248-2 Low-Voltage Fuses — Part 2: Class C Fuses

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UL 248-3 Low-Voltage Fuses — Part 3: Class CA and CB Fuses

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UL 248-4 Low-Voltage Fuses — Part 4: Class CC Fuses

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UL 248-5 Low-Voltage Fuses — Part 5: Class G Fuses

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UL 248-6 Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

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UL 248-8 Low-Voltage Fuses — Part 8: Class J Fuses

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UL 248-9 Low-Voltage Fuses — Part 9: Class K Fuses

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UL 248-10 Low-Voltage Fuses — Part 10: Class L Fuses

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UL 248-12 Low-Voltage Fuses — Part 12: Class R Fuses

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UL 248-15 Low-Voltage Fuses — Part 15: Class T Fuses

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UL 248-17 Low-Voltage Fuses — Part 17: Class CF Fuses

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UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 489H	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, for Use with Direct Current (DC) Microgrids

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

	UL 9540	Energy Storage Systems and Equipment
708	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

UL 83	Thermoplastic-Insulated Wires and Cables

UL 360	Liquid-Tight Flexible Metal Conduit

UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

UL 497A	Secondary Protectors for Communications Circuits

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

	UL 1008S	Solid-State Transfer Switches
	UL 1569	Metal-Clad Cables
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
710	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
	UL 2200	Stationary Engine Generator Assemblies
	UL 8801	Photovoltaic Luminaire Systems
	UL 9540	Energy Storage Systems and Equipment
	UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
	UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

722	UL 13	Standard for Power-Limited Circuit Cables
	UL 444	Standard for Safety for Communications Cables
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1651	Optical Fiber Cable

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts

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UL 1685	Standard for Safety for Vertical-Tray Fire-Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables

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UL 1724	Fire Tests for Electrical Circuit Protective Systems

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UL 2024	Standard for Safety for Communications Cables

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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UL 2556	Standard for Wire and Cable Test Methods

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725	UL 1310	Class 2 Power Units

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UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

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UL 9990	Information and Communication Technology (ICT) Power Cables

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UL 61010-2-201	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-201: Particular Requirements for Control Equipment

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UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
726	UL 1400-1	Fault-Managed Power Systems — Part 1 General Requirements

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UL 1400-2	Fault-Managed Power Systems — Part 2 Requirements for Cables

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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UL 2556	Wire and Cable Test Methods

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728	UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings

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UL 5B	Strut-Type Channel Raceways and Fittings

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UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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UL 209	Cellular Metal Floor Raceways and Fittings

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UL 467	Grounding and Bonding Equipment

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UL 514A	Metallic Outlet Boxes

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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	UL 568	Nonmetallic Cable Tray Systems
	UL 884	Underfloor Raceways and Fittings
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems
	UL 268A	Smoke Detectors for Duct Application
	UL 486C	Splicing Wire Connectors
	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	UL 1425	Cables for Non–Power-Limited Fire-Alarm Circuits
	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories
	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 60730-2-14	Automatic Electrical Controls; Part 2: Particular Requirements for Electric Actuators
770	UL 467	Grounding and Bonding Equipment

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UL 568	Nonmetallic Cable Tray Systems

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UL 1651	Optical Fiber Cable

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UL 2024	Optical Fiber and Communication Cable Raceway

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
800	UL 444	Communications Cables

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UL 467	Grounding and Bonding Equipment

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UL 489A	Circuit Breakers for Use in Communication Equipment

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UL 497	Protectors for Paired-Conductor Communications Circuits

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UL 497A	Secondary Protectors for Communications Circuits

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UL 497C	Protectors for Coaxial Communications Circuits

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UL 497E	Protectors for Antenna Lead-In Conductors

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UL 523 Telephone Service Drop Wire

UL 568 Nonmetallic Cable Tray Systems

UL 723 Test for Surface Burning Characteristics of Building Materials

UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 1666 Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

UL 1685 Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1863 Communication Circuit Accessories

UL 2024 Cable Routing Assemblies and Communications Raceways

UL 62275 Cable Management Systems — Cable Ties for Electrical Installation

805 UL 444 Communications Cables

UL 497 Protectors for Paired-Conductor Communications Circuits

UL 497A Secondary Protectors for Communications Circuits

UL 497C Protectors for Coaxial Communications Circuits

UL 497E Protectors for Antenna Lead-In Conductors

UL 523 Telephone Service Drop Wire

	UL 719	Nonmetallic-Sheathed Cables
	UL 1310	Class 2 Power Units
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
	UL 1863	Communication Circuit Accessories
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
810	UL 150	Antenna Rotators
	UL 452	Antenna-Discharge Units
	UL 467	Grounding and Bonding Equipment
	UL 497E	Protectors for Antenna Lead-In Conductors
820	UL 444	Communications Cables
	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 1655	Community-Antenna Television Cables
830	UL 444	Communications Cables

UL 497A	Secondary Protectors for Communications Circuits
UL 497C	Protectors for Coaxial Communications Circuits
UL 497E	Protectors for Antenna Lead-In Conductors
UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
840 UL 444	Communications Cables
UL 467	Grounding and Bonding Equipment
UL 498A	Current Taps and Adapters
UL 1310	Class 2 Power Units
UL 1651	Optical Fiber Cable
UL 1863	Communication Circuit Accessories
UL 2024	Cable Routing Assemblies and Communications Raceways

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 11(A) and 11(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 12(A) and 12(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

Table A.1(b) Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement

Article	**Standard Number**	**Standard Title**
110	UL 969	Marking and Labeling Systems

	UL 9691	Recommended Practice for Nameplates for Use in Electrical Installations
235	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL 486C	Splicing Wire Connectors
	UL 514B	Conduit, Tubing and Cable Fittings
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 2200	Stationary Engine Generator Assemblies
	UL 2876	Remote Racking Devices for Switchgear and Controlgear
245	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
	NEMA C37.54	American National Standard for Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear—Conformance Test Procedures
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.46	IEEE Standard Specifications for High-Voltage (>1000 V) Expulsion and Current-Limiting Power Class Fuses and Fuse Disconnecting Switches
	IEEE C37.47	IEEE Standard Specifications for High-Voltage (>1000 V) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
300	UL 635	Insulating Bushings
314	UL 514C	Conduit, Tubing, and Cable Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes
320	UL 514A	Metallic Outlet Boxes

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
322	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
324	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
330	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
332	UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
334	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 514B	Conduit, Tubing, and Cable Fittings

UL 651	Schedule 40 and 80 Rigid PVC Conduit

UL 797	Electrical Metallic Tubing — Steel

UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1565	Positioning Devices

UL 2239	Hardware for the Support of Conduit, Tubing and Cable

UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
335	UL 2250	Instrumentation Tray Cable
337	UL 1565	Positioning Devices

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
344	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
348	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
350	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
352	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
353	UL 635	Insulating Bushings
355	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
356	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
358	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
362	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
368	UL 857	Busways
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables

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UL 498	Attachment Plugs and Receptacles

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UL 498B	Receptacles with Integral Switching Means

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 514B	Conduit, Tubing, and Cable Fittings

UL 817	Cord Sets and Power-Supply Cords

UL 1650	Portable Power Cable

	UL 1680	Stage and Lighting Cables
402	UL 66	Fixture Wire
408	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
424	UL 834	Heating, Water Supply, and Power Boilers — Electric

UL 1693	Electric Radiant Heating Panels and Heating Panel Sets

UL 1995	Heating and Cooling Equipment

UL 1996	Electric Duct Heaters

UL 60335-1	Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2–40
425	UL 834	Heating, Water Supply, and Power Boilers — Electric
426	UL 1588	Roof and Gutter De-Icing Cable Units
427	UL 515	Electrical Resistance Trace Heating for Commercial Applications

UL 1462	Mobile Home Pipe Heating Cable

	UL 2049	Residential Pipe Heating Cable
430	UL 248-13	Low Voltage Fuses — Part 13: Semiconductor Fuses
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL 347A	Medium Voltage Power Conversion Equipment
445	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
450	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 1561	Dry-Type General Purpose and Power Transformers

	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
	IEEE C57.12.00	IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
	IEEE C57.12.28	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity
	IEEE C57.12.29	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity for Coastal Environments
	UL 1562	Standard for Transformers, Distribution, Dry-Type Over 600 Volts
	IEEE C57.16	IEEE Standard for Requirements, Terminology, and Test Code for Dry-Type Air-Core Series-Connected Reactors
460	UL 810	Capacitors

UL 1283	Electromagnetic Interference Filters

	UL 60384-14	Fixed Capacitors for Use in Electronic Equipment — Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains
470	UL 508	Industrial Control Equipment

	UL 1283	Electromagnetic Interference Filters
495	IEEE C37.20.2	IEEE Standard for Metal-Clad Switchgear
	IEEE C37.20.3	IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)
	IEEE C37.20.4	IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)
	IEEE C37.20.9	IEEE Standard for Metal-Enclosed Switchgear Rated 1 kV to 52 kV Incorporating Gas Insulating Systems
	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
	NEMA C37.54	American National Standard for Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear—Conformance Test Procedures
	NEMA C37.55	American National Standard for Switchgear—Medium Voltage Metal-Clad Assemblies—Conformance Test Procedures
	NEMA C37.57	American National Standard for Switchgear—Metal-Enclosed Interrupter Switchgear Assemblies—Conformance Testing
	NEMA C37.58	American National Standard for Switchgear—Indoor AC Medium Voltage Switches for Use in Metal-Enclosed Switchgear —Conformance Test Procedures
	IEEE C37.59	IEEE Standard for Requirements for Conversion of Power Switchgear Equipment
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.46	IEEE Standard Specifications for High-Voltage (>1000 V) Expulsion and Current-Limiting Power Class Fuses and Fuse Disconnecting Switches
	IEEE C37.47	IEEE Standard Specifications for High-Voltage (>1000 V) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
	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
	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
	IEEE C37.23	IEEE Standard for Metal-Enclosed Bus
	IEEE C37.20.6	IEEE Standard for 4.76 kV to 38 kV Rated Ground and Test Devices Used in Enclosures
	UL 2748	Arcing Fault Quenching Equipment
	UL 2877	Power Supplies, Medium Voltage
	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes

UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
UL 347A	Medium Voltage Power Conversion Equipment
UL 347C	Outline of Investigation for Medium Voltage Solid State Resistive Load Controllers, Up to 15KV
UL 1008A	Transfer Switch Equipment, Over 1000 Volts

500	ANSI/IEEE C2	National Electrical Safety Code, Section 127A, Coal Handling Areas

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API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations

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API RP 500	Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

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API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

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ASHRAE 15	Safety Standard for Refrigeration Systems.

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ASME B1.20.1	Pipe Threads, General Purpose (Inch)

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IEEE 844.2	Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

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IEEE 60079-30-2	IEEE/IEC International Standard for Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation, and maintenance

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IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

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ISA-12.10	Area Classification in Hazardous (Classified) Dust Locations

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ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

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ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 32	Standard for Drycleaning Facilities

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 35	Standard for the Manufacture of Organic Coatings

NFPA 36	Standard for Solvent Extraction Plants

NFPA 45	Standard on Fire Protection for Laboratories Using Chemicals

NFPA 55	Compressed Gases and Cryogenic Fluids Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

UL 60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

UL 120002	Certificate Standard for AEx Equipment for Hazardous (Classified) Locations

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

UL 121303	Guide for Combustible Gas Detection as a Method of Protection

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and 22 Hazardous (Classified) Locations
501	UL 62	Flexible Cord and Cable

	UL 504	Mineral-Insulated, Metal-Sheathed Cable
502	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
503	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
504	ISA-RP 12.06.01	Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety
505	ANSI/API RP 14FZ	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations

API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

ASME B1.20.1	Pipe Threads, General Purpose (Inch)

EI 15	Model Code of Safe Practice, Part 15: Area Classification Code for Installations Handling Flammable Fluids

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

ISA-60079-10-1 (12.24.01)	Explosive Atmospheres — Part 10-1: Classification of Areas — Explosive gas atmospheres

ISA-60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

UL 80079-20-1	Explosive Atmospheres — Part 20-1: Material Characteristics for Gas and Vapour Classification — Test Methods and Data

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

UL 121303	Guide for Use of Detectors for Flammable Gases

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
506	ASME B1.20.1	Pipe Threads, General Purpose (Inch)

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

ISA-60079-10-2 (12.10.05)	Explosive Atmospheres — Part 10-2: Classification of Areas — Combustible Dust Atmospheres

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
511	NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

	NFPA 88A	Standard for Parking Structures
512	ICC IFC	International Fire Code

NFPA 1	Fire Code

NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 36	Standard for Solvent Extraction Plants

NFPA 58	Liquefied Petroleum Gas Code

NFPA 70B	Recommended Practice for Electrical Equipment Maintenance

	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
513	NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

	NFPA 409	Standard on Aircraft Hangars
514	NFPA 2	Hydrogen Technologies Code

NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 52	Vehicular Natural Gas Fuel Systems Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

	NFPA 303	Fire Protection Standard for Marinas and Boatyards
515	NFPA 30	Flammable and Combustible Liquids Code
516	NFPA 13	Standard for the Installation of Sprinkler Systems

	NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials
	NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids
	NFPA 77	Recommended Practice on Static Electricity
	NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids
	NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
620	UL 4	Armored Cable
	UL 44	Thermoset-Insulated Wires and Cables
	UL 66	Fixture Wire
	UL 504	Mineral Insulated Wire
	UL 1063	Machine-Tool Wires and Cables
	UL 1569	Metal Clad Cable
625	UL 3001	Distributed Energy Generation and Storage Systems
	UL 3010	Single Site Energy Systems
630	UL 1276	Welding Cable
650	UL 1651	Optical Fiber Cable
660	UL 62	Flexible Cords and Cables
	UL 817	Cord Sets and Power Supply Cords
668	UL 4	Armored Cable

	UL 62	Flexible Cords and Cables
670	UL 2011	Machinery
675	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1263	Irrigation Cable
690	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
691	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
692	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
694	UL 44	Thermoset-Insulated Wires and Cables

UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
700	UL 3001	Distributed Energy Generation and Storage Systems
701	UL 3001	Distributed Energy Generation and Storage Systems
702	UL 3001	Distributed Energy Generation and Storage Systems
705	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
710	UL 3001	Distributed Energy Generation and Storage Systems

UL 3010	Single Site Energy Systems

Additional Proposed Changes

File Name	Description	Approved
Annex_A_Product_Safety_Standards_PI.docx	Due to formatting errors in Terraview, a Word version of the PI is included.	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

The proposed 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.

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL Solutions
Street Address:
City:
State:
Zip:

Submittal Date:	Tue Aug 29 11:44:51 EDT 2023
Committee:	NEC-P09

Annex A.1(a) & (b) Product Safety Standards

Make the following additions to Annex A1.b:

Article	Standard	Title
495	IEEE C37.20.2	IEEE Standard for Metal-Clad Switchgear
	IEEE C37.20.3	IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)
	IEEE C37.20.4	IEEE Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV)
	IEEE C37.20.9	IEEE Standard for Metal-Enclosed Switchgear Rated 1 kV to 52 kV Incorporating Gas Insulating Systems
	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
	NEMA C37.54	American National Standard for Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear—Conformance Test Procedures
	NEMA C37.55	American National Standard for Switchgear—Medium Voltage Metal-Clad Assemblies—Conformance Test Procedures
	NEMA C37.57	American National Standard for Switchgear—Metal-Enclosed Interrupter Switchgear Assemblies—Conformance Testing
	NEMA C37.58	American National Standard for Switchgear—Indoor AC Medium Voltage Switches for Use in Metal-Enclosed Switchgear—Conformance Test Procedures
	IEEE C37.59	IEEE Standard for Requirements for Conversion of Power Switchgear Equipment
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.46	IEEE Standard Specifications for High-Voltage (>1000 V) Expulsion and Current-Limiting Power Class Fuses and Fuse Disconnecting Switches
	IEEE C37.47	IEEE Standard Specifications for High-Voltage (>1000 V) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
	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
	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
	IEEE C37.23	IEEE Standard for Metal-Enclosed Bus
	IEEE C37.20.6	IEEE Standard for 4.76 kV to 38 kV Rated Ground and Test Devices Used in Enclosures
	UL 2748	Arcing Fault Quenching Equipment
	UL 2877	Power Supplies, Medium Voltage
	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes

Article	Standard	Title
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL 347A	Medium Voltage Power Conversion Equipment
	UL 347C	Outline of Investigation for Medium Voltage Solid State Resistive Load Controllers, Up to 15KV
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
450	IEEE C57.12.00	IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
	IEEE C57.12.28	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity
	IEEE C57.12.29	IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity for Coastal Environments
	UL 1562	Standard for Transformers, Distribution, Dry-Type Over 600 Volts
	IEEE C57.16	IEEE Standard for Requirements, Terminology, and Test Code for Dry-Type Air-Core Series-Connected Reactors
314	UL 3004	Outline of Investigation for Medium Voltage Junction Boxes
235	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
	UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL 486C	Splicing Wire Connectors
	UL 514B	Conduit, Tubing and Cable Fittings
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 2200	Stationary Engine Generator Assemblies
	UL 2876	Remote Racking Devices for Switchgear and Controlgear
245	IEEE C37.09	IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
	NEMA C37.54	American National Standard for Indoor AC High Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear—Conformance Test Procedures
	IEEE C37.41	IEEE Standard Design Tests for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.42	IEEE Standard Specifications for High-Voltage (>1000 V) Fuses and Accessories
	IEEE C37.46	IEEE Standard Specifications for High-Voltage (>1000 V) Expulsion and Current-Limiting Power Class Fuses and Fuse Disconnecting Switches

Article	Standard	Title
	IEEE C37.47	IEEE Standard Specifications for High-Voltage (>1000 V) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
430	UL 347 (Relocate from A1.a)	Medium-Voltage AC Contactors, Controllers, and Control Centers
	UL 347A (Relocate from A1.a)	Medium Voltage Power Conversion Equipment

Make the following revisions to Annex A1.a:

Article	Standard	Title
230	Remove UL 347	
	Remove UL 1008A	
315	Renumber the table in correct numeric order.	310, 315, 312, 314 **to** 310, 312, 314, 315
490	Remove all entries in Article 490 which has been relocated to Table A1.b, and renumbered to Article 495, with additional standards added.	

Rationale: This Public Input is submitted on behalf of a Correlating Committee Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, Donny Cook, Scott Higgins, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Kevin Rogers, Tony Ricciuti, Paul Knapp, Paul Sullivan, George Smith, Eric Simmon, Kevin Arnold, Larry Wildermuth, and Kyle Krueger.

The proposed 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.

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

Table A.1(a) Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement

Article	Standard Number	Standard Title
110	UL 10C	Positive Pressure Fire Tests of Door Assemblies
	UL 305	Panic Hardware
	UL 486D	Sealed Wire Connector Systems
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
210	UL 498	Attachment Plugs and Receptacles
	UL 935	Fluorescent-Lamp Ballasts
	UL 943	Ground Fault Circuit Interrupters
	UL 1029	High-Intensity-Discharge Lamp Ballast
	UL 1699	Arc-Fault Circuit-Interrupters
	UL 1699A	Outlet Branch Circuit AFCIs
225	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
	UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
230	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 67	Panelboards

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UL 98	Enclosed and Dead-Front Switches

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UL 218	Fire Pump Controllers

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UL 231	Power Outlets

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UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 414	Meter Sockets

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UL 486A-486B	Wire Connectors

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UL 486C	Splicing Wire Connectors

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 508	Industrial Control Equipment

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UL 508A	Industrial Control Panels

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UL 514B	Conduit, Tubing and Cable Fittings

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 845	Motor Control Centers

UL 857	Busways

UL 869A	Reference Standard for Service Equipment

UL 891	Switchboards

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

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UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 1740	Robots and Robotic Equipment

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UL 1953	Power Distribution Blocks

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UL 2011	Machinery

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UL 2200	Stationary Engine Generator Assemblies

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UL 2416	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

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UL 2446	Unitary Boiler Room Systems

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UL 2565	Industrial Metalworking and Woodworking Machine Tools

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UL 2735	Electric Utility Meters

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UL 2745	Meter Socket Adapters for Communications Equipment

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UL 2876	Remote Racking Devices for Switchgear and Controlgear

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UL 4248-1	Fuseholders — Part 1: General Requirements

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UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules

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	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
240	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 2: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

	UL 489I	Solid State Molded-Case Circuit Breakers
	UL 943	Ground-Fault Circuit-Interrupters
	UL 1053	Ground-Fault Sensing and Relaying Equipment
	UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
	UL 4248-1	Fuseholders — Part 1: General Requirements
242	UL 1449	Surge Protective Devices
250	UL 1	Flexible Metal Conduit
	UL 4	Armored Cable
	UL 5	Surface Metal Raceways and Fittings
	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 467	Grounding and Bonding Equipment
	UL 486A-486B	Wire Connectors
	UL 486C	Splicing Wire Connectors
	UL 486D	Sealed Wire Connector Systems
	UL 498	Attachment Plugs and Receptacles

UL 504	Mineral-Insulated, Metal-Sheathed Cable

UL 514A	Metallic Outlet Boxes

UL 514B	Conduit, Tubing, and Cable Fittings

UL 797	Electrical Metallic Tubing — Steel

UL 797A	Electrical Metallic Tubing — Aluminum

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1569	Metal-Clad Cables

	UL 1652	Flexible Metallic Tubing
300	UL 4	Armored Cable

UL 44	Thermoset-Insulated Wires and Cables

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UL 83A	Fluoropolymer Insulated Wire

UL 263	Fire Tests of Building Construction and Materials

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 498B	Receptacles with Integral Switching Means

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 514A	Metallic Outlet Boxes

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	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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	UL 1953	Power Distribution Blocks
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	UL 44	Thermoset-Insulated Wires and Cables

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	UL 83A	Fluoropolymer Insulated Wire

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	UL 514B	Conduit, Tubing, and Cable Fittings

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UL 83	Thermoplastic-Insulated Wires and Cables

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UL 234	Low Voltage Lighting Fixtures for use in Recreational Vehicles

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UL 60730-1	Automatic Electrical Controls; Part 1: General Requirements

	UL 60730-2-9	Automatic Electrical Controls; Part 2: Particular Requirements for Temperature Sensing Controls
552	SAE J1128-2015	Low Voltage Primary Cable, for Types GXL, HDT, and SXL

SAE J1127-2015	Low Voltage Battery Cable, for Types SGT and SGR

UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
UL 62	Flexible Cords and Cables
UL 67	Panelboards
UL 231	Power Outlets
UL 234	Low Voltage Lighting Fixtures for Use in Recreational Vehicles
UL 360	Liquid-Tight Flexible Metal Conduit
UL 430	Waste Disposers
UL 467	Grounding and Bonding Equipment
UL 514A	Metallic Outlet Boxes
UL 514B	Conduit, Tubing, and Cable Fittings
UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 817	Cord Sets and Power-Supply Cords
UL 916	Energy Management Equipment
UL 943	Ground-Fault Circuit-Interrupters

UL 1004-4	Electric Generators
UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 1598	Luminaires
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 2108	Low Voltage Lighting Systems
UL 2200	Stationary Engine Generator Assemblies
UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
UL 6	Electrical Rigid Metal Conduit — Steel
UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
UL 231	Power Outlets
UL 486D	Sealed Wire Connector Systems
UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 676	Underwater Luminaires and Submersible Junction Boxes
UL 943	Ground-Fault Circuit-Interrupters
UL 1053	Ground-Fault Sensing and Relaying Equipment
UL 1650	Portable Power Cable

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
590	UL 496	Lampholders

UL 514B	Conduit, Tubing, and Cable Fittings

UL 588	Seasonal and Holiday Decorative Products

UL 817	Cord Sets

UL 943	Ground-Fault Circuit-Interrupters

UL 1088	Temporary Lighting Strings

UL 1377	Wire used in Low Voltage Seasonal Lighting Products In Circuits With a Maximum Available Power of 15W

600	UL 1	Flexible Metal Conduit

UL 5	Surface Metal Raceways and Fittings

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UL 13	Power-Limited Circuit Cables

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UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

UL 360	Liquid-Tight Flexible Metal Conduit

UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

UL 814	Gas-Tube-Sign Cable

UL 879	Electric Sign Components

UL 879A	LED Sign and Sign Retrofit Kits

UL 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice

UL 943	Ground-Fault Circuit-Interrupters

UL 1310	Class 2 Power Units

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

Ul 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 2161	Neon Transformers and Power Supplies

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

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UL 3001	Distributed Energy Generation and Storage Systems

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UL 3003	Distributed Generation Cables

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UL 3703	Solar Trackers

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UL 4703	Photovoltaic Wire

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UL 6703	Connectors for Use in Photovoltaic Systems

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UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

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UL 8703	Concentrator Photovoltaic Modules and Assemblies

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UL 9703	Distributed Generation Wiring Harnesses

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UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements For Construction

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UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements For Testing

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UL 62109	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
604	UL 1	Flexible Metal Conduit

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UL 4	Armored Cable

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UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings
UL 5B	Strut-Type Channel Raceways and Fittings
UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits
UL 62	Flexible Cords and Cables
UL 183	Manufactured Wiring Systems
UL 209	Cellular Metal Floor Raceways and Fittings
UL 360	Liquid-Tight Flexible Metal Conduit
UL 797	Electrical Metallic Tubing — Steel
UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel
UL 857	Busways
UL 1569	Metal-Clad Cables
UL 2024	Cable Routing Assemblies and Communications Raceways
UL 962	Household and Commercial Furnishings
UL 1286	Office Furnishings Systems
UL 1310	Class 2 Power Units
UL 2999	Individual Commercial Office Furnishings
UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
610	UL 62	Flexible Cords and Cables

	UL 2273	Festoon Cable
620	UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 98	Enclosed and Dead-Front Switches

UL 104	Elevator Door Locking Devices and Contacts

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1310	Class 2 Power Units

UL 1449	Surge Protective Devices

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 2556	Wire and Cable Test Methods

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
625	UL 62	Flexible Cords And Cables

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UL 1650	Portable Power Cable

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UL 2202	Electric Vehicle (EV) Charging System Equipment

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UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 1: General Requirements

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UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 2: Particular Requirements for Protection Devices for Use in Charging Systems

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UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles

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UL 2580	Batteries for Use in Electric Vehicles

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UL 2594	Electric Vehicle Supply Equipment

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	UL 9741	Electric Vehicle Power Export Equipment (EVPE)
626	UL 62	Flexible Cords and Cables

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UL 231	Power Outlets

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UL 498	Attachment Plugs and Receptacles

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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UL 817	Cord Sets and Power-Supply Cords

UL 1651	Optical Fiber Cable

	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 13	Power Limited Circuit Cables

UL 62	Flexible Cords and Cables

UL 813	Commercial Audio Equipment

UL 1310	Class 2 Power Units

UL 1419	Professional Video and Audio Equipment

UL 1492	Audio-Video Products and Accessories

UL 1711	Amplifiers for Fire Protective Signaling Systems

UL 2269	Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes

UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use

UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 38	Manual Signaling Boxes for Fire Alarm Systems

UL 268	Smoke Detectors for Fire Alarm Systems

UL 444	Communications Cables

UL 464	Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 497B	Protectors for Data Communications and Fire Alarm Circuits

UL 833	Control Units and Accessories for Fire Alarm Systems

UL 864	Control Units and Accessories for Fire Alarm Systems

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits

UL 1449	Surge Protective Devices

UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

UL 1638	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1651	Optical Fiber Cable

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1690	Data-Processing Cable

UL 1778	Uninterruptible Power Systems

UL 2024	Cable Routing Assemblies and Communications Raceways

UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements

UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding

UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors

UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
646	UL 10C	Positive Pressure Fire Tests of Door Assemblies

UL 62	Flexible Cords and Cables

UL 67	Panelboards

UL 98	Enclosed and Dead-Front Switches

UL 305	Panic Hardware

UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 845	Motor Control Centers

UL 869A	Reference Standard for Service Equipment

	UL 891	Switchboards
	UL 924	Emergency Lighting and Power Equipment
	UL 977	Fused Power-Circuit Devices
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1008M	Meter-Mounted Transfer Switches
	UL 1008S	Solid-State Transfer Switches
	UL 1062	Unit Substations
	UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
	UL 1429	Pullout Switches
	UL 1449	Surge Protective Devices
	UL 1655	Community-Antenna Television Cables
	UL 1989	Standby Batteries
	UL 2755	Modular Data Centers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
647	UL 1598	Luminaires
650	UL 1310	Class 2 Power Units

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UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
670	ANSI/CSA-C22.2 No. 19085-1	Woodworking machines — Safety — Part 1: Common requirements

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UL 508	Industrial Control Equipment

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UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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675	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

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	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
680	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 20	General Use Snap-Switches

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UL 62	Flexible Cords and Cables

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires

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UL 467	Grounding and Bonding Equipment

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 676	Underwater Luminaires and Submersible Junction Boxes
UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
UL 943	Ground-Fault Circuit-Interrupters
UL 943C	Special Purpose Ground-Fault Circuit-Interrupters
UL 1004-10	Pool Pump Motors
UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
UL 1241	Junction Boxes for Swimming Pool Luminaires
UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1261	Electric Water Heaters for Pools and Tubs
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 1569	Metal-Clad Cables
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 1795	Hydromassage Bathtubs
UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
UL 2452	Electric Swimming Pool and Spa Cover Operators

UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2995	Lifts for Swimming Pools and Spas

	UL 60335-2-1000	Household and Similar Electrical Appliances: Particular Requirements for Electrically Powered Pool Lifts
682	UL 486D	Sealed Wire Connector Systems

UL 1650	Portable Power Cable

	UL 1838	Low Voltage Landscape Lighting Systems
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

UL 467	Grounding and Bonding Equipment

UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

UL 1569	Metal-Clad Cables

UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

UL 1703	Flat-Plate Photovoltaic Modules and Panels

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

UL 3001	Distributed Energy Generation and Storage Systems

UL 3003	Distributed Generation Cables

UL 3005	Distributed Energy Resource Management Systems

UL 3703	Solar Trackers

UL 3730	Photovoltaic Junction Boxes

UL 3741	Photovoltaic Hazard Control

UL 4703	Photovoltaic Wire

UL 6703	Connectors for Use in Photovoltaic Systems

UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

UL 8703	Concentrator Photovoltaic Modules and Assemblies

UL 8801	Photovoltaic Luminaire Systems

UL 9703	Distributed Generation Wiring Harnesses

UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction

UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing

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UL 62109-1	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements

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UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

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692	UL 2262	Fuel Cell Modules for Use in Portable and Stationary Equipment

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UL 2262A	Borohydride Fuel Cartridges with Integral Fuel Processing for Use with Portable Fuel Cell Power Systems or Similar Equipment

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UL 2265	Fuel Cell Power Units and Fuel Storage Containers for Portable Devices

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UL 2265A	Hand-held or Hand-Transportable Fuel Cell Power Units with Disposable Methanol Fuel Cartridges for use in Original Equipment Manufacturer's Information Technology Equipment

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UL 2265C	Hand-Held or Hand-Transportable Alkaline (Direct Borohydride) Fuel Cell Power Units and Borohydride Fuel Cartridges For Use With Consumer Electronics or Information Technology Equipment

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UL 2266	Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunications Equipment

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UL 2267	Fuel Cell Power Systems for Installation in Industrial Electric Trucks

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694	UL 467	Grounding and Bonding Equipment

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UL 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2227	Flexible Motor Supply Cable and Wind Turbine Tray Cable

UL 2736	Single Pole Separable Interconnecting Cable Connectors for Use with Wind Turbine Generating Systems

UL 4143	Wind Turbine Generator — Life Time Extension (LTE)

UL 6141	Wind Turbines Permitting Entry of Personnel

UL 6142	Wind Turbine Generating Systems — Small

695	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 218	Fire Pump Controllers

UL 448	Centrifugal Stationary Pumps for Fire-Protection Service

UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes

UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 1004-5	Fire Pump Motors

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1569	Metal-Clad Cables

UL 1724	Fire Tests for Electrical Circuit Protective Systems

	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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700	UL 924	Emergency Lighting and Power Equipment

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	UL 1008	Transfer Switch Equipment

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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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	UL 1449	Surge Protective Devices

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	UL 1724	Fire Tests for Electrical Circuit Protective Systems

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	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 2200	Stationary Engine Generator Assemblies
701	UL 924	Emergency Lighting and Power Equipment

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	UL 1008	Transfer Switch Equipment

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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
702	UL 98	Enclosed and Dead-Front Switches

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	UL 1008	Transfer Switch Equipment

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	UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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	UL 1008M	Meter-Mounted Transfer Switches

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	UL 1008S	Solid-State Transfer Switches
705	UL 62	Flexible Cords and Cables

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UL 98	Enclosed and Dead-Front Switches

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

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UL 1429	Pullout Switches

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2200	Stationary Engine Generator Assemblies

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UL 3003	Distributed Generation Cables

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 6142	Small Wind Turbine Systems

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UL 9540	Energy Storage Systems and Equipment

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	UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters
706	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

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UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

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UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

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UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

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UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 489H	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, for Use with Direct Current (DC) Microgrids

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

	UL 9540	Energy Storage Systems and Equipment
708	UL 1	Flexible Metal Conduit

	UL 4	Armored Cable
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
	UL 497A	Secondary Protectors for Communications Circuits
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1008M	Meter-Mounted Transfer Switches
	UL 1008S	Solid-State Transfer Switches
	UL 1569	Metal-Clad Cables
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
710	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
	UL 2200	Stationary Engine Generator Assemblies
	UL 8801	Photovoltaic Luminaire Systems
	UL 9540	Energy Storage Systems and Equipment

UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements

UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

722 UL 13 Standard for Power-Limited Circuit Cables

UL 444	Standard for Safety for Communications Cables

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1651	Optical Fiber Cable

UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts

UL 1685	Standard for Safety for Vertical-Tray Fire-Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables

UL 1724	Fire Tests for Electrical Circuit Protective Systems

UL 2024	Standard for Safety for Communications Cables

UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

UL 2556	Standard for Wire and Cable Test Methods

725 UL 1310 Class 2 Power Units

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UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

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UL 9990	Information and Communication Technology (ICT) Power Cables

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UL 61010-2-201	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-201: Particular Requirements for Control Equipment

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UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
726	UL 1400-1	Fault-Managed Power Systems — Part 1 General Requirements

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UL 1400-2	Fault-Managed Power Systems — Part 2 Requirements for Cables

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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UL 2556	Wire and Cable Test Methods

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728	UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings

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UL 5B	Strut-Type Channel Raceways and Fittings

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UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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	UL 209	Cellular Metal Floor Raceways and Fittings
	UL 467	Grounding and Bonding Equipment
	UL 514A	Metallic Outlet Boxes
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	UL 568	Nonmetallic Cable Tray Systems
	UL 884	Underfloor Raceways and Fittings
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems
	UL 268A	Smoke Detectors for Duct Application
	UL 486C	Splicing Wire Connectors
	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	UL 1425	Cables for Non–Power-Limited Fire-Alarm Circuits
	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 60730-2-14	Automatic Electrical Controls; Part 2: Particular Requirements for Electric Actuators
770	UL 467	Grounding and Bonding Equipment

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UL 568	Nonmetallic Cable Tray Systems

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UL 1651	Optical Fiber Cable

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UL 2024	Optical Fiber and Communication Cable Raceway

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
800	UL 444	Communications Cables

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UL 467	Grounding and Bonding Equipment

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UL 489A	Circuit Breakers for Use in Communication Equipment

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UL 497	Protectors for Paired-Conductor Communications Circuits

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UL 497A	Secondary Protectors for Communications Circuits

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UL 497C	Protectors for Coaxial Communications Circuits

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	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 523	Telephone Service Drop Wire
	UL 568	Nonmetallic Cable Tray Systems
	UL 723	Test for Surface Burning Characteristics of Building Materials
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
	UL 1863	Communication Circuit Accessories
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
805	UL 444	Communications Cables
	UL 497	Protectors for Paired-Conductor Communications Circuits
	UL 497A	Secondary Protectors for Communications Circuits
	UL 497C	Protectors for Coaxial Communications Circuits
	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 523	Telephone Service Drop Wire

UL 719	Nonmetallic-Sheathed Cables

UL 1310	Class 2 Power Units

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1863	Communication Circuit Accessories

UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
810	UL 150	Antenna Rotators

UL 452	Antenna-Discharge Units

UL 467	Grounding and Bonding Equipment

	UL 497E	Protectors for Antenna Lead-In Conductors
820	UL 444	Communications Cables

UL 497E	Protectors for Antenna Lead-In Conductors

	UL 1655	Community-Antenna Television Cables
830	UL 444	Communications Cables

UL 497A	Secondary Protectors for Communications Circuits

	UL 497C	Protectors for Coaxial Communications Circuits
	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
840	UL 444	Communications Cables
	UL 467	Grounding and Bonding Equipment
	UL 498A	Current Taps and Adapters
	UL 1310	Class 2 Power Units
	UL 1651	Optical Fiber Cable
	UL 1863	Communication Circuit Accessories
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 11(A) and 11(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 12(A) and 12(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

Table A.1(b) Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement

Article	**Standard Number**	**Standard Title**
110	UL 969	Marking and Labeling Systems

	UL 9691	Recommended Practice for Nameplates for Use in Electrical Installations
300	UL 635	Insulating Bushings
314	UL 514C	Conduit, Tubing, and Cable Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
320	UL 514A	Metallic Outlet Boxes

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
322	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
324	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
330	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
332	UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
334	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 514B	Conduit, Tubing, and Cable Fittings

UL 651	Schedule 40 and 80 Rigid PVC Conduit

UL 797	Electrical Metallic Tubing — Steel

UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1565	Positioning Devices

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UL 2239	Hardware for the Support of Conduit, Tubing and Cable

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UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

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	UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
335	UL 2250	Instrumentation Tray Cable
337	UL 1565	Positioning Devices

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
344	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
348	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
350	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
352	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
353	UL 635	Insulating Bushings
355	UL 635	Insulating Bushings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
356	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
358	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
362	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
368	UL 857	Busways
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables

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UL 498	Attachment Plugs and Receptacles

	UL 498B	Receptacles with Integral Switching Means
	UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts
	UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 817	Cord Sets and Power-Supply Cords
	UL 1650	Portable Power Cable
	UL 1680	Stage and Lighting Cables
402	UL 66	Fixture Wire
408	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations
	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
424	UL 834	Heating, Water Supply, and Power Boilers — Electric
	UL 1693	Electric Radiant Heating Panels and Heating Panel Sets
	UL 1995	Heating and Cooling Equipment
	UL 1996	Electric Duct Heaters
	UL 60335-1	Safety of Household and Similar Electrical Appliances, Part 1: General Requirements
	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2–40
425	UL 834	Heating, Water Supply, and Power Boilers — Electric
426	UL 1588	Roof and Gutter De-Icing Cable Units
427	UL 515	Electrical Resistance Trace Heating for Commercial Applications

UL 1462	Mobile Home Pipe Heating Cable

	UL 2049	Residential Pipe Heating Cable
430	UL 248-13	Low Voltage Fuses — Part 13: Semiconductor Fuses
445	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
450	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 1561	Dry-Type General Purpose and Power Transformers

	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
460	UL 810	Capacitors

UL 1283	Electromagnetic Interference Filters

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	UL 60384-14	Fixed Capacitors for Use in Electronic Equipment — Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains
470	UL 508	Industrial Control Equipment

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	UL 1283	Electromagnetic Interference Filters
500	ANSI/IEEE C2	National Electrical Safety Code, Section 127A, Coal Handling Areas

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API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations

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API RP 500	Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

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API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

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ASHRAE 15	Safety Standard for Refrigeration Systems.

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ASME B1.20.1	Pipe Threads, General Purpose (Inch)

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IEEE 844.2	Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

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IEEE 60079-30-2	IEEE/IEC International Standard for Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation, and maintenance

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IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

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ISA-12.10	Area Classification in Hazardous (Classified) Dust Locations

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ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 32	Standard for Drycleaning Facilities

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 35	Standard for the Manufacture of Organic Coatings

NFPA 36	Standard for Solvent Extraction Plants

NFPA 45	Standard on Fire Protection for Laboratories Using Chemicals

NFPA 55	Compressed Gases and Cryogenic Fluids Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

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NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

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UL 60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

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UL 120002	Certificate Standard for AEx Equipment for Hazardous (Classified) Locations

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UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

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UL 121303	Guide for Combustible Gas Detection as a Method of Protection

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	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and 22 Hazardous (Classified) Locations
501	UL 62	Flexible Cord and Cable

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	UL 504	Mineral-Insulated, Metal-Sheathed Cable
502	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
503	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

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	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
504	ISA-RP 12.06.01	Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety
505	ANSI/API RP 14FZ	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations

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API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

ASME B1.20.1	Pipe Threads, General Purpose (Inch)

EI 15	Model Code of Safe Practice, Part 15: Area Classification Code for Installations Handling Flammable Fluids

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

ISA-60079-10-1 (12.24.01)	Explosive Atmospheres — Part 10-1: Classification of Areas — Explosive gas atmospheres

ISA-60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

UL 80079-20-1	Explosive Atmospheres — Part 20-1: Material Characteristics for Gas and Vapour Classification — Test Methods and Data

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

UL 121303	Guide for Use of Detectors for Flammable Gases

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
506	ASME B1.20.1	Pipe Threads, General Purpose (Inch)

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

ISA-60079-10-2 (12.10.05)	Explosive Atmospheres — Part 10-2: Classification of Areas — Combustible Dust Atmospheres

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
511	NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

	NFPA 88A	Standard for Parking Structures
512	ICC IFC	International Fire Code

NFPA 1	Fire Code

NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 36	Standard for Solvent Extraction Plants

NFPA 58	Liquefied Petroleum Gas Code

NFPA 70B	Recommended Practice for Electrical Equipment Maintenance

	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
513	NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

	NFPA 409	Standard on Aircraft Hangars
514	NFPA 2	Hydrogen Technologies Code

NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 52	Vehicular Natural Gas Fuel Systems Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

	NFPA 303	Fire Protection Standard for Marinas and Boatyards
515	NFPA 30	Flammable and Combustible Liquids Code
516	NFPA 13	Standard for the Installation of Sprinkler Systems

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 77	Recommended Practice on Static Electricity

NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids

	NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
620	UL 4	Armored Cable

UL 44	Thermoset-Insulated Wires and Cables

UL 66	Fixture Wire

UL 504	Mineral Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1569	Metal Clad Cable
625	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
630	UL 1276	Welding Cable
650	UL 1651	Optical Fiber Cable
660	UL 62	Flexible Cords and Cables

	UL 817	Cord Sets and Power Supply Cords
668	UL 4	Armored Cable

	UL 62	Flexible Cords and Cables
670	UL 2011	Machinery
675	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1263	Irrigation Cable
690	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
691	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
692	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
694	UL 44	Thermoset-Insulated Wires and Cables

UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
700	UL 3001	Distributed Energy Generation and Storage Systems
701	UL 3001	Distributed Energy Generation and Storage Systems
702	UL 3001	Distributed Energy Generation and Storage Systems
705	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
710	UL 3001	Distributed Energy Generation and Storage Systems

UL 3010	Single Site Energy Systems

Statement of Problem and Substantiation for Public Input

Article 490 was renumbered to 495. This is to correct and reflect the new Article number.

Submitter Information Verification

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Committee: NEC-P09

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

Table A.1(a) Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement

Article	Standard Number	Standard Title
110	UL 10C	Positive Pressure Fire Tests of Door Assemblies
	UL 305	Panic Hardware
	UL 486D	Sealed Wire Connector Systems
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
210	UL 498	Attachment Plugs and Receptacles
	UL 935	Fluorescent-Lamp Ballasts
	UL 943	Ground Fault Circuit Interrupters
	UL 1029	High-Intensity-Discharge Lamp Ballast
	UL 1699	Arc-Fault Circuit-Interrupters
	UL 1699A	Outlet Branch Circuit AFCIs
225	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
	UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
230	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 67	Panelboards

UL 98	Enclosed and Dead-Front Switches

UL 218	Fire Pump Controllers

UL 231	Power Outlets

UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

UL 360	Liquid-Tight Flexible Metal Conduit

UL 414	Meter Sockets

UL 486A-486B	Wire Connectors

UL 486C	Splicing Wire Connectors

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 514B	Conduit, Tubing and Cable Fittings

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 845	Motor Control Centers

UL 857	Busways

UL 869A	Reference Standard for Service Equipment

UL 891	Switchboards

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 1740	Robots and Robotic Equipment

UL 1953	Power Distribution Blocks

UL 2011	Machinery

UL 2200	Stationary Engine Generator Assemblies

UL 2416	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

UL 2446	Unitary Boiler Room Systems

UL 2565	Industrial Metalworking and Woodworking Machine Tools

UL 2735	Electric Utility Meters

UL 2745	Meter Socket Adapters for Communications Equipment

UL 2876	Remote Racking Devices for Switchgear and Controlgear

UL 4248-1	Fuseholders — Part 1: General Requirements

UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules

	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
240	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 2: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 489I	Solid State Molded-Case Circuit Breakers

UL 943	Ground-Fault Circuit-Interrupters

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

	UL 4248-1	Fuseholders — Part 1: General Requirements
242	UL 1449	Surge Protective Devices
245	IEEE C37.41	Design Tests for High-Voltage (>1000 V) Fuses and Accessories
245	IEEE C37.42	Specifications for High-Voltage (>1000 V) Fuses and Accessories
250	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

UL 5	Surface Metal Raceways and Fittings

UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 360	Liquid-Tight Flexible Metal Conduit

UL 467	Grounding and Bonding Equipment

UL 486A-486B	Wire Connectors

UL 486C	Splicing Wire Connectors

UL 486D	Sealed Wire Connector Systems

	UL 498	Attachment Plugs and Receptacles
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 514A	Metallic Outlet Boxes
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 797	Electrical Metallic Tubing — Steel
	UL 797A	Electrical Metallic Tubing — Aluminum
	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1569	Metal-Clad Cables
	UL 1652	Flexible Metallic Tubing
300	UL 4	Armored Cable
	UL 44	Thermoset-Insulated Wires and Cables
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 83A	Fluoropolymer Insulated Wire
	UL 263	Fire Tests of Building Construction and Materials
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 746C	Polymeric Materials — Use in Electrical Equipment Evaluations
	UL 1569	Metal-Clad Cable

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 2239	Hardware for Support of Conduit, Tubing and Cable
	UL 2556	Wire and Cable Test Methods
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
310	UL 44	Thermoset-Insulated Wires and Cables
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 83A	Fluoropolymer Insulated Wire
	UL 224	Extruded Insulating Tubing
	UL 1063	Machine-Tool Wires and Cables
	UL 1441	Coated Electrical Sleeving
315	ANSI C119.4	Electric Connectors — Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93ºC and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100ºC
	IEEE 48	IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
	IEEE 386	IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
	IEEE 404	IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV
	UL 4	Armored Cable

	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 1072	Medium Voltage Power Cables
	UL 1569	Metal-Clad Cable
312	UL 50	Enclosures for Electrical Equipment
	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	UL 916	Energy Management Equipment
	UL 2808	Energy Monitoring Equipment
	UL 61010-1 and UL 61010-2-030	Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-030: Particular Requirements for Testing and Measuring Circuits
314	UL 50	Enclosures for Electrical Equipment
	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
	UL 486D	Sealed Wire Connector Systems
	UL 498	Attachment Plugs and Receptacles
	UL 498B	Receptacles with Integral Switching Means
	UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts
	UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

	UL 514A	Metallic Outlet Boxes
	UL 514B	Conduit, Tubing, and Cable Fittings
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UL 62841-3-12	Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery — Safety — Part 3-12: Particular requirements for Transportable Threading Machines

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UL 484	Room Air Conditioners

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UL 508	Industrial Control Equipment

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UL 1973	Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications

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UL 2054	Household and Commercial Batteries

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UL 1008A	Transfer Switch Equipment, Over 1000 Volts

500	FM 121303	Guide for Use of Detectors for Flammable Gases

IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids

NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment

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UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 844	Electric Heaters For Use in Hazardous (Classified) Locations

UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations

UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

UL 1389	Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations

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UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 2225	Cable and Cable Fittings for Use in Hazardous (Classified) Locations

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UL 60079-28	Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation.

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UL 60079-29-1	Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases

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UL 60079-30-1	Explosive Atmospheres — Electrical Resistance Trace Heating — General and Testing Requirements

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UL 60079-33	Explosive Atmospheres — Part 33: Equipment Protection by Special Protection “s”

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UL 121201	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

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UL 121303	Guide for Use of Detectors for Flammable Gases

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UL 122001	General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations

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UL 122701	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids

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501	IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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IEEE 1349	Guide for the Application of Electric Machines in Zone 2 and Class I, Division 2 Hazardous (Classified) Locations

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UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

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UL 121201	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

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UL 122001	General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations

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	UL 122701	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids
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NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment

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UL 674	Electric Motors and Generators for Use in Hazardous (Classified) Locations

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UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 823	Electric Heaters For Use in Hazardous (Classified) Locations

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UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

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UL 1309A	Cable for Mobile Installations

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UL 1836	Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 60079-33	Explosive Atmospheres — Part 33: Equipment Protection by Special Protection “s”

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UL 823	Standard for Electric Heaters For Use in Hazardous (Classified) Locations

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UL 844	Luminaires for Use in Hazardous (Classified) Locations

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UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 60079-30-1	Explosive Atmospheres — Electrical Resistance Trace Heating — General and Testing Requirements

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	UL 121201	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
504	UL 698A	Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations

UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations

	UL 120202	Recommendations for the Preparation, Content, and Organization of Intrinsic Safety Control Drawings
505	FM 121303	Guide for Use of Detectors for Flammable Gases

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IEEE 1349	Guide for the Application of Electric Machines in Zone 2 and Class I, Division 2 Hazardous (Classified) Locations

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UL 60079-28	Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation

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UL 60079-30-1	Explosive Atmospheres — Part 30-1: Electrical Resistance Trace Heating — General and Testing Requirements

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UL 121303	Guide for Use of Detectors for Flammable Gases

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	UL 122701	Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids
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UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

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UL 2225	Cable and Cable Fittings for Use in Hazardous (Classified) Locations

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UL 60079-0	Explosive Atmospheres — Part 0: Equipment — General Requirements

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UL 60079-2	Explosive atmospheres — Part 2: Equipment protection by pressurized enclosure “p”

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UL 60079-11	Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"

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UL 60079-18	Explosive Atmospheres — Part 18: Equipment Protection by Encapsulation “m”

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UL 60079-31	Explosive Atmospheres — Part 31: Equipment Dust Ignition Protection by Enclosure “t”

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UL 62784	Vacuum Cleaners and Dust Extractors Providing Equipment Protection Level Dc for the Collection of Combustible Dusts — Particular Requirements

UL 80079-36	Explosive Atmospheres — Part 36: Non-Electrical Equipment for Explosive Atmospheres — Basic Method and Requirements

UL 80079-37	Explosive Atmospheres — Part 37: Non-Electrical Equipment for Explosive Atmospheres — Non Electrical Type of Protection Constructional Safety “c”, Control of Ignition Source “b“, Liquid Immersion “k”

512	UL 1389	Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations
516	NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids

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517	AAMI ES 60601-1	Medical electrical equipment — Part 1: General requirements for basic safety and essential performance

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UL 5A	Nonmetallic Surface Raceways and Fittings

UL 467	Grounding and Bonding Equipment

UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 1022	Line Isolation Monitors

UL 1047	Isolated Power Systems Equipment

UL 1286	Office Furnishing Systems

UL 2930	Cord-and-Plug-connected Health Care Facility Outlet Assemblies

UL 60601-1	Medical Electrical Equipment — Part 1: General Requirements for Safety

	UL 122701	Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids
518	UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 943	Ground-Fault Circuit-Interrupters

UL 943C	Special Purpose Ground-Fault Circuit-Interrupters

UL 2305	Exhibition Display Units, Fabrication and Installation

	UL 2305A	Convention Center Cord Sets
520	UL 62	Flexible Cords and Cables

UL 334	Theater Lighting Distribution and Control Equipment

UL 1573	Stage and Studio Luminaires and Connector Strips

UL 1640	Portable Power-Distribution Equipment

	UL 1691	Single Pole Locking-Type Separable Connectors
522	UL 13	Power Limited Circuit Cables

UL 1063	Machine-Tool Wires and Cables

	UL 2250	Instrumentation Tray Cable
525	UL 62	Flexible Cords and Cables

UL 817	Cord Sets and Power-Supply Cords

UL 943	Ground-Fault Circuit-Interrupters

UL 943C	Special Purpose Ground-Fault Circuit-Interrupters

	UL 1691	Single Pole Locking-Type Separable Connectors
530	UL 62	Flexible Cords and Cables

UL 1479	Fire Tests of Penetration Firestops

UL 1573	Stage and Studio Luminaires and Connector Strips

UL 1680	Stage and Lighting Cables

UL 1691	Single Pole Locking-Type Separable Connectors

UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
540	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
545	UL 5	Surface Metal Raceways and Fittings

UL 5A	Nonmetallic Surface Raceways and Fittings

UL 5B	Strut-Type Channel Raceways and Fittings

UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

UL 20	General Use Snap Switches

UL 209	Cellular Metal Floor Raceways and Fittings

UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 514A	Metallic Outlet Boxes

UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

	UL 2024	Cable Routing Assemblies and Communications Raceways
547	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 62	Flexible Cords and Cables

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UL 514A	Metallic Outlet Boxes

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 1598	Luminaires

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	UL 2225	Cable and Cable Fittings for Use in Hazardous (Classified) Locations
550	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 83	Thermoplastic-Insulated Wires and Cables

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UL 307A	Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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UL 307B	Gas-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 467	Grounding and Bonding Equipment

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UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 817	Cord Sets and Power-Supply Cords

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1462	Mobile Home Pipe Heating Cable

UL 1598	Luminaires

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 2108	Low-Voltage Lighting Systems

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
551	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 62	Flexible Cords and Cables

UL 231	Power Outlets

UL 234	Low Voltage Lighting Fixtures for use in Recreational Vehicles

UL 360	Liquid-Tight Flexible Metal Conduit

UL 467	Grounding and Bonding Equipment

UL 486C	Splicing Wire Connectors

UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 514A	Metallic Outlet Boxes

UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 514D	Cover Plates for Flush-Mounted Wiring Devices

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 817	Cord Sets and Power-Supply Cords

UL 943	Ground-Fault Circuit-Interrupters

UL 1004-4	Electric Generators

UL 1008	Transfer Switch Equipment

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UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1449	Surge Protective Devices

UL 1598	Luminaires

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UL 2200	Stationary Engine Generator Assemblies

UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 60730-1	Automatic Electrical Controls; Part 1: General Requirements

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552	SAE J1128-2015	Low Voltage Primary Cable, for Types GXL, HDT, and SXL

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UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 62	Flexible Cords and Cables

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UL 67	Panelboards

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UL 231	Power Outlets

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UL 234	Low Voltage Lighting Fixtures for Use in Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 430	Waste Disposers

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UL 467	Grounding and Bonding Equipment

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UL 514A	Metallic Outlet Boxes

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 916	Energy Management Equipment

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UL 943	Ground-Fault Circuit-Interrupters

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UL 1004-4	Electric Generators

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment

UL 1598	Luminaires

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 2108	Low Voltage Lighting Systems

UL 2200	Stationary Engine Generator Assemblies

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
555	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 231	Power Outlets

UL 486D	Sealed Wire Connector Systems

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 676	Underwater Luminaires and Submersible Junction Boxes

UL 943	Ground-Fault Circuit-Interrupters

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1650	Portable Power Cable

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
590	UL 496	Lampholders

UL 514B	Conduit, Tubing, and Cable Fittings

UL 588	Seasonal and Holiday Decorative Products

UL 817	Cord Sets

UL 943	Ground-Fault Circuit-Interrupters

UL 1088	Temporary Lighting Strings

UL 1377	Wire used in Low Voltage Seasonal Lighting Products In Circuits With a Maximum Available Power of 15W

600	UL 1	Flexible Metal Conduit

UL 5	Surface Metal Raceways and Fittings

UL 5A	Nonmetallic Surface Raceways and Fittings

UL 13	Power-Limited Circuit Cables

UL 48	Electric Signs

UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

UL 360	Liquid-Tight Flexible Metal Conduit

UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

UL 814	Gas-Tube-Sign Cable

UL 879	Electric Sign Components

UL 879A	LED Sign and Sign Retrofit Kits

UL 879B	Polymeric Enclosure Systems for the Splice Between Neon Tubing Electrode Leads and GTO Cable, and the GTO Cable Leading to the Splice

UL 943	Ground-Fault Circuit-Interrupters

UL 1310	Class 2 Power Units

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

Ul 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 2161	Neon Transformers and Power Supplies

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

UL 3001	Distributed Energy Generation and Storage Systems

UL 3003	Distributed Generation Cables

	UL 3703	Solar Trackers
	UL 4703	Photovoltaic Wire
	UL 6703	Connectors for Use in Photovoltaic Systems
	UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings
	UL 8703	Concentrator Photovoltaic Modules and Assemblies
	UL 9703	Distributed Generation Wiring Harnesses
	UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements For Construction
	UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements For Testing
	UL 62109	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
604	UL 1	Flexible Metal Conduit
	UL 4	Armored Cable
	UL 5	Surface Metal Raceways and Fittings
	UL 5A	Nonmetallic Surface Raceways and Fittings
	UL 5B	Strut-Type Channel Raceways and Fittings

UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

UL 62	Flexible Cords and Cables

UL 183	Manufactured Wiring Systems

UL 209	Cellular Metal Floor Raceways and Fittings

UL 360	Liquid-Tight Flexible Metal Conduit

UL 797	Electrical Metallic Tubing — Steel

UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

UL 857	Busways

UL 1569	Metal-Clad Cables

	UL 2024	Cable Routing Assemblies and Communications Raceways
605	UL 962	Household and Commercial Furnishings

UL 1286	Office Furnishings Systems

UL 1310	Class 2 Power Units

UL 2999	Individual Commercial Office Furnishings

UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
610	UL 62	Flexible Cords and Cables

	UL 2273	Festoon Cable
620	UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 98	Enclosed and Dead-Front Switches

UL 104	Elevator Door Locking Devices and Contacts

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1310	Class 2 Power Units

UL 1449	Surge Protective Devices

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 2556	Wire and Cable Test Methods

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
625	UL 62	Flexible Cords And Cables

UL 1650	Portable Power Cable

UL 2202	Electric Vehicle (EV) Charging System Equipment

UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 1: General Requirements

UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 2: Particular Requirements for Protection Devices for Use in Charging Systems

UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles

UL 2580	Batteries for Use in Electric Vehicles

UL 2594	Electric Vehicle Supply Equipment

	UL 9741	Electric Vehicle Power Export Equipment (EVPE)
626	UL 62	Flexible Cords and Cables

UL 231	Power Outlets

UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 817	Cord Sets and Power-Supply Cords

UL 1651	Optical Fiber Cable

	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 13	Power Limited Circuit Cables

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UL 62	Flexible Cords and Cables

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UL 813	Commercial Audio Equipment

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UL 1310	Class 2 Power Units

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UL 1419	Professional Video and Audio Equipment

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UL 1492	Audio-Video Products and Accessories

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UL 1711	Amplifiers for Fire Protective Signaling Systems

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UL 2269	Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes

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UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use

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UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 38	Manual Signaling Boxes for Fire Alarm Systems

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UL 268	Smoke Detectors for Fire Alarm Systems

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UL 444	Communications Cables

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UL 464	Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

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UL 497B	Protectors for Data Communications and Fire Alarm Circuits

UL 833	Control Units and Accessories for Fire Alarm Systems

UL 864	Control Units and Accessories for Fire Alarm Systems

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits

UL 1449	Surge Protective Devices

UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

UL 1638	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1651	Optical Fiber Cable

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1690	Data-Processing Cable

UL 1778	Uninterruptible Power Systems

UL 2024	Cable Routing Assemblies and Communications Raceways

UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements

UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding

UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors

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UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
646	UL 10C	Positive Pressure Fire Tests of Door Assemblies

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UL 62	Flexible Cords and Cables

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UL 67	Panelboards

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UL 98	Enclosed and Dead-Front Switches

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UL 305	Panic Hardware

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UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 508	Industrial Control Equipment

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UL 508A	Industrial Control Panels

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UL 845	Motor Control Centers

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UL 869A	Reference Standard for Service Equipment

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UL 891	Switchboards

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UL 924	Emergency Lighting and Power Equipment

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1655	Community-Antenna Television Cables

UL 1989	Standby Batteries

UL 2755	Modular Data Centers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
647	UL 1598	Luminaires
650	UL 1310	Class 2 Power Units

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
670	ANSI/CSA-C22.2 No. 19085-1	Woodworking machines — Safety — Part 1: Common requirements

UL 508	Industrial Control Equipment

UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

675	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
680	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 20	General Use Snap-Switches

UL 62	Flexible Cords and Cables

UL 360	Liquid-Tight Flexible Metal Conduit

UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires

UL 467	Grounding and Bonding Equipment

UL 486D	Sealed Wire Connector Systems

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 676	Underwater Luminaires and Submersible Junction Boxes
UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
UL 943	Ground-Fault Circuit-Interrupters
UL 943C	Special Purpose Ground-Fault Circuit-Interrupters
UL 1004-10	Pool Pump Motors
UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
UL 1241	Junction Boxes for Swimming Pool Luminaires
UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1261	Electric Water Heaters for Pools and Tubs
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 1569	Metal-Clad Cables
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 1795	Hydromassage Bathtubs
UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
UL 2452	Electric Swimming Pool and Spa Cover Operators
UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2995	Lifts for Swimming Pools and Spas

	UL 60335-2-1000	Household and Similar Electrical Appliances: Particular Requirements for Electrically Powered Pool Lifts
682	UL 486D	Sealed Wire Connector Systems

UL 1650	Portable Power Cable

	UL 1838	Low Voltage Landscape Lighting Systems
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

UL 467	Grounding and Bonding Equipment

UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

UL 1569	Metal-Clad Cables

UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

UL 1703	Flat-Plate Photovoltaic Modules and Panels

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

UL 3001	Distributed Energy Generation and Storage Systems

UL 3003	Distributed Generation Cables

UL 3005	Distributed Energy Resource Management Systems

UL 3703	Solar Trackers

UL 3730	Photovoltaic Junction Boxes

UL 3741	Photovoltaic Hazard Control

UL 4703	Photovoltaic Wire

UL 6703	Connectors for Use in Photovoltaic Systems

UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

UL 8703	Concentrator Photovoltaic Modules and Assemblies

UL 8801	Photovoltaic Luminaire Systems

UL 9703	Distributed Generation Wiring Harnesses

UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction

UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing

UL 62109-1	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements

UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

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692	UL 2262	Fuel Cell Modules for Use in Portable and Stationary Equipment

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UL 2262A	Borohydride Fuel Cartridges with Integral Fuel Processing for Use with Portable Fuel Cell Power Systems or Similar Equipment

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UL 2265	Fuel Cell Power Units and Fuel Storage Containers for Portable Devices

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UL 2265A	Hand-held or Hand-Transportable Fuel Cell Power Units with Disposable Methanol Fuel Cartridges for use in Original Equipment Manufacturer's Information Technology Equipment

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UL 2265C	Hand-Held or Hand-Transportable Alkaline (Direct Borohydride) Fuel Cell Power Units and Borohydride Fuel Cartridges For Use With Consumer Electronics or Information Technology Equipment

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UL 2266	Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunications Equipment

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UL 2267	Fuel Cell Power Systems for Installation in Industrial Electric Trucks

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694	UL 467	Grounding and Bonding Equipment

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UL 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2227	Flexible Motor Supply Cable and Wind Turbine Tray Cable

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UL 2736	Single Pole Separable Interconnecting Cable Connectors for Use with Wind Turbine Generating Systems

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UL 4143	Wind Turbine Generator — Life Time Extension (LTE)

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 6142	Wind Turbine Generating Systems — Small

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695	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 218	Fire Pump Controllers

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UL 448	Centrifugal Stationary Pumps for Fire-Protection Service

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UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes

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UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 1004-5	Fire Pump Motors

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1569	Metal-Clad Cables

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UL 1724	Fire Tests for Electrical Circuit Protective Systems

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
700	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1449	Surge Protective Devices
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2200	Stationary Engine Generator Assemblies
701	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
702	UL 98	Enclosed and Dead-Front Switches
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1008M	Meter-Mounted Transfer Switches
	UL 1008S	Solid-State Transfer Switches
705	UL 62	Flexible Cords and Cables

UL 98	Enclosed and Dead-Front Switches

UL 486D	Sealed Wire Connector Systems

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1429	Pullout Switches

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 2200	Stationary Engine Generator Assemblies

UL 3003	Distributed Generation Cables

UL 6141	Wind Turbines Permitting Entry of Personnel

UL 6142	Small Wind Turbine Systems

UL 9540	Energy Storage Systems and Equipment

	UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters
706	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 489H	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, for Use with Direct Current (DC) Microgrids

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

	UL 9540	Energy Storage Systems and Equipment
708	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
	UL 497A	Secondary Protectors for Communications Circuits
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1008M	Meter-Mounted Transfer Switches
	UL 1008S	Solid-State Transfer Switches
	UL 1569	Metal-Clad Cables
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
710	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
	UL 2200	Stationary Engine Generator Assemblies
	UL 8801	Photovoltaic Luminaire Systems
	UL 9540	Energy Storage Systems and Equipment
	UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements
	UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

722	UL 13	Standard for Power-Limited Circuit Cables
	UL 444	Standard for Safety for Communications Cables
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	UL 1651	Optical Fiber Cable
	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts
	UL 1685	Standard for Safety for Vertical-Tray Fire-Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2024	Standard for Safety for Communications Cables
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2556	Standard for Wire and Cable Test Methods
725	UL 1310	Class 2 Power Units
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

UL 9990	Information and Communication Technology (ICT) Power Cables

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UL 61010-2-201	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-201: Particular Requirements for Control Equipment

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UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
726	UL 1400-1	Fault-Managed Power Systems — Part 1 General Requirements

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UL 1400-2	Fault-Managed Power Systems — Part 2 Requirements for Cables

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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UL 2556	Wire and Cable Test Methods

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728	UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings

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UL 5B	Strut-Type Channel Raceways and Fittings

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UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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UL 209	Cellular Metal Floor Raceways and Fittings

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UL 467	Grounding and Bonding Equipment

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UL 514A	Metallic Outlet Boxes

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 568	Nonmetallic Cable Tray Systems

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UL 884	Underfloor Raceways and Fittings

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UL 1724	Fire Tests for Electrical Circuit Protective Systems

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UL 2024	Cable Routing Assemblies and Communications Raceways

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	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems

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UL 268A	Smoke Detectors for Duct Application

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UL 486C	Splicing Wire Connectors

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UL 497B	Protectors for Data Communication and Fire Alarm Circuits

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UL 1424	Cables for Power-Limited Fire-Alarm Circuits

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UL 1425	Cables for Non–Power-Limited Fire-Alarm Circuits

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UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

	UL 60730-2-14	Automatic Electrical Controls; Part 2: Particular Requirements for Electric Actuators
770	UL 467	Grounding and Bonding Equipment

UL 568	Nonmetallic Cable Tray Systems

UL 1651	Optical Fiber Cable

UL 2024	Optical Fiber and Communication Cable Raceway

UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
800	UL 444	Communications Cables

UL 467	Grounding and Bonding Equipment

UL 489A	Circuit Breakers for Use in Communication Equipment

UL 497	Protectors for Paired-Conductor Communications Circuits

UL 497A	Secondary Protectors for Communications Circuits

UL 497C	Protectors for Coaxial Communications Circuits

UL 497E	Protectors for Antenna Lead-In Conductors

UL 523	Telephone Service Drop Wire

UL 568	Nonmetallic Cable Tray Systems

UL 723	Test for Surface Burning Characteristics of Building Materials

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1863	Communication Circuit Accessories

UL 2024	Cable Routing Assemblies and Communications Raceways

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
805	UL 444	Communications Cables

UL 497	Protectors for Paired-Conductor Communications Circuits

UL 497A	Secondary Protectors for Communications Circuits

UL 497C	Protectors for Coaxial Communications Circuits

UL 497E	Protectors for Antenna Lead-In Conductors

UL 523	Telephone Service Drop Wire

UL 719	Nonmetallic-Sheathed Cables

UL 1310	Class 2 Power Units

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1863	Communication Circuit Accessories

UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

UL 62275	Cable Management Systems — Cable Ties for Electrical Installation

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
810	UL 150	Antenna Rotators

UL 452	Antenna-Discharge Units

UL 467	Grounding and Bonding Equipment

	UL 497E	Protectors for Antenna Lead-In Conductors
820	UL 444	Communications Cables

UL 497E	Protectors for Antenna Lead-In Conductors

	UL 1655	Community-Antenna Television Cables
830	UL 444	Communications Cables

UL 497A	Secondary Protectors for Communications Circuits

UL 497C	Protectors for Coaxial Communications Circuits

UL 497E	Protectors for Antenna Lead-In Conductors

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
840	UL 444	Communications Cables

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UL 467	Grounding and Bonding Equipment

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UL 498A	Current Taps and Adapters

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UL 1310	Class 2 Power Units

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UL 1651	Optical Fiber Cable

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UL 1863	Communication Circuit Accessories

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UL 2024	Cable Routing Assemblies and Communications Raceways

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 11(A) and 11(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 12(A) and 12(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

Table A.1(b) Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement

Article	**Standard Number**	**Standard Title**
110	UL 969	Marking and Labeling Systems

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	UL 9691	Recommended Practice for Nameplates for Use in Electrical Installations
300	UL 635	Insulating Bushings
314	UL 514C	Conduit, Tubing, and Cable Fittings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
320	UL 514A	Metallic Outlet Boxes

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
322	UL 5	Surface Metal Raceways and Fittings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
324	UL 5	Surface Metal Raceways and Fittings

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
330	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
332	UL 1565	Positioning Devices

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	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
334	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 651	Schedule 40 and 80 Rigid PVC Conduit

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UL 797	Electrical Metallic Tubing — Steel

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UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1565	Positioning Devices

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UL 2239	Hardware for the Support of Conduit, Tubing and Cable

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UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
335	UL 2250	Instrumentation Tray Cable
337	UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
344	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
348	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
350	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
352	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
353	UL 635	Insulating Bushings
355	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
356	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
358	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
362	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
368	UL 857	Busways
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables

UL 498	Attachment Plugs and Receptacles

UL 498B	Receptacles with Integral Switching Means

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 514B	Conduit, Tubing, and Cable Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 1650	Portable Power Cable

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	UL 1680	Stage and Lighting Cables
402	UL 66	Fixture Wire
408	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
424	UL 834	Heating, Water Supply, and Power Boilers — Electric

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UL 1693	Electric Radiant Heating Panels and Heating Panel Sets

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UL 1995	Heating and Cooling Equipment

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UL 1996	Electric Duct Heaters

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UL 60335-1	Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

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	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2–40
425	UL 834	Heating, Water Supply, and Power Boilers — Electric
426	UL 1588	Roof and Gutter De-Icing Cable Units
427	UL 515	Electrical Resistance Trace Heating for Commercial Applications

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UL 1462	Mobile Home Pipe Heating Cable

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	UL 2049	Residential Pipe Heating Cable
430	UL 248-13	Low Voltage Fuses — Part 13: Semiconductor Fuses
445	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
450	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

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UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

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UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

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UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

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UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

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UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

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UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

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UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

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UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 1561	Dry-Type General Purpose and Power Transformers

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	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
460	UL 810	Capacitors

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UL 1283	Electromagnetic Interference Filters

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	UL 60384-14	Fixed Capacitors for Use in Electronic Equipment — Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains
470	UL 508	Industrial Control Equipment

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	UL 1283	Electromagnetic Interference Filters
500	ANSI/IEEE C2	National Electrical Safety Code, Section 127A, Coal Handling Areas

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API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations

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API RP 500	Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

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API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

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ASHRAE 15	Safety Standard for Refrigeration Systems.

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ASME B1.20.1	Pipe Threads, General Purpose (Inch)

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IEEE 844.2	Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

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IEEE 60079-30-2	IEEE/IEC International Standard for Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation, and maintenance

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IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

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ISA-12.10	Area Classification in Hazardous (Classified) Dust Locations

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ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

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ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 32	Standard for Drycleaning Facilities

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 35	Standard for the Manufacture of Organic Coatings

NFPA 36	Standard for Solvent Extraction Plants

NFPA 45	Standard on Fire Protection for Laboratories Using Chemicals

NFPA 55	Compressed Gases and Cryogenic Fluids Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

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NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

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UL 60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

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UL 120002	Certificate Standard for AEx Equipment for Hazardous (Classified) Locations

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UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

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UL 121303	Guide for Combustible Gas Detection as a Method of Protection

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	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and 22 Hazardous (Classified) Locations
501	UL 62	Flexible Cord and Cable

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	UL 504	Mineral-Insulated, Metal-Sheathed Cable
502	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
503	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

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	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
504	ISA-RP 12.06.01	Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety
505	ANSI/API RP 14FZ	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations

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API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

ASME B1.20.1	Pipe Threads, General Purpose (Inch)

EI 15	Model Code of Safe Practice, Part 15: Area Classification Code for Installations Handling Flammable Fluids

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

ISA-60079-10-1 (12.24.01)	Explosive Atmospheres — Part 10-1: Classification of Areas — Explosive gas atmospheres

ISA-60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

UL 80079-20-1	Explosive Atmospheres — Part 20-1: Material Characteristics for Gas and Vapour Classification — Test Methods and Data

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

UL 121303	Guide for Use of Detectors for Flammable Gases

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
506	ASME B1.20.1	Pipe Threads, General Purpose (Inch)

IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

ISA-60079-10-2 (12.10.05)	Explosive Atmospheres — Part 10-2: Classification of Areas — Combustible Dust Atmospheres

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
511	NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

	NFPA 88A	Standard for Parking Structures
512	ICC IFC	International Fire Code

NFPA 1	Fire Code

NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 36	Standard for Solvent Extraction Plants

NFPA 58	Liquefied Petroleum Gas Code

NFPA 70B	Recommended Practice for Electrical Equipment Maintenance

	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
513	NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

	NFPA 409	Standard on Aircraft Hangars
514	NFPA 2	Hydrogen Technologies Code

NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 52	Vehicular Natural Gas Fuel Systems Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

	NFPA 303	Fire Protection Standard for Marinas and Boatyards
515	NFPA 30	Flammable and Combustible Liquids Code
516	NFPA 13	Standard for the Installation of Sprinkler Systems

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 77	Recommended Practice on Static Electricity

NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids

	NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
620	UL 4	Armored Cable

UL 44	Thermoset-Insulated Wires and Cables

UL 66	Fixture Wire

UL 504	Mineral Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1569	Metal Clad Cable
625	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
630	UL 1276	Welding Cable
650	UL 1651	Optical Fiber Cable
660	UL 62	Flexible Cords and Cables

	UL 817	Cord Sets and Power Supply Cords
668	UL 4	Armored Cable

	UL 62	Flexible Cords and Cables
670	UL 2011	Machinery
675	UL 44	Thermoset-Insulated Wires and Cables

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UL 83	Thermoplastic-Insulated Wires and Cables

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UL 83A	Fluoropolymer Insulated Wire

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UL 1063	Machine-Tool Wires and Cables

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	UL 1263	Irrigation Cable
690	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
691	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
692	UL 44	Thermoset-Insulated Wires and Cables

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UL 83	Thermoplastic-Insulated Wires and Cables

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UL 83A	Fluoropolymer Insulated Wire

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UL 1063	Machine-Tool Wires and Cables

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UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
694	UL 44	Thermoset-Insulated Wires and Cables

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UL 62	Flexible Cords and Cables

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UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire	

UL 1063	Machine-Tool Wires and Cables	

UL 3001	Distributed Energy Generation and Storage Systems	

	UL 3010	Single Site Energy Systems
700	UL 3001	Distributed Energy Generation and Storage Systems
701	UL 3001	Distributed Energy Generation and Storage Systems
702	UL 3001	Distributed Energy Generation and Storage Systems
705	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
710	UL 3001	Distributed Energy Generation and Storage Systems

UL 3010	Single Site Energy Systems	

Statement of Problem and Substantiation for Public Input

The standards for high voltage fuses are being added to Annex A.1(a) in relation to the proposed listing requirement for Article 245.

IEEE C37.41 Design Tests for High-Voltage (>1000 V) Fuses and Accessories
IEEE C37.42 Specifications for High-Voltage (>1000 V) Fuses and Accessories

Note: This PI is intended to only add the above standards to Table A.1(a). Any other changes presented are due to TerraView not correctly interpreting the changes.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4044-NFPA 70-2023 [Section No. 245.2]	Listing requirement for HV fuses in Article 245
Public Input No. 4044-NFPA 70-2023 [Section No. 245.2]	

Submitter Information Verification

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Submittal Date:	Wed Sep 06 14:54:56 EDT 2023
Committee:	NEC-P09

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

Table A.1(a) Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement

Article	Standard Number	Standard Title
110	UL 10C	Positive Pressure Fire Tests of Door Assemblies
	UL 305	Panic Hardware
	UL 486D	Sealed Wire Connector Systems
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
210	UL 498	Attachment Plugs and Receptacles
	UL 935	Fluorescent-Lamp Ballasts
	UL 943	Ground Fault Circuit Interrupters
	UL 1029	High-Intensity-Discharge Lamp Ballast
	UL 1699	Arc-Fault Circuit-Interrupters
	UL 1699A	Outlet Branch Circuit AFCIs
225	UL 6	Electrical Rigid Metal Conduit — Steel
	UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel
	UL 360	Liquid-Tight Flexible Metal Conduit
	UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
	UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
230	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

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UL 67	Panelboards

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UL 98	Enclosed and Dead-Front Switches

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UL 218	Fire Pump Controllers

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UL 231	Power Outlets

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UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 414	Meter Sockets

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UL 486A-486B	Wire Connectors

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UL 486C	Splicing Wire Connectors

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 508	Industrial Control Equipment

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UL 508A	Industrial Control Panels

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UL 514B	Conduit, Tubing and Cable Fittings

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 845	Motor Control Centers

UL 857	Busways

UL 869A	Reference Standard for Service Equipment

UL 891	Switchboards

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1558	Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

UL 1740	Robots and Robotic Equipment

UL 1953	Power Distribution Blocks

UL 2011	Machinery

UL 2200	Stationary Engine Generator Assemblies

UL 2416	Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

UL 2446	Unitary Boiler Room Systems

UL 2565	Industrial Metalworking and Woodworking Machine Tools

UL 2735	Electric Utility Meters

UL 2745	Meter Socket Adapters for Communications Equipment

UL 2876	Remote Racking Devices for Switchgear and Controlgear

UL 4248-1	Fuseholders — Part 1: General Requirements

UL 60947-1	Low-Voltage Switchgear and Controlgear — Part 1: General Rules

	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy
240	UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 2: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-11	Low-Voltage Fuses — Part 11: Plug Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 489I	Solid State Molded-Case Circuit Breakers

UL 943	Ground-Fault Circuit-Interrupters

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

	UL 4248-1	Fuseholders — Part 1: General Requirements
	UL 1449	Surge Protective Devices
242	IEEE C37.09	Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
245 245	NEMA C37.54	Indoor Alternating Current High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear — Conformance Test Procedures
250	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

UL 5	Surface Metal Raceways and Fittings

UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 360	Liquid-Tight Flexible Metal Conduit

UL 467	Grounding and Bonding Equipment

UL 486A-486B	Wire Connectors

UL 486C	Splicing Wire Connectors

UL 486D	Sealed Wire Connector Systems

	UL 498	Attachment Plugs and Receptacles
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 514A	Metallic Outlet Boxes
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 797	Electrical Metallic Tubing — Steel
	UL 797A	Electrical Metallic Tubing — Aluminum
	UL 1242	Electrical Intermediate Metal Conduit — Steel
	UL 1569	Metal-Clad Cables
	UL 1652	Flexible Metallic Tubing
300	UL 4	Armored Cable
	UL 44	Thermoset-Insulated Wires and Cables
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 83A	Fluoropolymer Insulated Wire
	UL 263	Fire Tests of Building Construction and Materials
	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 746C	Polymeric Materials — Use in Electrical Equipment Evaluations

	UL 1569	Metal-Clad Cable

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

	UL 2239	Hardware for Support of Conduit, Tubing and Cable

	UL 2556	Wire and Cable Test Methods

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
310	UL 44	Thermoset-Insulated Wires and Cables

	UL 83	Thermoplastic-Insulated Wires and Cables

	UL 83A	Fluoropolymer Insulated Wire

	UL 224	Extruded Insulating Tubing

	UL 1063	Machine-Tool Wires and Cables

	UL 1441	Coated Electrical Sleeving
315	ANSI C119.4	Electric Connectors — Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93ºC and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100ºC

IEEE 48	IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV

IEEE 386	IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

IEEE 404	IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV

	UL 4	Armored Cable

	UL 504	Mineral-Insulated, Metal-Sheathed Cable

	UL 1072	Medium Voltage Power Cables

	UL 1569	Metal-Clad Cable
312	UL 50	Enclosures for Electrical Equipment

	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

	UL 916	Energy Management Equipment

	UL 2808	Energy Monitoring Equipment

	UL 61010-1 and UL 61010-2-030	Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-030: Particular Requirements for Testing and Measuring Circuits
314	UL 50	Enclosures for Electrical Equipment

	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

	UL 486D	Sealed Wire Connector Systems

	UL 498	Attachment Plugs and Receptacles

	UL 498B	Receptacles with Integral Switching Means

	UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

	UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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	UL 514A	Metallic Outlet Boxes

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	UL 514B	Conduit, Tubing, and Cable Fittings

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	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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	UL 514D	Cover Plates for Flush-Mounted Wiring Devices

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	UL 1953	Power Distribution Blocks
320	UL 4	Armored Cable

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	UL 44	Thermoset-Insulated Wires and Cables

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	UL 83	Thermoplastic-Insulated Wires and Cables

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	UL 83A	Fluoropolymer Insulated Wire

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	UL 514B	Conduit, Tubing, and Cable Fittings

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	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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	UL 1063	Machine-Tool Wires and Cables

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	UL 1565	Positioning Devices

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	UL 2239	Hardware for the Support of Conduit, Tubing, and Cable

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322	UL 486A-486B	Wire Connectors

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	UL 498	Attachment Plugs and Receptacles
	UL 514A	Metallic Outlet Boxes
324	UL 486A-486B	Wire Connectors
	UL 498	Attachment Plugs and Receptacles
330	UL 44	Thermoset-Insulated Wires and Cables
	UL 66	Fixture Wire
	UL 83	Thermoplastic-Insulated Wires and Cables
	UL 83A	Fluoropolymer Insulated Wire
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 1063	Machine-Tool Wires and Cables
	UL 1565	Positioning Devices
	UL 1569	Metal-Clad Cables
	UL 2225	Cables and Cable-Fittings For Use In Hazardous (Classified) Locations
	UL 2239	Hardware for the Support of Conduit, Tubing, and Cable
332	UL 504	Mineral-Insulated, Metal-Sheathed Cable
	UL 514B	Conduit, Tubing and Cable Fittings
334	UL 719	Nonmetallic-Sheathed Cables
	UL 2256	Nonmetallic Sheathed Cable Interconnects

	UL 62275	Cable Management Systems — Cable Ties for Electrical Installations
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	UL 62841-4-1000	Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery — Safety — Part 4-1000: Particular Requirements For Utility Machines
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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 541	Refrigerated Vending Machines

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	UL 1004-4	Electric Generators
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450	UL 10C	Positive Pressure Fire Tests of Door Assemblies
	UL 305	Panic Hardware
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480	UL 10C	Positive Pressure Fire Tests of Door Assemblies
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	UL 347A	Medium Voltage Power Conversion Equipment
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UL 347C	Medium Voltage Solid State Resistive Load Controllers, Up to 15kV

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UL 1008A	Transfer Switch Equipment, Over 1000 Volts

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500	FM 121303	Guide for Use of Detectors for Flammable Gases

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IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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IEEE 1349	Guide for the Application of Electric Machines in Zone 2 and Class I, Division 2 Hazardous (Classified) Locations

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NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

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NFPA 34	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids

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NFPA 496	Standard for Purged and Pressurized Enclosures for Electrical Equipment

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UL 674	Electric Motors and Generators for Use in Hazardous (Classified) Locations

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UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

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UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 823	Electric Heaters For Use in Hazardous (Classified) Locations

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UL 844	Electric Heaters For Use in Hazardous (Classified) Locations

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UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations

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UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

UL 1389	Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations

UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 60079-29-1	Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases

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UL 60079-30-1	Explosive Atmospheres — Electrical Resistance Trace Heating — General and Testing Requirements

UL 60079-33	Explosive Atmospheres — Part 33: Equipment Protection by Special Protection "s"

UL 121201	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

UL 121303	Guide for Use of Detectors for Flammable Gases

UL 122001	General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations

UL 122701	Requirements for Process Sealing Between Electrical Systems and Potentially Flammable or Combustible Process Fluids

501	IEEE 844.1	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — General, Testing, Marking, and Documentation Requirements

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UL 823	Standard for Electric Heaters For Use in Hazardous (Classified) Locations

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UL 1072	Medium-Voltage Power Cables

UL 1203	Explosionproof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members

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UL 60079-30-1	Part 30-1: Electrical Resistance Trace Heating — General and Testing Requirements

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UL 60079-33	Explosive Atmospheres — Part 33: Equipment Protection by Special Protection “s”

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UL 121201	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

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UL 674	Electric Motors and Generators for Use in Hazardous (Classified) Locations

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UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations

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UL 60079-28	Part 30-1: Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation

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UL 80079-37	Explosive Atmospheres — Part 37: Non-Electrical Equipment for Explosive Atmospheres — Non Electrical Type of Protection Constructional Safety “c”, Control of Ignition Source “b“, Liquid Immersion “k”

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512	UL 1389	Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations
516	NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

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	UL 943C	Special Purpose Ground-Fault Circuit-Interrupters

	UL 2305	Exhibition Display Units, Fabrication and Installation

	UL 2305A	Convention Center Cord Sets
520	UL 62	Flexible Cords and Cables

	UL 334	Theater Lighting Distribution and Control Equipment

	UL 1573	Stage and Studio Luminaires and Connector Strips

	UL 1640	Portable Power-Distribution Equipment

	UL 1691	Single Pole Locking-Type Separable Connectors
522	UL 13	Power Limited Circuit Cables

	UL 1063	Machine-Tool Wires and Cables

	UL 2250	Instrumentation Tray Cable
525	UL 62	Flexible Cords and Cables

	UL 817	Cord Sets and Power-Supply Cords

	UL 943	Ground-Fault Circuit-Interrupters

	UL 943C	Special Purpose Ground-Fault Circuit-Interrupters

	UL 1691	Single Pole Locking-Type Separable Connectors
530	UL 62	Flexible Cords and Cables

	UL 1479	Fire Tests of Penetration Firestops

	UL 1573	Stage and Studio Luminaires and Connector Strips

UL 1680	Stage and Lighting Cables

UL 1691	Single Pole Locking-Type Separable Connectors

UL 1836	Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations

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UL 20	General Use Snap Switches

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UL 514A	Metallic Outlet Boxes

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550	UL 6	Electrical Rigid Metal Conduit — Steel

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UL 307A	Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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UL 234	Low Voltage Lighting Fixtures for use in Recreational Vehicles

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UL 360	Liquid-Tight Flexible Metal Conduit

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UL 467	Grounding and Bonding Equipment

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UL 486C	Splicing Wire Connectors

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UL 498	Attachment Plugs and Receptacles

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UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

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UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

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UL 514A	Metallic Outlet Boxes

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UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

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UL 514D	Cover Plates for Flush-Mounted Wiring Devices

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UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

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UL 817	Cord Sets and Power-Supply Cords

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UL 943	Ground-Fault Circuit-Interrupters

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UL 1004-4	Electric Generators

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UL 1008	Transfer Switch Equipment

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UL 1008M	Transfer Switch Equipment, Meter Mounted

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UL 1008S	Solid-State Transfer Switches

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UL 1242	Electrical Intermediate Metal Conduit — Steel

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UL 1660	Liquid-Tight Flexible Nonmetallic Conduit

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UL 2200	Stationary Engine Generator Assemblies

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	UL 60730-2-9	Automatic Electrical Controls; Part 2: Particular Requirements for Temperature Sensing Controls
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UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations
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UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment

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UL 2108	Low Voltage Lighting Systems

UL 2200	Stationary Engine Generator Assemblies

UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
555 UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 231	Power Outlets

UL 486D	Sealed Wire Connector Systems

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 676	Underwater Luminaires and Submersible Junction Boxes

UL 943	Ground-Fault Circuit-Interrupters

UL 1053	Ground-Fault Sensing and Relaying Equipment

UL 1650	Portable Power Cable

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UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems
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UL 879A	LED Sign and Sign Retrofit Kits
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UL 5	Surface Metal Raceways and Fittings

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UL 5A	Nonmetallic Surface Raceways and Fittings
UL 5B	Strut-Type Channel Raceways and Fittings
UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits
UL 62	Flexible Cords and Cables
UL 183	Manufactured Wiring Systems
UL 209	Cellular Metal Floor Raceways and Fittings
UL 360	Liquid-Tight Flexible Metal Conduit
UL 797	Electrical Metallic Tubing — Steel
UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel
UL 857	Busways
UL 1569	Metal-Clad Cables
UL 2024	Cable Routing Assemblies and Communications Raceways
605 UL 962	Household and Commercial Furnishings
UL 1286	Office Furnishings Systems
UL 1310	Class 2 Power Units
UL 2999	Individual Commercial Office Furnishings
UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
610	UL 62	Flexible Cords and Cables

	UL 2273	Festoon Cable
620	UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 98	Enclosed and Dead-Front Switches

UL 104	Elevator Door Locking Devices and Contacts

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1310	Class 2 Power Units

UL 1449	Surge Protective Devices

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 2556	Wire and Cable Test Methods

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
625	UL 62	Flexible Cords And Cables

UL 1650	Portable Power Cable

UL 2202	Electric Vehicle (EV) Charging System Equipment

UL 2231-1	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 1: General Requirements

UL 2231-2	Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits — Part 2: Particular Requirements for Protection Devices for Use in Charging Systems

UL 2251	Plugs, Receptacles and Couplers for Electrical Vehicles

UL 2580	Batteries for Use in Electric Vehicles

UL 2594	Electric Vehicle Supply Equipment

	UL 9741	Electric Vehicle Power Export Equipment (EVPE)
626	UL 62	Flexible Cords and Cables

UL 231	Power Outlets

UL 498	Attachment Plugs and Receptacles

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 498F	Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts

UL 817	Cord Sets and Power-Supply Cords

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UL 1651	Optical Fiber Cable

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	UL 1686	Pin and Sleeve Configurations
630	UL 551	Transformer-Type Arc-Welding Machines
640	UL 13	Power Limited Circuit Cables

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UL 62	Flexible Cords and Cables

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UL 813	Commercial Audio Equipment

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UL 1310	Class 2 Power Units

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UL 1419	Professional Video and Audio Equipment

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UL 1492	Audio-Video Products and Accessories

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UL 1711	Amplifiers for Fire Protective Signaling Systems

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UL 2269	Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes

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UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use

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UL 60065	Audio, Video and Similar Electronic Apparatus — Safety Requirements

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
645	UL 38	Manual Signaling Boxes for Fire Alarm Systems

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UL 268	Smoke Detectors for Fire Alarm Systems

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UL 444	Communications Cables

UL 464	Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 497B	Protectors for Data Communications and Fire Alarm Circuits

UL 833	Control Units and Accessories for Fire Alarm Systems

UL 864	Control Units and Accessories for Fire Alarm Systems

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits

UL 1449	Surge Protective Devices

UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

UL 1638	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1651	Optical Fiber Cable

UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

UL 1690	Data-Processing Cable

UL 1778	Uninterruptible Power Systems

UL 2024	Cable Routing Assemblies and Communications Raceways

UL 60950-1	Information Technology Equipment Safety — Part 1: General Requirements

UL 60950-21	Information Technology Equipment Safety — Part 21: Remote Power Feeding

UL 60950-22	Information Technology Equipment Safety — Part 22: Equipment to be Installed Outdoors

UL 60950-23	Information Technology Equipment Safety — Part 23: Large Data Storage Equipment

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
646	UL 10C	Positive Pressure Fire Tests of Door Assemblies

UL 62	Flexible Cords and Cables

UL 67	Panelboards

UL 98	Enclosed and Dead-Front Switches

UL 305	Panic Hardware

UL 347	Medium-Voltage AC Contactors, Controllers, and Control Centers

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 508	Industrial Control Equipment

UL 508A	Industrial Control Panels

UL 845	Motor Control Centers

UL 869A	Reference Standard for Service Equipment

UL 891	Switchboards

UL 924	Emergency Lighting and Power Equipment

UL 977	Fused Power-Circuit Devices

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1062	Unit Substations

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1429	Pullout Switches

UL 1449	Surge Protective Devices

UL 1655	Community-Antenna Television Cables

UL 1989	Standby Batteries

UL 2755	Modular Data Centers

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
647	UL 1598	Luminaires
650	UL 1310	Class 2 Power Units

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords	

	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
670	ANSI/CSA-C22.2 No. 19085-1	Woodworking machines — Safety — Part 1: Common requirements

UL 508	Industrial Control Equipment

UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

675	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
680	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 20	General Use Snap-Switches

UL 62	Flexible Cords and Cables

UL 360	Liquid-Tight Flexible Metal Conduit

UL 379	Power Units for Fountain, Swimming Pool, and Spa Luminaires

UL 467	Grounding and Bonding Equipment

UL 486D	Sealed Wire Connector Systems

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 676	Underwater Luminaires and Submersible Junction Boxes
UL 676A	Potting Compounds for Swimming Pool, Fountain, and Spa Equipment
UL 943	Ground-Fault Circuit-Interrupters
UL 943C	Special Purpose Ground-Fault Circuit-Interrupters
UL 1004-10	Pool Pump Motors
UL 1081	Swimming Pool Pumps, Filters, and Chlorinators
UL 1241	Junction Boxes for Swimming Pool Luminaires
UL 1242	Electrical Intermediate Metal Conduit — Steel
UL 1261	Electric Water Heaters for Pools and Tubs
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 1569	Metal-Clad Cables
UL 1660	Liquid-Tight Flexible Nonmetallic Conduit
UL 1795	Hydromassage Bathtubs
UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
UL 2452	Electric Swimming Pool and Spa Cover Operators

UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

UL 2995	Lifts for Swimming Pools and Spas

	UL 60335-2-1000	Household and Similar Electrical Appliances: Particular Requirements for Electrically Powered Pool Lifts
682	UL 486D	Sealed Wire Connector Systems

UL 1650	Portable Power Cable

	UL 1838	Low Voltage Landscape Lighting Systems
690	UL 98B	Enclosed and Dead-Front Switches for Use in Photovoltaic Systems

UL 248-19	Low-Voltage Fuses — Part 19: Photovoltaic Fuses

UL 467	Grounding and Bonding Equipment

UL 489B	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures For Use With Photovoltaic (PV) Systems

UL 508I	Disconnect Switches Intended for Use in Photovoltaic Systems

UL 1569	Metal-Clad Cables

UL 1699B	Photovoltaic (PV) DC Arc-Fault Circuit Protection

UL 1703	Flat-Plate Photovoltaic Modules and Panels

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 2703	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels

UL 3001	Distributed Energy Generation and Storage Systems

UL 3003	Distributed Generation Cables

UL 3005	Distributed Energy Resource Management Systems

UL 3703	Solar Trackers

UL 3730	Photovoltaic Junction Boxes

UL 3741	Photovoltaic Hazard Control

UL 4703	Photovoltaic Wire

UL 6703	Connectors for Use in Photovoltaic Systems

UL 7103	Investigation for Building-Integrated Photovoltaic Roof Coverings

UL 8703	Concentrator Photovoltaic Modules and Assemblies

UL 8801	Photovoltaic Luminaire Systems

UL 9703	Distributed Generation Wiring Harnesses

UL 61730-1	Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction

UL 61730-2	Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing

	UL 62109-1	Power Converters for Use in Photovoltaic Power Systems — Part 1: General Requirements	
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation	
692	UL 2262	Fuel Cell Modules for Use in Portable and Stationary Equipment	
	UL 2262A	Borohydride Fuel Cartridges with Integral Fuel Processing for Use with Portable Fuel Cell Power Systems or Similar Equipment	
	UL 2265	Fuel Cell Power Units and Fuel Storage Containers for Portable Devices	
	UL 2265A	Hand-held or Hand-Transportable Fuel Cell Power Units with Disposable Methanol Fuel Cartridges for use in Original Equipment Manufacturer's Information Technology Equipment	
	UL 2265C	Hand-Held or Hand-Transportable Alkaline (Direct Borohydride) Fuel Cell Power Units and Borohydride Fuel Cartridges For Use With Consumer Electronics or Information Technology Equipment	
	UL 2266	Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunications Equipment	
	UL 2267	Fuel Cell Power Systems for Installation in Industrial Electric Trucks	
694	UL 467	Grounding and Bonding Equipment	
	UL 489C	Molded-Case Circuit Breakers and Molded-Case Switches for Use with Wind Turbines	
	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources	
	UL 2227	Flexible Motor Supply Cable and Wind Turbine Tray Cable	

UL 2736	Single Pole Separable Interconnecting Cable Connectors for Use with Wind Turbine Generating Systems

UL 4143	Wind Turbine Generator — Life Time Extension (LTE)

UL 6141	Wind Turbines Permitting Entry of Personnel

UL 6142	Wind Turbine Generating Systems — Small

695	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 218	Fire Pump Controllers

UL 448	Centrifugal Stationary Pumps for Fire-Protection Service

UL 448B	Residential Fire Pumps Intended for One- and Two-Family Dwellings and Manufactured Homes

UL 448C	Stationary, Rotary-Type, Positive-Displacement Pumps for Fire Protection Service

UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 1004-5	Fire Pump Motors

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1569	Metal-Clad Cables

UL 1724	Fire Tests for Electrical Circuit Protective Systems

	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
700	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1449	Surge Protective Devices
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
	UL 2200	Stationary Engine Generator Assemblies
701	UL 924	Emergency Lighting and Power Equipment
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
702	UL 98	Enclosed and Dead-Front Switches
	UL 1008	Transfer Switch Equipment
	UL 1008A	Transfer Switch Equipment, Over 1000 Volts
	UL 1008M	Meter-Mounted Transfer Switches

	UL 1008S	Solid-State Transfer Switches
705	UL 62	Flexible Cords and Cables

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UL 98	Enclosed and Dead-Front Switches

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UL 486D	Sealed Wire Connector Systems

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UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

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UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

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UL 1429	Pullout Switches

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UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

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UL 2200	Stationary Engine Generator Assemblies

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UL 3003	Distributed Generation Cables

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UL 6141	Wind Turbines Permitting Entry of Personnel

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UL 6142	Small Wind Turbine Systems

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UL 9540	Energy Storage Systems and Equipment

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	UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters
706	UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

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UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

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UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-6	Low-Voltage Fuses — Part 6: Class H Non-Renewable Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 248-10	Low-Voltage Fuses — Part 10: Class L Fuses

UL 248-12	Low-Voltage Fuses — Part 12: Class R Fuses

UL 248-15	Low-Voltage Fuses — Part 15: Class T Fuses

UL 248-17	Low-Voltage Fuses — Part 17: Class CF Fuses

UL 248-18	Low-Voltage Fuses — Part 18: Class CD Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 489H	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, for Use with Direct Current (DC) Microgrids

UL 1066	Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

	UL 9540	Energy Storage Systems and Equipment
708	UL 1	Flexible Metal Conduit

UL 4	Armored Cable

UL 83	Thermoplastic-Insulated Wires and Cables

UL 360	Liquid-Tight Flexible Metal Conduit

UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

UL 497A	Secondary Protectors for Communications Circuits

UL 1008	Transfer Switch Equipment

UL 1008A	Transfer Switch Equipment, Over 1000 Volts

UL 1008M	Meter-Mounted Transfer Switches

UL 1008S	Solid-State Transfer Switches

UL 1569	Metal-Clad Cables

	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
710	UL 1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

UL 2200	Stationary Engine Generator Assemblies

UL 8801	Photovoltaic Luminaire Systems

UL 9540	Energy Storage Systems and Equipment

UL 62109-1	Power Converters for use in Photovoltaic Power Systems — Part 1: General Requirements

UL 62109-2	Power Converters for Use in Photovoltaic Power Systems — Part 2: Particular Requirements for Inverters

722 UL 13 Standard for Power-Limited Circuit Cables

UL 444	Standard for Safety for Communications Cables

UL 1424	Cables for Power-Limited Fire-Alarm Circuits

UL 1651	Optical Fiber Cable

UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts

UL 1685	Standard for Safety for Vertical-Tray Fire-Propagation and Smoke- Release Test for Electrical and Optical-Fiber Cables

UL 1724	Fire Tests for Electrical Circuit Protective Systems

UL 2024	Standard for Safety for Communications Cables

UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

UL 2556	Standard for Wire and Cable Test Methods

725 UL 1310 Class 2 Power Units

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	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers

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	UL 9990	Information and Communication Technology (ICT) Power Cables

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	UL 61010-2-201	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-201: Particular Requirements for Control Equipment

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	UL 61800-5-1	Adjustable Speed Electrical Power Drive Systems — Part 5-1: Safety Requirements — Electrical, Thermal and Energy

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	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
726	UL 1400-1	Fault-Managed Power Systems — Part 1 General Requirements

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	UL 1400-2	Fault-Managed Power Systems — Part 2 Requirements for Cables

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	UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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	UL 2556	Wire and Cable Test Methods

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728	UL 5	Surface Metal Raceways and Fittings

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	UL 5A	Nonmetallic Surface Raceways and Fittings

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	UL 5B	Strut-Type Channel Raceways and Fittings

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	UL 5C	Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits

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	UL 209	Cellular Metal Floor Raceways and Fittings
	UL 467	Grounding and Bonding Equipment
	UL 514A	Metallic Outlet Boxes
	UL 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
	UL 568	Nonmetallic Cable Tray Systems
	UL 884	Underfloor Raceways and Fittings
	UL 1724	Fire Tests for Electrical Circuit Protective Systems
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
760	UL 268	Smoke Detectors for Fire Alarm Signaling Systems
	UL 268A	Smoke Detectors for Duct Application
	UL 486C	Splicing Wire Connectors
	UL 497B	Protectors for Data Communication and Fire Alarm Circuits
	UL 1424	Cables for Power-Limited Fire-Alarm Circuits
	UL 1425	Cables for Non–Power-Limited Fire-Alarm Circuits
	UL 1480	Speakers for Fire Alarm and Signaling Systems, Including Accessories

UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 60730-2-14	Automatic Electrical Controls; Part 2: Particular Requirements for Electric Actuators
770	UL 467	Grounding and Bonding Equipment

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UL 568	Nonmetallic Cable Tray Systems

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UL 1651	Optical Fiber Cable

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UL 2024	Optical Fiber and Communication Cable Raceway

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UL 2196	Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
800	UL 444	Communications Cables

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UL 467	Grounding and Bonding Equipment

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UL 489A	Circuit Breakers for Use in Communication Equipment

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UL 497	Protectors for Paired-Conductor Communications Circuits

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UL 497A	Secondary Protectors for Communications Circuits

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UL 497C	Protectors for Coaxial Communications Circuits

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UL 497E	Protectors for Antenna Lead-In Conductors

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UL 523	Telephone Service Drop Wire

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UL 568	Nonmetallic Cable Tray Systems

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UL 723	Test for Surface Burning Characteristics of Building Materials

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UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

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UL 1666	Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

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UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

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UL 1863	Communication Circuit Accessories

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UL 2024	Cable Routing Assemblies and Communications Raceways

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	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
805	UL 444	Communications Cables

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UL 497	Protectors for Paired-Conductor Communications Circuits

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UL 497A	Secondary Protectors for Communications Circuits

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UL 497C	Protectors for Coaxial Communications Circuits

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UL 497E	Protectors for Antenna Lead-In Conductors

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UL 523	Telephone Service Drop Wire

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	UL 719	Nonmetallic-Sheathed Cables
	UL 1310	Class 2 Power Units
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
	UL 1863	Communication Circuit Accessories
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 62275	Cable Management Systems — Cable Ties for Electrical Installation
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
810	UL 150	Antenna Rotators
	UL 452	Antenna-Discharge Units
	UL 467	Grounding and Bonding Equipment
	UL 497E	Protectors for Antenna Lead-In Conductors
820	UL 444	Communications Cables
	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 1655	Community-Antenna Television Cables
830	UL 444	Communications Cables
	UL 497A	Secondary Protectors for Communications Circuits

	UL 497C	Protectors for Coaxial Communications Circuits
	UL 497E	Protectors for Antenna Lead-In Conductors
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
840	UL 444	Communications Cables
	UL 467	Grounding and Bonding Equipment
	UL 498A	Current Taps and Adapters
	UL 1310	Class 2 Power Units
	UL 1651	Optical Fiber Cable
	UL 1863	Communication Circuit Accessories
	UL 2024	Cable Routing Assemblies and Communications Raceways
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 11(A) and 11(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements
Tables 12(A) and 12(B)	UL 1310	Class 2 Power Units
	UL 1434	Thermistor-Type Devices
	UL 5085-3	Low Voltage Transformers — Part 3: Class 2 and Class 3 Transformers
	UL 62368-1	Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements

Table A.1(b) Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement

Article	**Standard Number**	**Standard Title**
110	UL 969	Marking and Labeling Systems

	UL 9691	Recommended Practice for Nameplates for Use in Electrical Installations
300	UL 635	Insulating Bushings
314	UL 514C	Conduit, Tubing, and Cable Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
320	UL 514A	Metallic Outlet Boxes

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
322	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
324	UL 5	Surface Metal Raceways and Fittings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
330	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
332	UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
334	UL 6	Electrical Rigid Metal Conduit — Steel

UL 6A	Electrical Rigid Metal Conduit — Aluminum, Red Brass and Stainless Steel

UL 514B	Conduit, Tubing, and Cable Fittings

UL 651	Schedule 40 and 80 Rigid PVC Conduit

UL 797	Electrical Metallic Tubing — Steel

UL 797A	Electrical Metallic Tubing — Aluminum and Stainless Steel

UL 1242	Electrical Intermediate Metal Conduit — Steel

UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable

	UL 2420	Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515	Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

	UL 2515A	Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
335	UL 2250	Instrumentation Tray Cable
337	UL 1565	Positioning Devices

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
340	UL 493	Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables
342	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
344	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
348	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
350	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
352	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
353	UL 635	Insulating Bushings
355	UL 635	Insulating Bushings

	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
356	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
358	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
362	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
368	UL 857	Busways
392	UL 568	Nonmetallic Cable Tray Systems
400	UL 62	Flexible Cords and Cables

	UL 498	Attachment Plugs and Receptacles

UL 498B	Receptacles with Integral Switching Means

UL 498D	Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts

UL 498E	Attachment Plugs, Cord Connectors and Receptacles — Enclosure Types for Environmental Protection

UL 514B	Conduit, Tubing, and Cable Fittings

UL 817	Cord Sets and Power-Supply Cords

UL 1650	Portable Power Cable

	UL 1680	Stage and Lighting Cables
402	UL 66	Fixture Wire
408	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

	UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
424	UL 834	Heating, Water Supply, and Power Boilers — Electric

UL 1693	Electric Radiant Heating Panels and Heating Panel Sets

UL 1995	Heating and Cooling Equipment

UL 1996	Electric Duct Heaters

UL 60335-1	Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

	UL 60335-2-40	Household and Similar Electrical Appliances, Part 2–40
425	UL 834	Heating, Water Supply, and Power Boilers — Electric
426	UL 1588	Roof and Gutter De-Icing Cable Units
427	UL 515	Electrical Resistance Trace Heating for Commercial Applications

	UL 1462	Mobile Home Pipe Heating Cable

	UL 2049	Residential Pipe Heating Cable
430	UL 248-13	Low Voltage Fuses — Part 13: Semiconductor Fuses
445	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
450	UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 50E	Enclosures for Electrical Equipment, Environmental Considerations

UL 248-1	Low-Voltage Fuses — Part 1: General Requirements

UL 248-2	Low-Voltage Fuses — Part 2: Class C Fuses

UL 248-3	Low-Voltage Fuses — Part 3: Class CA and CB Fuses

UL 248-4	Low-Voltage Fuses — Part 4: Class CC Fuses

UL 248-5	Low-Voltage Fuses — Part 5: Class G Fuses

UL 248-8	Low-Voltage Fuses — Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses — Part 9: Class K Fuses

UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

UL 1561	Dry-Type General Purpose and Power Transformers

	UL 5085-2	Low Voltage Transformers — Part 2: General Purpose Transformers
460	UL 810	Capacitors

	UL 1283	Electromagnetic Interference Filters

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	UL 60384-14	Fixed Capacitors for Use in Electronic Equipment — Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains
470	UL 508	Industrial Control Equipment

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	UL 1283	Electromagnetic Interference Filters
500	ANSI/IEEE C2	National Electrical Safety Code, Section 127A, Coal Handling Areas

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API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations

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API RP 500	Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

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API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

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ASHRAE 15	Safety Standard for Refrigeration Systems.

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ASME B1.20.1	Pipe Threads, General Purpose (Inch)

_

IEEE 844.2	Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

_

IEEE 60079-30-2	IEEE/IEC International Standard for Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation, and maintenance

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IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems

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ISA-12.10	Area Classification in Hazardous (Classified) Dust Locations

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ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data

ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads

NFPA 30	Flammable and Combustible Liquids Code

NFPA 32	Standard for Drycleaning Facilities

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 35	Standard for the Manufacture of Organic Coatings

NFPA 36	Standard for Solvent Extraction Plants

NFPA 45	Standard on Fire Protection for Laboratories Using Chemicals

NFPA 55	Compressed Gases and Cryogenic Fluids Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

NFPA 77	Recommended Practice on Static Electricity

NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

NFPA 780	Standard for the Installation of Lightning Protection Systems

NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

UL 60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen

UL 120002	Certificate Standard for AEx Equipment for Hazardous (Classified) Locations

UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

UL 121303	Guide for Combustible Gas Detection as a Method of Protection

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and 22 Hazardous (Classified) Locations
501	UL 62	Flexible Cord and Cable

	UL 504	Mineral-Insulated, Metal-Sheathed Cable
502	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
503	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
504	ISA-RP 12.06.01	Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety
505	ANSI/API RP 14FZ	Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations

API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

API RP 2003	Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
EI 15	Model Code of Safe Practice, Part 15: Area Classification Code for Installations Handling Flammable Fluids
IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance
IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance
IIAR 2	Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems
ISA-60079-10-1 (12.24.01)	Explosive Atmospheres — Part 10-1: Classification of Areas — Explosive gas atmospheres
ISA-60079-29-2	Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen
ISO 965-1	ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data
ISO 965-3	ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads
NFPA 30	Flammable and Combustible Liquids Code
NFPA 77	Recommended Practice on Static Electricity
NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

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NFPA 780	Standard for the Installation of Lightning Protection Systems

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UL 80079-20-1	Explosive Atmospheres — Part 20-1: Material Characteristics for Gas and Vapour Classification — Test Methods and Data

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UL 120101	Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations

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UL 121303	Guide for Use of Detectors for Flammable Gases

_

	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
506	ASME B1.20.1	Pipe Threads, General Purpose (Inch)

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IEEE 844.2	Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures — Application Guide for Design, Installation, Testing, Commissioning, and Maintenance

_

IEEE 60079-30-2	Explosive Atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance

_

ISA-60079-10-2 (12.10.05)	Explosive Atmospheres — Part 10-2: Classification of Areas — Combustible Dust Atmospheres

_

NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

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	UL RP 121203	Recommended Practice for Portable/Personal Electronic Products Suitable for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2, Class III, Division 1, Class III, Division 2, Zone 21 and Zone 22 Hazardous (Classified) Locations
511	NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

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	NFPA 88A	Standard for Parking Structures
512	ICC IFC	International Fire Code

NFPA 1	Fire Code

NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 36	Standard for Solvent Extraction Plants

NFPA 58	Liquefied Petroleum Gas Code

NFPA 70B	Recommended Practice for Electrical Equipment Maintenance

	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
513	NFPA 30	Flammable and Combustible Liquids Code

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

	NFPA 409	Standard on Aircraft Hangars
514	NFPA 2	Hydrogen Technologies Code

NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 52	Vehicular Natural Gas Fuel Systems Code

NFPA 58	Liquefied Petroleum Gas Code

NFPA 59	Utility LP-Gas Plant Code

	NFPA 303	Fire Protection Standard for Marinas and Boatyards
515	NFPA 30	Flammable and Combustible Liquids Code
516	NFPA 13	Standard for the Installation of Sprinkler Systems

NFPA 33	Standard for Spray Application Using Flammable or Combustible Materials

NFPA 34	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids

NFPA 77	Recommended Practice on Static Electricity

NFPA 91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids

	NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
620	UL 4	Armored Cable

UL 44	Thermoset-Insulated Wires and Cables

UL 66	Fixture Wire

UL 504	Mineral Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1569	Metal Clad Cable
625	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
630	UL 1276	Welding Cable
650	UL 1651	Optical Fiber Cable
660	UL 62	Flexible Cords and Cables

	UL 817	Cord Sets and Power Supply Cords
668	UL 4	Armored Cable

	UL 62	Flexible Cords and Cables
670	UL 2011	Machinery
675	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

	UL 1263	Irrigation Cable
690	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
691	UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
692	UL 44	Thermoset-Insulated Wires and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

UL 83A	Fluoropolymer Insulated Wire

UL 1063	Machine-Tool Wires and Cables

UL 3001	Distributed Energy Generation and Storage Systems

	UL 3010	Single Site Energy Systems
694	UL 44	Thermoset-Insulated Wires and Cables

UL 62	Flexible Cords and Cables

UL 83	Thermoplastic-Insulated Wires and Cables

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	UL 83A	Fluoropolymer Insulated Wire

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	UL 1063	Machine-Tool Wires and Cables

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	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
700	UL 3001	Distributed Energy Generation and Storage Systems
701	UL 3001	Distributed Energy Generation and Storage Systems
702	UL 3001	Distributed Energy Generation and Storage Systems
705	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems
710	UL 3001	Distributed Energy Generation and Storage Systems

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	UL 3010	Single Site Energy Systems

Statement of Problem and Substantiation for Public Input

The standards for medium voltage circuit breakers are being added to Annex A.1(a) in relation to the proposed listing requirement for Article 245.

IEEE C37.09 Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
NEMA C37.54 Indoor Alternating Current High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear — Conformance Test Procedures

Note: This PI is intended to only add the above standards to Table A.1(a). Any other changes presented are due to TerraView formatting problems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4039-NFPA 70-2023 [Section No. 245.2]	Listing requirements for MV circuit breakers
Public Input No. 4039-NFPA 70-2023 [Section No. 245.2]	

Submitter Information Verification

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Committee:	NEC-P09

Public Input No. 3088-NFPA 70-2023 [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 Ysc 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, Ysc 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.

Statement of Problem and Substantiation for Public Input

This information is added to align with the proposed addition of the Informational Note in 315.60(D) in PI 3076.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3076-NFPA 70-2023 [Section No. 315.60(D)(1)]	Requirement in 315 associated with Annex B Example.
Public Input No. 3076-NFPA 70-2023 [Section No. 315.60(D)(1)]	

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Committee: NEC-P09

Public Input No. 1526-NFPA 70-2023 [New Part after II.]

450.20 Dry-Type Transformers in Hazardous (Classified) Locations

Where dry-type transformers are installed in a hazardous (classified) location(s), they shall comply with one of the following:

1. Ventilated transformers not listed for the specific hazardous location shall be rated with an insulation class so the exposed winding hot spots do not exceed the maximum allowable temperature rating (T-Code). The nameplate shall be marked with the maximum hot spot temperature rating.

2. Encapsulated transformers not listed for the specific hazardous location, shall have a surface temperature not to exceed the maximum allowable temperature rating (T-Code). The nameplate shall be marked with the maximum surface temperature rating.

3. Listed ventilated or encapsulated transformers.

Statement of Problem and Substantiation for Public Input

Many in the electrical industry believe that dry-type transformers must be listed and/or encapsulated where installed in hazardous locations. Of course, this isn't true, but this new section would give more guidance to the user when placing a dry-type transformer in a hazardous location.

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Public Input No. 3095-NFPA 70-2023 [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.**

Statement of Problem and Substantiation for Public Input

This Public Input is to add specific requirements for switch faceplates (cover plates) which incorporate integral night lights or USB chargers similar to Section 406.6(D) for receptacles. A faceplate that solely utilizes the switches Line and Load terminals for electrical power shall not be permitted for use on a switch with a marked OFF position. This faceplate design relies on let-through current through the load for functionality. This is in direct violation of Section 404.20(B), which states that when the switch is in the marked OFF position, the device “shall completely disconnect all ungrounded conductors to the load it controls”. Bypassing the switch’s OFF position allows continual power to the load and hence defeating the safeguard provided in Section 404.20(B).

Faceplates (cover plates) with integral night lights or integral USB chargers, if connected to a switch through friction, shall meet the same safety requirements as in Section 406.6(D) for receptacle faceplates with integral night lights or USB chargers.

If the switch terminals are used for spring-tensioned contact for electrical power, the heads of the terminal screws will need to be without paint or enamel. Paint or enamel will, in effect, render electrical contact through spring tension non-conductive.

Faceplates with integral night lights or integral USB chargers that utilize Line and Load terminals for power must be evaluated to the minimum safety requirements and Listed for their intended use. Per Section 110.3(B), listed or labeled equipment shall be installed and used in accordance with the instructions provided. Faceplates which use spring tension for electrical contact must be evaluated for safe use, especially with variations of terminal placement or materials or coatings.

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

404.2 Listing Requirements

The following shall be listed:

1) Switches

2) Electronic control switches

Statement of Problem and Substantiation for Public Input

The two items should be relocated from 404.14 and 404.22 for compliance with the NEC Style Manual Section 2.2.1.

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Public Input No. 3768-NFPA 70-2023 [New Section after 404.14]

404.15 Switch Connections.

(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) Terminal Connections.

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).

(C) 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.

(D) 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:

a. 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

b. Where snap switches with integral enclosures comply with 300.15(E)

c. Where lighting in the area is controlled by automatic means

d. 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.

Statement of Problem and Substantiation for Public Input

This text was deleted from 404.2 in a related PI to comply with NEC style manual section 2.4.1. Deleted text is added to 404.15 to complete relocation.

Related Public Inputs for This Document

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

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Public Input No. 2714-NFPA 70-2023 [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.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 2715-NFPA 70-2023 [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~~ .

Statement of Problem and Substantiation for Public Input

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The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 2843-NFPA 70-2023 [Section No. 460.27]

460.~~27~~ 27 Equipment Grounding Conductor .

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.

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.

Statement of Problem and Substantiation for Public Input

The section title must be revised to match the technical requirement. In accordance with NEC style manual section 2.1.3.2 the title must be descriptive and concise with the intent of the requirement.
See 215.6 Feeder Equipment Grounding Conductor, 320.108 Equipment Grounding Conductor, 330.108 Equipment Grounding Conductor, 334.108 Equipment Grounding Conductor, 410.182 Equipment Grounding Conductor, 547.27 Separate Equipment Grounding Conductor, 555.37 Equipment Grounding Conductor, and 690.45 Size of Equipment Grounding Conductors.

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Public Input No. 2844-NFPA 70-2023 [Section No. 470.21]

470.~~21~~ 21 Equipment Grounding Conductor .

Resistor and reactor cases or enclosures shall be connected to the equipment grounding conductor.

Exception: Resistor or reactor cases or enclosures supported on a structure designed to operate at other than ground potential shall not be connected to the equipment grounding conductor.

Statement of Problem and Substantiation for Public Input

The section title must be revised to match the technical requirement. In accordance with NEC style manual section 2.1.3.2 the title must be descriptive and concise with the intent of the requirement.
See 215.6 Feeder Equipment Grounding Conductor, 320.108 Equipment Grounding Conductor, 330.108 Equipment Grounding Conductor, 334.108 Equipment Grounding Conductor, 410.182 Equipment Grounding Conductor, 547.27 Separate Equipment Grounding Conductor, 555.37 Equipment Grounding Conductor, and 690.45 Size of Equipment Grounding Conductors.

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